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ELECTRICITY, MEDICAL. See MATERIA MEDICA.

ELECTRIDES, anciently islands in the Adriatic sea, which received their name from the quantity of amber (electrum) which they produced. They were at the mouth of the Po, according to Apollonius of Rhodes; but some historians doubt of their existence.

ELECTROMETER. In various parts of the article ELECTRICITY, we have described a great variety of instruments for ascertaining the presence of electricity, and measuring its quantity or proportion.

But there are several instruments of this kind that have not been described in that article; and as they are well deserving a place in this work, either from the ingenuity of their construction, the reputation of their inventors, or the intrinsic value of the instruments themselves, we shall give an account of them here.

Plate CC., Fig. 1. Plate CC. is a geometrical representation of Mr. Cavallato's improved atmospheric electrometer, of half its real size. The principal part of this instrument is a glass tube CDMN, cemented at the bottom into the wooden piece AB, by which part the instrument is to be held when used for the atmosphere; and it also serves to screw the instrument into its wooden case ABO, fig. 2. when it is not to be used. The upper part of the tube CDMN, is shaped tapering to a smaller extremity, which is entirely covered with sealing-wax, melted by heat, and not dissolved in spirits. Into this tapering part a small tube is cemented, the lower extremity of which being also covered with sealing-wax, projects a short way within the tube CDMN. Into this smaller tube a wire is cemented, which with its lower extremity touches the flat piece of ivory H, fastened to the tube by means of cork; the upper extremity of the wire projects about a quarter of an inch above the tube, and screws into the brass cap EF, which is open at the bottom, and serves to defend the waxed part of the instrument from the rainy, &c. In fig. 3, a section of this brass cap is represented, in order to show its internal shape, and the manner in which it is screwed to the wire, projecting above the tube L. The small tube L, and the upper extremity of the large tube CDMN, appear like one continued piece, on account of the sealing-wax, which covers them both. The conical corks P of this electrometer, which by their repulsion show the electricity, &c. are as small as

Vol. VIII. Part I.

†

case EX, the wires being so placed that they may touch the pieces of ivory, which serves for terminals, at the same time the wire EF is inserted into the brass cap EF, which is so contrived that it can be drawn out of the instrument, &c.

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Electrom. open air, a little above his head, so that he may conveniently see the corks P, which will immediately diverge if there be any sufficient quantity of electricity; whose nature, i.e., whether positive or negative, may be ascertained by bringing an excited piece of sealing-wax, or other electric, towards the brass cap EF.

It is perhaps unnecessary to remark, that this observation must be made in an open place, as the roads out of town, the fields, the top of a house, &c.

The principal advantages of this electrometer, as stated by Mr. Cavallo, are as follows.

1. The smallness of its size. Mr. Cavallo made one so small, that its case, which was of brass, measured only three inches and a half in length, and nine-tenths of an inch in diameter, and yet it acted perfectly well.
2. Its being always ready for experiments, without fear of entangling the threads, or having an equivocal result by the sluggishness of its motion.
3. Its not being disturbed by wind or rain.
4. Its great sensibility; and,
5. Its keeping the communicated electricity longer than any other electrometer.

II. Sammure's Electrometer. M. de Sammure's electrometer, with which he made the observations on atmospheric electricity, which have been related in the second chapter of Part V. of the article Electrical, and represented at fig. 4. is much the same with that of Mr. Cavallo above described. The following are the most material circumstances in which they differ: First, the fine wires, by which the balls are suspended, should not be long enough to reach the tin-foil which is pasted on the inside of the glass, because the electricity, when strong, will cause them to touch this tin-foil twice consecutively, and thus deprive them in a moment of their electricity. To prevent this defect, and yet give them a sufficient degree of motion, it is necessary to use larger glasses than those that are generally applied to Mr. Cavallo's electrometer; two or three inches in diameter will be found to answer the purpose very well. But as it is necessary to carry off the electricity which may be communicated to the inside of the glass, and thus be confounded with that which belongs to substances that are under examination, all pieces of tin-foil should be pasted on the inside of the glass; the balls should not be more than one-twentieth of an inch diameter, suspended by silver wires, moving freely in holes nicely rounded. The bottom of the electrometer should be of metal; for this renders it more easy to deprive it of any acquired electricity, by touching the bottom and top at the same time.

In order to collect a great quantity of electricity from the air, the electrometer is furnished with a pointed wire, 12 inches or two feet long, which unscrews in three or four pieces, to render the instrument more portable; see fig. 4. When it rains or snows, the small parasols, fig. 5, is to be screwed on the top of the instrument, as by this its insulation is preserved, notwithstanding the rain.

This instrument indicates not only the electricity of fog, but that also of serene weather, and enables us to discover the kind of electricity which reigns in the atmosphere; and to a certain degree to form an estimate of its quantity, and that under two different points of view, the degree of intensity, and the distance from Electrometer the earth at which it first begins to be sensible.

A conductor raised for the purpose of making observation on atmospheric electricity will be found to exhibit signs of electricity, only when the electric fluid is more or less condensed in the air, than in the earth. Though the air resists the passage of the electric fluid, it is not absolutely impermeable to it; it suffers it to pass gradually, and generally with more ease in proportion as its mass or thickness is less. It is therefore interesting to discover at what height it is necessary to be elevated, in order to find a sensible difference between the electricity of the earth, and that of the air. A very sensible difference may be generally discovered by this instrument, at the distance of four or five feet from the ground; sometimes it may be seen if the instrument is placed even on the ground; while at others, it must be raised seven or more feet before the balls will open; sometimes, though seldom, this height is not sufficient.

This distance is generally greatest when the electricity is strongest, though necessarily modified by a variety of circumstances, some of which are known, as the degree of dryness or humidity of the air, and others are unknown.

The degree of intensity, at a given height, may be discovered thus; raise the electrometer, and judge by the divisions which are placed on the edge of it, the degree of their divergence. To find the relation between this degree of divergence, and the force of the electricity, M. de Sammure took the following method: As he could not with certainty double or triple a given quantity of electricity; yet as a given force may be reduced one half, a fourth or eighth, &c. by dividing between two equal and similar bodies, the electricity contained in one; he took two of his unarmed electrometers, which were as similar as possible, and electrified one of them, so that the balls separated precisely six lines; he then touched the top thereof by the top of that which was not electrified; in an instant the electricity was equally divided between them, as was evident by the divergence of the balls, which was four lines in each; consequently a diminution of half the intensity had only lessened the divergence one-third. One of these electrometers was then deprived of its electricity, and was afterwards brought in contact with the other as before; the remaining electricity divided itself again between them, and the balls fell from four to twenty-eight lines, nearly in the same proportion as before; in the third operation they fell to nineteen; in the fourth to one, where he was obliged to stop, as there was now sufficient force in the fluid to pass from one electrometer to the other, and distribute itself uniformly between them. The same experiment, repeated several times, gave very nearly the same results. Negative electricity diminished also in the same proportion as the positive. The following table may therefore be considered as giving a general, though not exact idea of the increase in force, which corresponds to different degrees of divergence in the balls; it is only calculated to every fourth of a line; the force of electricity is always expressed by whole numbers, as it would be ridiculous to put a greater degree of exactness in the numbers than is to be found in the experiments which form the bases of the calculation.
Those who are desirous to carry this measure of the electric force farther, may do it by having similar electrometers constructed, but made upon a larger scale, and with heavier balls, which would only separate one line, with the degree of electricity that makes the smaller ones diverge six lines; these would consequently measure a force 1024 times greater than that which forms the unity of the preceding table; and thus by degrees we may be enabled to discover the ratio of the strongest discharge of a great battery, or perhaps even of thunder itself, to that of a piece of amber, which only attracts a bit of straw or any other light substance.

In order to observe the electricity of the atmosphere with this instrument, we must first bring the electric fluid contained in the electrometer to the same degree of density with that at the surface of the earth; this is easily done by letting the bottom and top touch the ground at the same time; then raise the point, keeping the bottom still in contact with the ground, from whence it may be lifted up in a vertical position till the balls are level with the eye.

The second circumstance is to render the divergence of the balls, which is occasioned by the electricity of the air, permanent. This is effected by touching the top of the electrometer with the finger; but here the acquired electricity becomes contrary to that of the body by which they are electrified. Let us suppose, for example, that the electrometer is at five feet from the ground, and the balls diverging; touch the top of the electrometer with the finger, and the balls will close; but they will again open, if the electrometer is withdrawn from the influence of the electricity of the air, by being brought nearer the ground, or into the house. M. Sansure only employed this method when the electricity was so weak that he could not perceive any until the electrometer was raised considerably above his eye; as in this case he could not perceive the divergence of the balls, he always endeavoured to obtain a permanent electricity in the foregoing manner.

The following example will render the use of the foregoing observations more familiar. Choose an open situation free from trees and houses, screw the conductor on the top of the electrometer, lay hold of it by its base, and place it so that the base and conductor may touch the ground at the same time; then elevate it to the height of the eye, and observe the quantity of lines, or fourths of a line, that the balls have diverged; now lower it till the balls almost touch each other, and observe what distance the top of the conductor is from the ground; and this is the height from the ground at which the electricity of the air begins to be sensible. If the electricity of the air is sufficiently strong to make the balls diverge when it stands upon the ground, one of the lengths of the electrometer must be unscrewed from it. If the balls, however, still diverge, the other parts of the conductor should also be unscrewed, and you may mark down, that the electricity is sensible at zero, or on the surface of the earth. If, on the contrary, the electricity is so weak, as not to cause the balls to diverge when they are even with the eye, and consequently when the conductor is two feet higher, or seven feet from the ground, you should then raise it a foot higher; while it is thus elevated, touch the top with the other hand; when this hand is taken away, lower the electrometer, and if it is electrified, you may say the electricity is sensible at eight feet; if it is not, raise it as high as the arm can reach, and repeat the same operation; if any electricity is found, write down electricity sensible at nine feet; if not, mark 9, or no electricity relative to this instrument, and this mode of employing it, for signs of electricity may still be obtained, by throwing a metallic ball 50 or 60 feet into the air, which is at the same time connected with the electrometer by a metallic thread.

One advantage of this instrument is, that it will often exhibit signs of electricity when none can be obtained from a conductor of 100 feet in height, because it can more easily be preserved from humidity, &c. which will destroy the insulation of the large conductors.

This electrometer may be used instead of the condenser of M. Volta, by only placing it on a piece of oiled silk, somewhat larger than the base of the instrument; but in this case, it is the base, and not the top of the instrument, which must be brought into contact with the substance whose electricity is to be explored.

It is easy to discover also by this instrument, the electricity of any substance, as of clothes, hair of different animals, &c. For this purpose, it must be held by the hand and the substance rubbed (only once) by the ball of the electrometer; the kind of electricity may be ascertained in the usual manner. It is, however, to observe here, that at the top of the electrometer acts in this case as an insulated rubber, the electricity it acquires is always contrary to that of the rubbed body.

III. Codet's ELECTROMETER, is thus described by the author, as translated in Nicholson's Journal.

Fig. 6. In a glass tube A, 18 or 20 inches long, Fig. 6. is included another shorter tube X, sealed at both ends. This tube contains a graduated scale: one of the ends of these two tubes is cemented in a handle of turned wood,
Electrometer.-Wood, C, by which it is held in the hand; the other end is closed by a brass cap, D; the distance between the extremities of the small tube and that of the larger one is filled with red wax, B, B; on the cap D is screwed at pleasure, either a ring E, or a brass hook F. The ring is used for applying the instrument to the ball of a conductor, and the hook when it is hung to a ring; on the cap D is a brass stem G, terminating by a knob. This stem is bended, and the extremity of its knob must be directly beneath the line with which the graduated scale of the small tube commences.

Round the large tube is a brass ring H, half of which extends to the length of twelve or fifteen lines in the form of a half tube P, applied against the sides of the tube. This gutter serves to mark the degrees, by sliding along the graduated scale by means of a button beneath I. On the ring H is fixed one of the small electrometers invented by Saussure, K, K, which is surmounted by a stem V, on which stem is fixed at pleasure either a point L, or a ball M, of the same size as that which terminates the stem G, opposite which it is placed. The extremity of this point or ball must be placed immediately over the extremity of the half tube of the electroscope P, in order to the centre of the ball, which terminates the stem G.

At the top of Saussure’s electroscope is a small ring N, which serves to connect it with the chain Z when required.

To explain the use of this instrument by a single experiment, charge a Leyden jar, till the spontaneous overflowing announces it to be saturated. Then place the ring E on the knob of this bottle, and cause the electroscope of Saussure, armed with its point, to slide towards it. Observe the degree at which the divergence of the thread stream commences, and at that instant suppress the point, and adapt in its place the ball M. Continue to advance the electrometer of Saussure till the electric pressure of the atmosphere in the jar causes the threads to diverge; again observe the degree, replace the point L, and close the shutters of the room; then continue to advance the electrometer till the luminous point appears, which again affords new degrees. Lastly, replace the ball M, and fix the chain Z to the small ring N: cause it to communicate with the exterior coating of the jar, and advance the electrometer till the explosion takes place. Then comparing the different degrees, we may ascertain theComparative difference between the respective methods.

As soon as these relative proportions have been once accurately ascertained by attentive observations, one of those methods alone will be sufficient for measuring the intensity of electricity; and, in fact, if the body intended to be submitted to examination be little charged with the electric fluid, the diverging of the threads, by means of the point, will fix the limits of the electric atmosphere: if it be more, the pressure of the atmosphere on the ball M, which is substituted for the point, will indicate this quantity. In short, if the body be loaded with a considerable mass of electric matter, it will be shown by the luminous point. If a Leyden jar, instead of being positively, is negatively electrified, the point indicates it at the same time that it measures the electric atmosphere, for instead of a luminous point, a

will be observed upon the ball of the jar, and another electric

at the end of the point.

Let us now apply this electrometer to useful observations.

In order to connect the idea of a determinate quantity of fluid to each degree of the electrometer, it is necessary to compare these degrees with the known quantities. Suppose for instance we have a jar, the coating of which is six inches square; electrify it till a spontaneous discharge takes place, and remark, by means of Henley’s electrometer, at what degree this discharge is effected. Again, electrify the jar, till it is nearly saturated, and measuring with this electrometer, observe, that the luminous point appears for instance at two degrees; then say, that when the electrometer, applied to an electrified body, marks two degrees, the body contains six inches square of electricity. Repeat this experiment with a plate of glass, the coating of which is seven, eight, ten, or twelve square inches, and we may form a scale of proportion, which is of the greatest utility in accurate experiments.

In endeavouring to ascertain some of these propositions, (says M. Cadet), I have made an observation which has convinced me of the utility of my electrometer in discovering the capacity of electrifying apparatus.

Having taken a jar from an electric battery, I electrified it, and measured it with a point which I passed along a string of silk; on observing the distance at which the luminous point appeared, I joined this jar to another of the same size, and imagined that by doubling the quantity of matter, the measure I had taken would also be doubled; on the contrary, however, the latter measure was not more than about one-third of the former: I then added a third bottle; and still obtained nearly the same result: whence the following proposition appears to be established; namely, that the extent of the electric atmosphere is in an inverse ratio to the quantity of fluid accumulated. Another observation which I have several times made, on measuring the electric atmosphere of a conductor, is, that the limits of this atmosphere form an elliptic figure around the body, nearly similar to that represented at fig. 7.

This doubtless arises from the electrified body suspended in a chamber, being nearer to the earth than the ceiling; but it would be a curious experiment to measure it at an equal distance from every attracting body, in order to observe whether the fluid has not really a tendency to descend towards the earth, rather than in any other direction. It is my intention to repeat this experiment, as I consider it of great importance to ascertain whether electricity gravitates towards the globe.

"From these first attempts, I conceive my electrometer would be well adapted for measuring the absolute capacity of Leyden jars, and also their capacity with regard to their size, or to the quality of the glass of which they are constructed; for the latter, by its greater or less density, absorbs a greater or less quantity of fluid."

IV. Levenson’s Electrometer. This is a simplified improvement on Brooke’s steelyard electrometer, and should have been described when that instrument was mentioned, instead of Mr. Adams’s; but it did not occur to us till after that sheet was printed.
The following account is given of this electrometer, in a letter from Mr. Lawson to the editor of the Philosophical Magazine.

"Some time age it struck me that some additions to Brooke's electrometer might be made, so as to fit it for a good discharging electrometer to measure the repulsion between two balls (of a certain size) in grains, and also effect the discharge of a battery at the same time. The instrument known by the name of Cuthbertson's discharging electrometer, (See Electricity, N° 203.) was at that time the best, and indeed the only instrument for discharging batteries or jars by its own action, then made; but I think this will be found, in the essentials, and in the theory and use, a more perfect instrument.

On the basis (fig. 8.) is fixed the glass pillar G, supporting the hollow brass ball B. I is a light graduated brass tube, divided (from the weight W towards the ball B) into 100 parts, each representing 1 grain. W is a sliding weight. L, a light brass ball screwed to the end of the tube E. On the other end of which tube I is fixed, and adjustable close to, the ball L, or at any lower station between that and the ring r. The brass tube to which the ball A is fixed is divided into inches, halves, and quarters: (a more minute division is unnecessary and improper.) The divisions begin, or the line o is marked on the said tube at the ring r, when the three balls A, L, F, are close together. The ring r serves as an index, as the divisions pass in succession into the glass tube P on lowering the ball A. The hook H is screwed into the base of P. The quadrants, or Henley's electrometer, Q, is supported in a long brass stem, to keep it out of the atmosphere of the lower part of the instrument; under the instrument, fig. 9. shows the operation of the ball B, fig. 8. In the first place the ball screws in half, horizontally. The light tube I passes through the ball, and is suspended nearly in the centre of it by some silk twist, a, which small silk twist is fixed into the eye of the adjusting wire, a, part of which wire isfiled square and goes through the square hole A. The nut s screws on a, and serves to adjust the light tube I vertically. The light plates PP are of copper, and move freely on the wire w w somewhat like a hinge, and rest on the copper wires CC, serving to make the direct communication between the inside and out of the battery or jar. NN are notches serving to let the tube I descend when the discharge is made. Into the tube Z, the glass pillar is ground. Note, that at the bottom of the notch N is a piece of brass filled with a Y, and so placed as to keep the centres of the balls L and E, fig. 8. under each other when they come close together.

When the instrument is adjusted, which is done by placing the weight W, fig. 8. at o on the line of grains, and then screwing or unscrewing the counterbalance ball C, till the tube I rises slowly into its horizontal position; then set the ball A at the distance from the ball L that you choose, and the weight W placed at the division or number of grains that you wish the repulsive power of the electricity to arrive at before the discharge is made: this being done, connect the battery or jar with the ball B, by means of the wire y, the end of which goes into B at the hole X, and should stand at right angles to B, the ball y resting on the battery: then connect the outside of the battery or jar with the hook H. As the battery charges, the electrometer Q continues to rise; and when it is so highly charged that the repulsive power between the balls L and F is equal to the number of grains at which the weight W was placed, the ball L will descend, and deliver the charge of the battery to the ball A. The substance or thing through which the shock is intended to be passed, must form part of the communication between the hook H and the outside of the battery or jar.

V. Hauget's Electrometer. Fig. 10. contains a representation of this electrometer, and the different parts of which it consists. OP is a board of dry mahogany, twelve inches in length and four in breadth, which serves as a stand for the instrument. In this board are fastened two massy brass plates, M and N, which support the two brass caps or rings GG, with the two forks of tempered steel KK screwed into them. The two rings GG are well covered with varnish.

In the ring is fastened a brass rod, which terminates in a ball E of the same metal, and an inch in diameter. The length of the rod and ball together is four inches and a half.

A very delicate beam AB, the arms of which are of unequal length, moves on a short triangular axis (a knife edge) of well tempered steel, on the fork K of the pillar M. It is seventeen inches in length, and so constructed that the short arm forms a third, and the long one two-thirds of the whole beam. The short arm of brass furnished with the ball B, exactly of the same size as the ball E, is divided into forty-five parts equivalent to grains. The long arm A is of glass covered with copal varnish, and ends in an ivory ball A, into which is fitted an ivory hook R, destined to support the ivory cap CD. The beam AB is graduated to thirty more complete, this scale is suspended by three hairs.

A very delicate beam CD, eleven inches in length, moves on an axis like the former, on the pillar N, though not here shown. This beam is proportioned in the same manner, one arm being a third and the other two-thirds of the whole length. The long arm of brass is furnished at the end with a ball D, and divided into thirty parts corresponding to grains. The short arm of glass terminates in a long roundish plate C, covered with copal varnish. The steel forks are shown by the sections of the two brass caps FF, as are also the two knife edges I, L. By these caps the escape of the electric matter is partly prevented.

A brass ring Q, capable of being moved along the short arm of the upper beam AB, shows by means of marks determined by trial and cut out on the beam, the number of grains which must be placed in the small scale to restore the equilibrium of the beam, at each distance of the ring Q from the point of suspension.

On the long arm CD of the lower beam there is also a moveable ring S, which, like the ring Q, shows in grains, by its distance from the point of suspension, the power requisite to overcome the preponderance of LD in regard to LC.

The power necessary for this purpose will be found, if
Electromes. the shell H, which weighs exactly fourteen grains, be
sisted to sink down on the glass plate C, and the ring
be pushed forwards till both the arms of the beam are
in equilibrium. The part of the beam on which the
ring s has moved, is divided into fourteen parts, so that
marks the place where the ring s must stand when the
beam, in its free state, is in equilibrium; and 14
stands at the place where the ring s again restores a
perfect equilibrium when the shell H is laid on the glass
plate C. Each of these parts, which are divided into
quarters, indicates a grain. The lower divisions of the
scale will be found with more accuracy, if quarters of a
grain be put in succession, into the shell H (after it has
been laid on the plate C), and the ring s be moved be-
tween each quarter of a grain until the perfect equili-
rium is restored. This place on the beam is then to
be marked, and you may continue in this manner until
the 30th part of a grain be given. Both scales, for the
sake of distinctness, are only divided so low as quarters
of a grain; though the instrument is so delicate, and
most absolutely so, that 1 part of a grain is suffi-
cient to destroy the equilibrium.

The two glass pillars M and N, together with the
steel forks affixed to them, are so fitted into the stand,
that both the beams lie parallel to each other as well as
to the rod GE. In this position of the beams AB, the
calls B and E are just in contact. The smallest glass
pillar N is of such a height that the ball of the beam
CD stands at the distance of exactly four lines from the
ring C, and cannot move without touching the latter.
The small shell H is suspended in such a manner that
there is a distance of exactly two lines between it and
the shell C. In each of the brass rings GG is a small
hole, that the instrument may be connected with the
two sides of an electric jar. I is a brass wire, with
a hollow bit of ivory, o, destined to support the beam
CD, which is necessarily preponderate at D, in order
to prevent oscillation between the discharges to be ex-
namined by the instrument.

It may be readily comprehended that, when the
beams AB has moved, A must pass over twice the space
that B does; and this is the case in the
stance to regard to C and D. If AB are therefore con-
ected with the external, and CD with the internal side
of a battery, but in such a manner that the instrument
is at a sufficient distance beyond the electric atmosphere;
and if the battery be charged, the repulsive effect of
the electric power will oblige the ball B to separate
from the ball E; the shell H must therefore naturally
sink down with double velocity, so that when
the ball B rises a line, the shell H must sink two ; when it
reaches this depth it will touch the shell C, and the
atter, by the power excited in it, will be obliged to sink,
by which D must naturally again ascend in a double
proportion to the sinking of C; so that when C has
fallen two lines, D must have ascended four, and D
that moment touches the ring by which the two sides
of the battery are connected with each other, and dis-
charges the battery.

But as the attractive electric power between unlike
atmospheres, under like circumstances, is at least as
strong as its repulsive power between like atmospheres,
it would thence follow, that the electric power, instead
of repelling the ball B from the ball E, would rather
attract D, and by its contact with C, promote the dis-
charging; by which the instrument would fail of its elec-
tric object, and be subjected to the temperature of the at-
mosphere like all other electrometers; and, besides this,
the electric power could no longer be determined by
weight. To obviate this inconvenience, the instrument,
in all electrical experiments, must be applied in such a
manner that the power with which the ball D is attracted
by AB may exceed in strength the power required to
repel the ball B from the ball E. For this purpose the
ring s must always be removed two divisions farther
on CD, towards D, than the ring Q is shifted on AB
towards B. If, for example, an electric force were re-
quired equal to eight grains, according to this elec-
 trometer, the ring Q must be removed to the place where
8 stands, and the ring s to the place marked 10. The
repulsive power will then naturally repel the balls B and
E before Q is in a position to attract the ball D, as
a power of two grains would be necessary for this pur-
pose, besides that of the eight already in action. The
shell H with its weight of fourteen grains, will easily
come to the preponderance of LD over LC, so it
amounts only to ten grains, and therefore nothing exists
that can impede the discharging.

When the ring s, according to the required power,
is removed as far towards D, that the shell H is not
able by its weight to destroy the preponderance of LD
in regard to LC, the active power of the shell H must
be so far increased by the addition of weights, that it
can act with a preponderance of four grains on the
plate C. If, for example, an electric power of 14
grains be required, the ring s must be removed to 16,
by which LD rests upon s, with a preponderance of
16 grains in regard to 16C. Now, to make H act on
the plate C with a preponderance of four grains, it must
be increased to 20 grains, that is, six grains more
must be added, as it weighs only 14; which six
grains are again laid upon LB; and therefore the ring
Q is shifted to 20, so the strength of the repulsive power
is pointed out by 14 grains.

If an electric power of 25 grains be required, the
ring s must be removed to 27, and the weight 17
grains be put into the shell H; in order to produce a
preponderance of four grains in regard to s. These 17
grains are added to the required power of 25 grains,
and the ring Q is pushed to 32, &c. In this manner
the repulsive power always acts before the attractive
power can.

It may be readily perceived that the faults and in-
nconveniences common to all the electrometers hitherto
employed, and which have been already mentioned,
cannot take place here; because the discharging is
performed by immediate connection between the positive
and negative electricity in the instrument itself, without
any external means being employed.

One of the most essential advantages of this instru-
ment is, the certainty with which the same result may
be expected when the experiment is repeated. From
the same degree of electric power, whatever be the
temperature of the atmosphere, it will always be ne-
cessary to commence the separation of the two balls B and
E from each other, the quantity of coated glass and the
distance of the ring Q from the axis L being the same.

Another no less important advantage of this instru-
ment is, that in an experiment where the same electric
power,
power, often repeated, is necessary to ascertain the result with accuracy; such, for example, as the charging a battery through acids, water, &c.; the same degree of precaution is not necessary as is indispensably so in any other electrometer, as the person who puts the machine in motion has nothing to do but to count how often the electrometer discharges itself; and the instrument is not enclosed in a glass case; or prevented in any other manner from external contact, or any other circumstances which might render the experiment uncertain.

I flatter myself (says M. Hauch), that the simplicity of the construction of this instrument, the facility with which it may be made at a very small expense, and the certainty that two instruments, prepared according to the same scale, with a like quantity of coated glass, must exactly correspond with each other; but above all, that the certainty and accuracy by which experiments may be made with it, and by these means be accurately described, are advantages which will not be found united in any of the electrometers hitherto invented.

We shall close this account of electrometers with describing the construction and use of M. Coulomb's electrometer, or, as he calls it, Electrical Balance.

Fig. 11. ABDC (fig. 11.) represents a glass cylinder, twelve inches in diameter and the same in height, covered by a glass plate fitted to it by a projecting fillet on the under surface. The cover is pierced by two bored holes, one inch and three-fourths in diameter. One of them i is in the centre, and receives the lower end of the glass tube fA, of twenty-four inches height, which is fixed in the hole with a cement made of sealing-wax, or other electric substance. The top of this tube receives the brass collar H, (fig. 12. N° 3.) bored truly cylindrical with a small shoulder, which rests on the top of the tube. This collar is fastened with cement, and receives the hollow cylinder Θ (fig. 12. N° 2.), to which is joined the circular plate a b, divided on the edge into 360 degrees. It is also pierced with a round hole G in the centre, which receives the cylindrical pin i (fig. 12. N° 1.) having a milled head h, and furnished with an index o, whose point is bent down so as to mark the divisions on the circle a b. This pin turns stiffly in the hole G, and the cylinder Θ moves steadily in the collar H. To the lower end of the centre pin is fastened a little pincer, q, formed like the end of a post-crayon, and tightened by the ring g, so as to hold fast the suspension wire, the lower end of which is grasped by a similar pincer, P (fig. 13.) tightened by the ring φ. The lower end Θ o is cylindrical, and is of such a weight, as to draw the wire perfectly straight, but without any risk of breaking it. It may be made equal to half of the weight of that will just break it.

This pincer is enlarged at C, and pierced with a hole, which tightly receives the arm g C g of the electrometer. This arm is eight inches long; and consists of a dry silk thread, or a slender straw completely dried, and dipped in melted lac or fine sealing-wax, and held perpendicularly before a clear fire, till it become a slender cylinder of about one-tenth of an inch in diameter. This occupies six of the eight inches, from g to q: the remaining two inches consist of a fine thread of the lac or sealing-wax, as it dries off in fusing the arm. At s, is a ball of pitch or fine cork, one-fourth or one-half of an inch in diameter, made very smooth, and gilded. It is balanced by a vertical circle of paper g, of large dimensions, made stiff with varnish. The resistance of the air to this plane soon checks the oscillations of the arm.

The whole instrument is seen in its place in fig. 11, where the arm hangs horizontally about the middle of the height of the great cylinder. In its oscillations the ball s moves round in a circle, whose centre is in the axis of the whole instrument. Its situation is indicated by a graduated circle so g, drawn on a slip of paper, and made to adhere to the glass by varnish. The electrified body whose action is to be observed, is another small ball of cork t, also gilt, or a brass ball well polished. This is carried by a stalk of lace m φ, inclosing a dry silk thread. This stalk is grasped by a clamp of clef deal, or any similar contrivance, which is made to lie firm on the glass cover. When this ball is let down through the hole m, it stands so as to touch the ball s on the arm, when that ball is opposite to Θ on the graduated circle.

In order to electrify the ball t, we are to employ the insulating handle, fig. 14, which is a slender stick of sealing-wax or lac, holding a metal wire that carries a small polished metallic ball. This is to be touched with some electrified body, such as the prime conductor of a machine, the knob of a jar, &c. This electrified ball is to be introduced cautiously into the hole m, and the ball t is to be touched with it. The ball s is immediately repelled to a distance, twisting the suspension wire, till the force of twist exerted by the wire balances the mutual repulsion of the balls s and t.

This is the process for examining the law of electric action. When it is desired to examine the action of different bodies in different states, another apparatus is wanted. This is represented by the piece c A d (fig. 15.) consisting of a plug of sealing-wax A, fitting Fig. 15. tightly into the hole m, and pierced by the wire c d, hooked at c, to receive a wire to connect it occasionally with an electrified body, and having below a polished metal ball d.

The instrument is fitted for observation in the following manner: The milled bullet d is turned at top, till the twist index s o is at the mark o of the twist circle. Then the whole is turned in the collar H, till the ball a stand opposite to the mark o of the paper circle o q, and at the same time the ball t or d is touched. The observation is thus made. The ball t is first electrified as just described, and thus o is repelled, and returning twists the wire, setting, after a few oscillations, at such a distance as is proportional to the repulsion. The twist-index is now turned so as to force a nearer to t. The repulsion thus produced is estimated by adding the motion of the index to the angle at which the ball first stopped. Giving the index another turn, we have another repulsion, which is estimated in a similar way, and thus we obtain as many measures as required.

It is not necessary to make this instrument of very large dimensions; one 14 inches high, and five in diameter, of which the arm g should occupy two inches and a half, will be sufficiently large for most purposes. The diameter of the glass cylinder must always be double the length of the arm g, that the position of this may not be disturbed by the action of the glass.

Dr Robinson considered this electrometer as one of the...
Electrometer. The most valuable instruments that have been made, as it is not only extremely delicate, but gives absolute measures with the greatest accuracy. For all purposes in which only repulsions were to be measured, he preferred it to his own instrument described in Electricity, No. 206.

He, however, suggested several improvements in it, which are deserving of attention.

The bottom should be furnished with a round hole, admitting the lower end of the cylinder C, belonging to the lower pinion (when the wire is strained at both ends) to hang freely, by which means much tedious oscillation will be prevented. It is much more convenient to have the suspension wire strained at both ends; and it should extend as far below the arms as above it, and the lower extremity should be grasped by a pinion that turns by a milled head in a hole at the end of a slender spring. The instrument may then be speedily adjusted by taking off the twist index at c, and gently turning the lower button till the ball α point exactly at α on the paper circle.

The instrument will be greatly improved, if, in place of the apparatus with the ball t, we substitute the piece represented at fig. 15, making some little changes in its construction. Thus, instead of the wire e d, is used the smallest glass tube that will admit of being varnished on the inside, which is done by drawing through it a silk thread dipped in varnish, made of lac.

The outside of the tube must also be varnished, and a brass ball d fixed at its lower end, and a slender wire surmounted by a ball, is to be inserted into the tube, so as to touch the ball below. The position of the ball d will not be liable to alteration, when the hole m is once stopped with the plug. In making delicate experiments, the upper ball c must be touched with the charger, represented at fig. 14, by which means the ball d is electrified. Then drawing out C by means of the forceps, the ball d is left completely insulated. In examining the electrical state of the atmosphere, to which purpose this instrument is well adapted, the wire must be allowed to remain in the tube.

It was by means of this incomparable instrument, that M. Coulomb made the valuable experiments, to which we alluded in the article Electricity, when treating of the law of action of the electric fluid. By means of this electrometer, he also made his experiments on the dissipation of electricity into the air, and along imperfect conductors. He ascertained the law of dissipation into the air from bodies in contact, and the relation which this bore to the original repulsion, by first observing the gradual approach of the ball α towards t, in proportion as the electricity dissipated from both, and then slackening the twist index till the ball α resumed its original situation.

The following was the general result of Mr Coulomb's experiments.

That the momentary dissipation of moderate degrees of electricity is proportional to the degree of electricity at the moment. He found that the dissipation is not sensibly affected by the state of the barometer or thermometer; nor is there any sensible difference of bodies of different sizes or different substances, or even different figures, provided that the electricity is very weak.

But he found that the dissipation was greatly affect-
ed by the different states of humidity of the air. In the Electrome-
scale of Sausure's hygrometer, the relation to the quan-
ty of water which a cubic foot of air is capable of holding in solution is distinctly marked; the relation of this solution to the dissipation of electricity in Coulomb's experiments may hence be seen in the following table, the first column of which marks the degrees of Sausure's hygrometer, the second how many grains of water are dissolved in a cubic foot of air at each degree, and the third column shows the corresponding dissipation per minute.

<table>
<thead>
<tr>
<th>Degree</th>
<th>grains</th>
<th>Dissipation</th>
</tr>
</thead>
<tbody>
<tr>
<td>69</td>
<td>6.197</td>
<td></td>
</tr>
<tr>
<td>75</td>
<td>7.295</td>
<td></td>
</tr>
<tr>
<td>80</td>
<td>8.045</td>
<td></td>
</tr>
<tr>
<td>87</td>
<td>9.221</td>
<td></td>
</tr>
</tbody>
</table>

Hence it follows, that the dissipation is very nearly in the triplicate ratio of the moisture of the air. Thus if we make \( \frac{69}{75} = \frac{6.197}{7.295} \) \( m \) will be = 2.764. If we make \( \frac{69}{80} = \frac{6.197}{8.045} \) \( m \) will be = 2.76; and if we make \( \frac{69}{87} = \frac{6.197}{9.221} \) \( m \) will be = 3.61; or at a medium \( m \) will be = 3.40.

The immediate object that M. Coulomb had in view in his experiments, was to ascertain the diminution of repulsion. He found that this, in a given state of the air, was a certain proportion of the whole repulsion taken at the moment of diminution, which is double the proportion of the density of the fluid; for the repulsions by which we judge of the dissipation are reciprocal, being exerted by every particle of fluid in the ball t of the electrometer, on every particle of fluid in the ball α. The diminution of repulsion is therefore proportional to the density of the electric fluid in each body; and as during the whole diminution, the densities continue to have their original proportion, and as the diminution of repulsion is directly proportional to the diminution of the products of the densities, it is consequently directly proportional to the square of either. If we put \( d \) for the density, the mutual repulsion will be represented by \( d^2 \), and its momentary diminution by the fluxion of \( d^2 \), or \( 2 d \frac{dd}{dt} = d \times d \). But \( 2 d \times d = 2 d : d \). The diminution of the repulsion observed by experiment will be to the whole repulsion, in double the proportion that the diminution of density, or the dissipation of fluid will have to the whole quantity of fluid at the moment of observation. Let us, for instance, suppose the observed diminution of repulsion to be \( \frac{1}{2} \); we may conclude, that the quantity of fluid lost by dissipation is \( \frac{1}{4} \). M. Coulomb did not examine the proportion of the dissipation from bodies of various sizes. But we know, that if two spheres communicate by a very long canal, their superficial densities, and the tendencies of fluid to escape from them, are inversely as the diameters of the spheres. Now, in a body that has twice the diameter of another body, the surface of the former is quadruple of that of the latter; and though the tendency of fluid to escape from the former is only the half of its tendency to escape from the latter, yet the greater surface of the former may so far make up for its smaller density, that the
the dissipation of fluid from a large sphere may in fact be greater than that from a small one in the same given time.

We have remarked above, that these experiments were made in a particular state of the air; and the law of dissipation ascertained by them is of course adapted only to that given state. In a different state of the air, even, it is supposed to be impressed with the same proportion of moisture, the law of dissipation may be different. The inference which M. Coulomb expected to draw from his experiments was, that the ratio of dissipation would prove to be less than the cube of the quantity of water held in solution, except when that quantity of water was what the air was capable of holding in solution at the given temperature.

This is agreeable to observation; for we know that air which is considered as dry, that is, when it is not nearly saturated with moisture, is the most favourable to electrical phenomena.

Such is the general result of Coulomb's experiments on the dissipation of electricity into the air.

The method in which M. Coulomb examined the dissipation along imperfect conductors, by means of this instrument, was, by completely insulating the ball, and then after observing the loss sustained by a body in contact with it from the air, sliding a metallic rod down the insulating stalk, till the dissipation began to exceed what took place only by the air.

From his experiments respecting the dissipation along imperfect conductors, he found that this took place in a different manner from that in which electricity escaped by communication with the contiguous air. The electricity seems to be diffused chiefly along the surface of the insulator, and appears principally to be produced by the moisture that is more or less attached to it. M. Coulomb illustrates this in the following manner.

Water is found to adhere to the surface of all bodies from which it is prevented by adhesion from escaping when the bodies are electrified, and is thus rendered capable of receiving a greater degree of electric power. Let us suppose that the particles of moisture are disposed uniformly over the surface, with intervals between them; the electricity that is communicated to one particle, must acquire a certain degree of density, before it can fly from this particle to the next, across the intervening insulating space. When an imperfect conductor of this kind is electrified at one extremity, the communicated electricity, in passing to the other extremity, must be weakened every step in passing from particle to particle.

Suppose we have three adjacent particles, which we may call a, b, and c; we infer from N° 374, of the article ELECTRICITY, that the motion of b is sensibly affected, only by the difference of a and c; and therefore the passage of electric fluid from b to c, requires that this difference be superior, or at least equal to the force necessary for clearing this coercive interval. Let a particle pass over. The density of fluid of the particle b is diminished, while the density of the particle on the other side of a remains as before. Therefore some fluid will pass from a to b, and from the particle preceding a to b; and so on, till we come to the electrified end of this insulator. It is plain, from this consideration, that we must at last arrive at a particle beyond c, where the whole repulsion of the preceding particle is just sufficient to clear the coercive interval. Some fluid will come over; and the repulsion of this, acting now in the opposite direction, will prevent any fluid from coming to supply its place in the particle which it has just quitted; the transference of fluid will therefore stop here, and beyond this point the insulation will be complete. Hence we perceive that there is a mathematical relation between the insulating power, and the length of the canal; and this may be ascertained by the theory which we adopted in the article ELECTRICITY. We shall here give an instance of this investigation; and, for the sake of simplicity, we shall take a very probable case, viz. where the insulating interval, or, as we may more properly call it, the coercive interval, is equal in every part of the canal.

Let R represent the coercive power of the insulator, or the degree of force required to clear the coercive interval between two particles. Suppose a ball C, fig. 16, suspended by a silken thread AB; and let us de Fig. 16 note the quantity of a redundant fluid in the ball by C, and let the densities at the different points of the canal be denoted by AD, P d, &c. ordinates to some curve D d B, cutting the axis in B, the point where the thread AB begins to insulate completely. Let P be an element of the axis; draw the ordinate p, a tangent to the curve d e f, the normal d e, and draw e f perpendicular to P d. Suppose AC=x, AF=2x, and P d=xy. Then we shall have P p=xy, and d e=y. It was shown in N° 374. of the article ELECTRICITY, that the only sensible action of the fluid on a particle at P is \( \frac{Cy}{(x+y)^2} \), when the action of the redundant fluid in the globe on the particle at P, having the density y, is denoted by \( \frac{P d x y d c}{(x+y)^2} \). Therefore \( \frac{Cy}{x} \) is \( \frac{P d p}{P p} \), the coercive power of the thread, which is supposed to be constant, \( \frac{P d}{P p} \) is therefore equal to some constant line R. But \( \frac{P d}{P p} \) (or \( \frac{y}{x} \)) \( d e = P d : PE \). The subnormal, PE, is therefore a constant line. But as this is the property of a parabola, the curve of density D d B must be a parabola, of which \( 2 PE = 2 R \) is the parameter.

Cor. 1.—The densities at different points of an imperfect insulator are in the subduplicate ratio of their distances from the point of complete insulation: for \( P d^2 : AD^2 = BP: BA \).

Cor. 2.—The lengths of canal requisite for insulating different densities of the electric fluid are in the duplicate ratio of their densities; for \( AB = \frac{AD^2}{2PE} \) and PE is a constant quantity.

Cor. 3.—The length of canal requisite for insulation is inversely as its coercive power, and may be represented by \( D^2 \). For \( AB = \frac{DA^2}{2PE} = \frac{D^2}{2R} \).

If we reflect on this theory, we shall perceive, that our formulæ determine the distribution of fluid along the surface of an imperfect conductor, only in a certain manner, supposing that the ball C has received a certain determinate portion of fluid, for this portion diffusing itself, particle by particle, through the conducting matter, will extend to d in such a manner, as that
Electrostatic repulsion shall be everywhere in equilibrio with the coercive power of the insulating interval, taken at a maximum. We must here remark that this resistance is not active, but only coercive, and may be compared to the resistance afforded by viscidity or friction. Any repulsion of electric fluid, which falls short of this, will not disturb the stability of the fluid that is spread along the canal, according to any law whatever. So that if $AD$ represent the electric density of the globe, and remain constant, any curve or density will answer, provided that $\frac{dd}{x}$ be everywhere less than $R$. It is therefore an indeterminate problem, to assign in general the disposition of fluid in the canal. The density is as the ordinates of a parabola on this supposition only, that the maximum of $R$ is everywhere the same. And, in this case, the distance $AB$ is a minimum: for, in other cases of density we must have $\frac{dd}{x}$ less than $R$. If, therefore, we vary a single element of the curve $dB$, in order, that the stability of the fluid may not be disturbed, having $d$ constant, we must necessarily have $\frac{dd}{x}$ larger, that $\frac{1}{x}$ may still be less than $R$; that is, we must lengthen the axis.

The reasonings which have thus been deduced from theory, were confirmed by M. Coulomb in a numerous set of experiments. These are chiefly valuable for having stated the relation that subsists between the electric density, and the length of support necessary for complete insulation. But as M. Coulomb has not given us the scale of his electrometer, according to which the absolute measures of the densities were determined, the experiments can be of but little use till this be known.

We hinted, at the end of the theoretical part of Electricity, that the theory of Volta's condenser might be more satisfactorily explained after we had considered the above experiments of Coulomb. The account which we gave of the condenser in Chap. xiii. of that article, (chiefly from Cavallio), was the only one we could properly give in that early part of our view of the science. We are now prepared for a more scientific account of the effects of that instrument. The following is nearly the manner in which Dr Robison considered the subject.

Let the cover of an electrophorus be furnished with a graduated electrometer, such as may indicate the proportional degrees of electricity: electrify it positively to any degree, we shall suppose six, while it is held in the hand, at a little distance, directly over a metallic plate lying on a wine glass, or such like insulating stand, but made to communicate with the ground by a wire. Now bring it gradually down towards the plate. Theory teaches, and we see it confirmed by experiment, that the electrometer will gradually subside, and will perhaps fall to $2^o$, before the electricity is communicated in a spark; but let us stop it before this happens; the attraction of the lying plate produces a compensation of four degrees of the mutual repulsion of the parts of the cover, by condensing the fluid on its inferior surface, and forming a deficient stratum above. This needs no farther explanation, after what we said under ELECTRICITY, on the charging of coated glass plates. Now we may suppose that the escape of the fluid from this body into the air, begins as soon as it is electrified to $6^o$, and that it will fly to the insulated plate with the degree $2$, if it be brought nearer. But if we can prevent this communication to the insulated plate, by interposing an electric, we may electrify the cover again, while so near the metallic plate, to $6^o$ before it be so manner to fly off into the air. If now it be removed from the lying plate, the fluid would cause the electrometer to rise to $10^o$, if it did not immediately pass off, and an electric excitement of any kind which could raise this body only to $6^o$ by its intensity, will, by means of this apparatus, raise it to the degree $10$, if it be sufficiently copious in extent. If we do the same thing when the wire which connects the lying plate with the ground is taken away, we know that the same diminution of the electricity of the other plate cannot be produced by bringing it down near the lying insulated plate.

The theory of Volta's condenser now becomes very simple. M. Volta seems to have obscured his conceptions of it, by being intent on the electrophorus which he had lately invented, and was thus led into fruitless attempts to explain the advantages of the imperfect conductor above the perfect insulator. But the condensing apparatus is wholly different from an electrophorus; its operations are more analogous to those of a coated plate now charged, and insulated only on one side; and such a coated plate lying on a table will be a complete condenser, if the upper coating be of the same dimensions as the plate of the condenser. All the directions given by M. Volta for preparing the imperfect conductors prove, that the effect produced is to make them as perfect conductors as possible for any degree of electricity that exceeds a certain small intensity, but such as shall not suffer this very weak electricity to clear the first step of the conducting space. The marble must be thoroughly dried, and even heated in an oven, and either used in this warm state, or must be varnished, so as to prevent the reabsorption of moisture. We know that marble of slender dimensions, so as to be completely dried throughout, will not conduct electricity till it has again become moist. A thick piece of marble is rendered dry only superficially, and still conducts internally. It is then in the best possible state for a condenser. The same is the case with dry unbaked wood. Varnishing the upper surface of a piece of marble or wood is equivalent to covering it with a thin glass plate. Now by this method of covering the top of the marble, a book, or even the table, with a piece of clean dry silk, they all become most perfect condensators. This view of the matter has great advantage. We learn from it how to form a condensing apparatus much more simple and at the same time much more efficacious. We require only the simple moveable plate, which must be covered on the under side with a very thin coating of the finest coach-painters varnish. By connecting this, by a wire, with the substance whose weak electricity is to be examined, this electricity will be raised in the proportion of the thickness of the varnish to the fourth of the plate's diameter. This condensation will be produced by attaching the wire from the insulating handle of the condensing plate, and then lifting this from the table on which it was lying. It will then afford sparks, though the original electricity
ELE

Electromagnetic electricity was not strong enough to affect the most delicate electrometer.

Electrophorus. See Electricity Index.

Electrum, in Natural History. See Amber.

ELEY, in Pharmacy, a form of medicine composed of powders and other ingredients, incorporated with some conserve, honey, or syrup; to be divided into doses, like balsams, when taken.

Vossius observes, that all the remedies prescribed for the sick, as well as the confections taken by way of regale, were called by the Greeks αἰλεῦτα, and αἰλον, of the verb αἰλοῦ, "I like;" whence, says he, was formed the Latin electiorum, and afterwards electuarium. This conjecture he supports from the laws of Sicily, where it is ordained, that electioriaries, syrups, and other remedies, be prepared after the legal manner. The Bollandists, who relate this etymology, seem to confirm it. For the composition and different sorts of electioriaries, see Pharmacy.

Eleemosynarius, in our old writers, is used for the almoner or peculiar officer who received the eleemosynary rents and gifts, and distributed them to pious and charitable uses. There was such an officer in all religious houses. The bishops also used to have their almoners, as now the king has.

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ELEGIAC, in ancient poetry, any thing belonging to elegy. See ELEGY.

ELEGIT, in Law, a writ of execution, which lies for a person who has recovered debt or damages; or upon a recognizance in any court against a defendant that is not able to satisfy the same in his goods.

ELEGY, a mournful and plaintive kind of poem. See the article Poetry.

Elements, in Physics, the first principles of which all bodies in the system of nature are composed.

These are supposed to be few in number, unchangeable, and by their combinations to produce that extensive variety of objects to be met with in the works of nature.

That there is in reality some foundation for this doctrine of elementary bodies is plain; for there are some principles evidently exempted from every change or decay, and which can be mixed or changed into different forms of matter. A person who surveys the works of nature in an inattentive manner, may perhaps form a contrary opinion, when he considers the numerous tribes of fossils, plants, and animals, with the wonderful variety that appears among them in almost every instance. He may from thence be induced to conclude, that nature employs a vast variety of materials in producing such prodigious diversity. But let him inquire into the origin of this apparent diversity, and he will find that these bodies which seem the most different from each other are composed nearly of the same elements. Thus the blood, chyle, milk, urine, &c. as well as the various solid parts of animals, are all composed of one particular substance; grass, for instance, by the assistance of air and water, and even sometimes of very insipid kinds of grass. The same simplicity presents itself in the original composition of the nourishment of vegetables, notwithstanding the variety among them with respect to hardness, elasticity, taste, odour, and medical qualities. They chiefly depend, for these, upon water, and the light of the sun; and the same simplicity must take place in animals that are fed on vegetables. The analysis of animal substances confirms this hypothesis; for they can all be reduced into a few principles, which are the same in all, and only differ with regard to the proportions in which they are combined. With regard to animals, the case appears to be the same; and the more we are acquainted with them, the more reason we have to believe that the variety in their origin is very small.

Notwithstanding the infinite variety of natural productions, therefore, it appears, that the materials employed in their formation are but few; that these are uniformly and certainly the same, totally exempted from any change or decay; and that the constant and gradual change of one body into another is produced by the various separations and combinations of the original and elementary parts, which is plain from the regularity and uniformity of nature at all times. There is a change of forms and combinations, through which it passes, and this has been the case from the earliest accounts of time; the productions of nature have always been of the same kind, and succeeded one another in the same order. If we examine an oak, for instance, we find it composed of the same matter with that of any other that has existed from the earliest ages. This regularity and uniformity in the course of nature shows that the elementary parts of bodies are permanent and unchangeable; for if these elementary particles which constituted an oak some thousand years ago, had been undergoing any gradual decay, the oaks of the present times would have been found considerably different from those that existed long ago; but as no difference has been observed, it would seem that the ultimate elements of bodies have always continued the same.

Reflections of this kind have suggested an idea of several principal elements of which all other bodies are composed, which by their various combinations furnished all the variety of natural bodies. Democritus, and other great philosophers of antiquity, fixed the number to four, which have retained the name of elements ever since. These are, fire, air, earth, and water; each of which they imagined was naturally disposed
Elements disposed to hold its own place in the universe. Thus the earth, as heaviest, naturally tended towards the centre, and occupied the lower parts; the water as approaching next to it in gravity, was spread chiefly on the outside of the earth: the air, being more subtle and rare, occupied the middle place; while the fire, being more subtle and active, receded to the greatest distance of all, and was supposed to compose the planets and stars. This system was extended to all the productions of nature. Meteors were produced from a combination of fire and air; animals were considered as composed of earth and water; and those stars which were warm had likewise a proportion of the element of fire. Thus they went on, explaining some of the most striking qualities of the several productions of nature from the different proportions of the four elements they contained.

But though this system appears not at all destitute of beauty and propriety, and on this account has been long received, we know from modern discoveries that these four substances are not really elementary bodies; nor do they answer our purpose in forming a system, as we know too little of the intimate structure and texture of them to enable us to explain other bodies by them.

Any other attempts that have been made to assign the number of elementary bodies have been much less fortunate. The older chemists, with Paracelsus at their head, pretend to speak of four elementary bodies, salt, sulphur, earth, and mercury: but when we attempt to form an idea of what they mean, we find it very perplexed; and that the expressions concerning them are enveloped in so much obscurity, that they cannot be comprehended; and the theory is built entirely upon experiments made on metallic substances.

Attempts have been made by some to show that the elements, whatever they are, must necessarily be invisible or imperceptible by any of our senses. An inquiry into their number or properties therefore must be attended with very little success; and all the knowledge we can have upon the subject must be drawn from a view of their combinations, and reasoning analogically from the transmutations we observe to take place in nature. The modern discoveries in astronomy have enabled us to proceed farther in this way than what it was possible for the ancient philosophers to do. We now find that all the different kinds of air are composed of that invisible and subtle fluid named heat, united in a certain way with some other substance; by which union the compound acquires the properties of gravitation, expansion, rarefaction, &c. for pure heat, unless when united with some terrestrial substance, neither gravitates nor expands. This is evident from the phenomena of the burning glass, where the light concentrated in the focus will neither heat the air nor water, unless it meets with something with which it can form a permanent union. Heat, therefore, is justly to be considered as one of the original elements; being always capable of uniting with bodies, and of being extricated from them unchanged: while the same bodies are by their union with it changed into various forms; water, for instance, into ice or vapour, both of which return into their original state by the abstraction or addition of heat in a certain degree. Hence it becomes almost natural to conclude, that there are only two elements in the universe; and this opinion we find adopted by several philosophers, particularly the count de Tresen in Elements of this Essay on the Electric Fluid. According to his doctrine, two primitive material substances seem to exist in nature; one that incessantly acts, and to which it is essential to be in motion; the other absolutely passive, and whose nature it is to be inert, and move entirely as directed by the former. Should this doctrine be adopted, little difficulty would occur in determining the active matter to be that universal fluid, which, in its various modifications of light, heat, and electricity, has such a share in the operations of nature. But in reasoning on the passive element we are greatly embarrassed; nor are the discoveries in aerology or any other science as yet able to remove the difficulty entirely. According to the doctrines which long prevailed among chemical philosophers, there are three things that seem to be unchangeable, viz. earth; phlogiston; and that invisible, though terrestrial and gravitating principle, called by the antiphlogiasts the aenogeneus or acidifying principle, and by the phlogiasts the basis of dephlogiasticated air. In our experiments, say they, on the first, we find that earth, though vitriolized by the most intense fire, may be recovered in its proper form; and some very pure earths, particularly magnesia alba, cannot be changed even in the focus of the most powerful mirror. In like manner we may dissipate charcoal in smoke by the solar rays, and the compound is inflammable air: we may decompose this compound by a metallic calx, and we have our charcoal again unchanged, for all metals contain charcoal in substance. Let us try to destroy it by common fire, and we have it then in the fixed air produced, from which it may be recovered unchanged by means of the electric spark. With the basis of dephlogiasticated air the case is still more difficult; for we cannot by any means procure a sight of it by itself. We may combine it with heat, and we have dephlogiasticated air; to the compound we may add charcoal, and we have fixed air: by decomposing the former by burning iron in it, we have the metal greatly increased in weight by some unknown substance; and if we attempt to separate the latter, we have water, or some kind of vapour which still conceals it from our view.

In some experiments which were made by the ingenious Mr Watt, it was found that nitrous acid might be phlogiasticated by the purest earth or metallic calx; whence, according to this doctrine, it is not unreasonable to suppose that phlogiston may be only a certain modification of earth, and not an element distinct from it: but with regard to the basis of dephlogiasticated air, no experiment has ever shown that it can either be procured by itself, or changed into any other substance; so that it appears to have the nature of an element as much as light or heat. Though we should therefore be inclined to divide the whole matter of the universe into two classes, the one active and the other acted upon, we must allow that the passive matter even on this earth is not precisely of the same kind: much less are we to extend our speculations in this respect to the celestial regions; for who can determine whether the substance of the moon is the same with that of our earth, or that the elements of Jupiter are the same with those of Saturn? There is even a difficulty with regard to the division which seems so well established, viz. of matter in general into active
island, about five miles from the castle of Bombay in
the East Indies. Of this we have the following de-
scription in Mr Grove's Voyage to the East Indies.

44 It can at most be but about three miles in compass,
and consists almost all of hill; at the foot of which, as
you look, you see, just above the shore, on your right,
an elephant, carefully cut out in stone, of the natural
height of a man, and at some little distance not impos-ible to
be taken for a real elephant, from the stone being nat-
urally of the colour of that beast. It stands on a plat-
form of stones of the same colour. On the back of
this elephant was placed, standing, another young one,
appearing to have been all of the same stone, but
has been long broken down. Of the meaning, or history,
of this image, there is no tradition old enough to give
any account. Returning then to the foot of the hill,
you ascend an easy ascent, which about half way up
the hill brings you to the opening or portal of a large
cavern hewn out of a solid rock into a magnificent
temple: for such surely it may be termed, considering
the immense workmanship of such an excavation; and
seems to me a far more bold attempt than that of the
pyramids of Egypt. There is a fair entrance into this
subterraneous temple, which is an oblong square, in
length about 80 or 90 feet, by 40 broad. The roof
is nothing but the rock cut flat at top, and in which
I could not discern any thing that did not show it to
be all of one piece. It is about ten feet high, and
supported towards the middle, at equidistance from the
sides and from the interior wall, by two four-
toed pillars of a singular order. They are very massive,
short in proportion to their thickness, and their capi-
tals bear some resemblance to a round cushion pressed
by the superincumbent mountain, with which they are
also of one piece. At the further end of this temple
are three gigantic figures: the face of one of them is
at least five feet in length, and of a proportionable
breadth. But these representations have no reference
or connection either to any known history or the
mythology of the Gentoes. They had continued in
a tolerable state of preservation and wholeness, consi-
dering the remoteness of their antiquity, until the ar-
ival of the Portuguese, who made themselves masters
of the place; and in the blind fury of their bigotry,
not sparing any idols but their own, they must have
even been at some pains to main and deface them, as
they now remain, considering the hardness of the stone.
It is said they even brought field-pieces to the demoli-
tion of images, which so greatly desired to be spared
for the enfeebled curiosity with which. Of this Queen
Catherine of Portugal was, it seems, so sensible, that
she could not conceive that any traveller would return
from that side of India without visiting the wonders
of this cavern; of which too the sight appeared to me
to exceed all the descriptions I had heard of them.
About two-thirds of the way up this temple, on each
side, and fronting each other, are two doors or outlets
into smaller grots or excavations, and freely open
to the air. Near and about the door-way, on the
right hand, are several mutilated images, single and in
groups. In one of the last, I remarked a kind of re-
semblance to the story of Solomon dividing the child,
these standing a figure with a drawn sword, holding in
one hand an infant with the head downwards, which
it appears in set to cleave through the middle. The
outlet
biggest, in commemoration of the travels of the goddess, and, of her lighting a torch in the flames of Mount Aetna. The sixth day was called *Laugus*; from *leucos*, the son of Jupiter and Ceres, who accompanied his mother in her search after Proserpine, with a torch in his hand. From that circumstance his statue had a torch in his hand, and was carried in solemn procession from the Ceramicus to Eleusis. The statue, with those that accompanied it, called *lauguspyr* was crowned with myrtle. In the way nothing was heard but singing and the noise of brazen kettles as the votaries danced along. The way through which they issued from the city was called *laugus steia*, the sacred way, the resting place of *laugus*, from a fig-tree which grew in the neighbourhood. They also stopped on a bridge over the Cephissus, where they derived those that passed by. After they had passed this bridge, they entered Eleusis by a place called *voura noera*, the mystical entrance.

On the seventh day were sports, in which the victors were rewarded with a measure of barley, as that grain had been first sown in Eleusis. The eighth day was called *Eoeraion igesia*, because once *Eoeraion* at his return from Epidaurus to Athens, was initiated by the repetition of the mystery of Eleusis. It became customary therefore to celebrate them a second time upon this, that such as had not hitherto been initiated might be lawfully admitted. The ninth and last day of the festival was called *Paraperion*, because it was usual to fill two such vessels with wine; one of them being placed towards the east, and the other towards the west; which, after the repetition of some mystical words, were both thrown down, and the wine being spilt on the ground, was offered as a libation.

The story of Ceres and Proserpine, the foundation of the Eleusinian mysteries, was partly local. It was both verbally delivered, and represented in allegorical show. Proserpine was gathering flowers when she was stolen by Pluto. Hence the procession of the holy basket, which was placed on a cart dragged along by oxen, and followed by a train of females, some carrying the mystic chest, shouting, *Haiai, Ceres!* At night a procession was made with lighted torches, to commemorate the goddess searching for her daughter. A measure of barley, the grain which, it was believed, she had given, was the reward of the victors in the gymnic exercises; and the transactions at the temple had a reference to the legend. A knowledge of these things and places, from which the profane were excluded, was the amount of initiation; and the mode of it, which had been devised by craft, was skilfully adapted to the reigning superstitions. The operation was forcible, and the effect in proportion. The priesthood flourished as piety increased. The dispensation was corrupt, but its tendency not malignant. It produced sanctity of manners and an attention to the social duties; desire to be as distinguished by what was deemed virtue as by silence.

Some have supposed the principal rites at this festival to have been obscene and abominable, and that from hence proceeded all the mysterious secrecy. They were carried from Eleusis to Rome in the reign of Adrian, where they were observed with the same ceremonies as before, though perhaps with more freedom and licentiousness. They lasted about 1800 years, and were at last abolished by Theodosius the Great.

**ELEUSIS,** in Ancient Geography, a town in Attica, between Megara and the Piraeus, celebrated for the festivals of Ceres. See the preceding article.—These rites were finally extinguished in Greece upon the invasion of Alaric the Goth. Eleusis, on the overthrow of its goddess and the cessation of its gainful traffic, probably became soon an obscure place, without character or riches. For some ages, however, it was not entirely forsaken, as is evident from the vast consumption of the ancient materials, and from the present remains, of which the following account is given by Dr. Chandler. **The port was small and of a circular form. The stones of one pier are seen above water, into the Greek, and the corresponding side may be traced. About half a mile from the shore is a long hill, which divides the plain. In the side next the sea are traces of a theatre, and on the top are cisterns cut in the rock. In the way to it, some masses of wall and rubbish, partly ancient, are standing; with ruined churches; and beyond, a long broken aqueduct crosses to the mountains. The Christian pirates had infested the place so much, that in 1676 it was abandoned. It is now a small village at the eastern extremity of the rocky brow, on which was once a castle; and is inhabited by a few Albanian families, employed in the culture of the plain, and superintended by a Turk, who resides in an old square tower. The proprietor was Achmet Aga, the prince or principal person of Athens.

The mystic temple at Eleusis was planned by Ictinus, the architect of the Parthenon. Pericles was overseer of the building. It was of the Doric order; the cell so large as to admit the company of a theatre. The columns on the pavement within, and their capitals, were raised by Corethus. Menenipides and the architraves and the pillars above them, which sustained the roof. Another completed the façade. This was a temple in two stories, with an exterior colonnade, which would have occupied the rooms required for the victims. The aspect was changed to a *Prastyle* under Demetrius the Phaleran; Philo, a famous architect, erecting a portico, which gave dignity to the fabric, and rendered the entrance more commodious. The site was beneath the brow, at the east end, and encompassed by the fortress. Some marbles, which are uncommonly massive, and some pieces of the columns, remain on the spot. The breadth of the cell is about 130 feet; the length, including the pronao and porches, is 208 feet; the diameter of the columns, which are fluted, 6 inches from the bottom of the shafts, is 6 feet, and more than six inches. The temple was a decastyle, or had 10 columns in the front, which was to the east. The peribolus or inclosure, which surrounded it on the north-east and on the south side, measures 987 feet in length from north to south, and 328 feet in breadth from east to west. On the west side it joined the angles of the west side of the temple in a straight line. Between the west wall of the inclosure and temple and the wall of the citadel was a passage of 42 feet 6 inches wide, which led to the summit of a high rock at the north-west angle of the inclosure, on which are visible the traces of a temple in *entasis*, in length 94 feet 6 inches from north to south, and in breadth from the west...
and anointed the monuments, after which he sacrificed a bull upon a pile of wood, invoking Jupiter and infernal Mercury, and inviting to the entertainment the souls of those happy heroes who had perished in the defence of their country. After this he filled a bowl with wine, saying, I drink to those who lost their lives in the defence of the liberties of Greece. There was also a festival of the same name observed by the Samians in honour of the god of love. Slaves, also, when they obtained their liberty, kept a holiday, which they called Eleutheria.

ELF, a term now almost obsolete, formerly used to denote a fairy or hobgoblin; an imaginary being, the creature of ignorance, superstition, and craft. See FAIRY.

ELF-ARROWS, in Natural History, a name given to the flints anciently fashioned into arrow-heads, and still found fossil in Scotland, America, and several other parts of the world: they are believed by the vulgar to be shot by fairies, and that cattle are sometimes killed by them.

ELGIN, the capital of the county of Moray in Scotland, and formerly a bishop's see, is situated on the river Lossie, about six miles north from the Spey, in W. Long. 2° 25'. N. Lat. 57° 40'. Mr Pennant says, it is a good town, and has many of the houses built over piazzas; but, excepting its great cattles, has little trade. It is principally remarkable for its ecclesiastical antiquities. The cathedral, now in ruins, has been formerly a very magnificent pile. The west door is very elegant and richly ornamented. The choir is very beautiful, and has a fine and light gallery running round it; and at the east end are two rows of narrow windows in an excellent Gothic taste. The chapter-house is an octagon; the roof supported by a fine single column, with next carvings of coats of arms round the capital. There is still a great tower on each side of this cathedral; but that in the centre, with the spire and whole roof, are fallen in; and form most awful fragments, mixed with the battered monuments of knights and prelates. Boethius says, that Duncan, who was killed by Macbeth at Inverness, lies buried here. The place is also crowded with a number of modern tomb-stones.

The cathedral was founded by Andrew de Moray, in 1224, on a piece of land granted by Alexander II.; and his remains were deposited in the choir, under a tomb of blue marble, in 1244. The great tower was built principally by John Innes bishop of this see, as appears by the inscription cut on one of the great pillars: "Hic Jacet in Xto, pater et dominus, Dominus Johannes de Innæs, luicæ ecclesie Episcopus:—qui hæc notable opus incepit et per septennium sedesavit."

Elgin is a royal borough. Population of the town and parish 4652.

ELGINSHIRE, the middle district of the ancient county of Moray. It is bounded on the north by that branch of the German ocean called the Moray Frith; on the east and south-east by Banffshire; on the south-west, by Inverness-shire; and on the west by the counties of Inverness and Nairn. It extends about 42 miles in length, and its average breadth is about 20. The southern part is rocky and mountainous, called the district of Braemoray, which is occupied with extensive
tensive forests. The lower parts, towards the north, are rich and fertile; but might easily be rendered more productive. The principal rivers are, the Spey, Findhorn, and Lossie; all of which abound with salmon. It contains two royal boroughs, viz. Elgin, the county town, and Forres; and several considerable towns, as Grantown, Garmouth, Lossiemouth, &c. The principal seats are Gordon-castle, the seat of the duke of Gordon; Castle Grant, the seat of Sir James Grant; Altyre, the seat of Colonel Cumming, &c. Morayshire abounds with many remains of antiquity; the principal of which are the magnificent cathedral of Elgin, the priory of Fussardine near the town of Elgin, the bishop's palace at Spynie, the castles of Lochindorb, Dunphemel, and the dun of Reylgus, in the parish of Edenkeillie. The ancient Scottish historians, particularly Fordun and Buchanan, give accounts of the Danes landing in Moray, about 1008, when Malcolm II. marched against them, and was defeated near Forres: after this they brought over their wives and children, and were in possession of the country for some time; until they were finally expelled by that monarch, after the victories gained over them at Luncarty near Perth, at Barrie in the county of Angus, and at Mortlach in the county of Baff. There are many monuments of that nation; the most remarkable of which is Sueno's stone or pillar, on the road from Naer to Forres, in the parish of Rafford. Except freestone, limestones, and marl, no mineral substance of value has been discovered.

<table>
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<tr>
<th>Parishes</th>
<th>Population in 1756</th>
<th>Population in 1790-1792</th>
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<tbody>
<tr>
<td>Alves</td>
<td>1601</td>
<td>1111</td>
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<tr>
<td>Birnie</td>
<td>735</td>
<td>403</td>
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<tr>
<td>Dallas</td>
<td>703</td>
<td>888</td>
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<tr>
<td>Drany</td>
<td>1714</td>
<td>1040</td>
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<tr>
<td>Duffus</td>
<td>1769</td>
<td>1800</td>
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<tr>
<td>Duthil</td>
<td>1785</td>
<td>2120</td>
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<td>1940</td>
<td>1500</td>
</tr>
<tr>
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<td>777</td>
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<tr>
<td>Speymouth</td>
<td>994</td>
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<tr>
<td>Spynie</td>
<td>865</td>
<td>602</td>
</tr>
<tr>
<td>Urquhart</td>
<td>1110</td>
<td>1050</td>
</tr>
</tbody>
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Population in 1811: 28,934

ELI, high priest of the Israelites, and judge over them for forty years, was descended from Abamar, a junior branch of the house of Aaron, and seems to have blended the priestly with the judicial character in the year 1156 before the commencement of the Christian era. It appears that the Jews were in a state of subjection or vassalage to the Philistines during the greater part of Eli's administration, and, what may at first appear singular, he contributed to the degeneracy of his countrymen, although his own piety and goodness were unquestionably great. He did not exert his magisterial authority in the exemplary punishment of vice, and even permitted his own sons with impatience to perpetrate the most atrocious acts of impiety and debauchery. This want of firmness, to give it so worse a name, was very reprehensible in one who filled such an important office, and peculiarly so in a man who was himself a saint.

The celebrated Samson made his appearance during the administration of Eli, taking part in the management of public affairs for about 20 years, by whose astonishing deeds the independent spirit of that people was in some measure revived. The circumstances attending the death of Samson, which betroved so calamitous to the nobility of the Philistines, might have induced the Jews to throw off the yoke; but they did not possess a sufficient degree of virtue and public spirit for such an exertion. Eli at this period was very far advanced in years, and, if possible, still more negligent in the discharge of his duty as a chief magistrate, allowing his two sons, Hopnui and Phineas, to proceed to the most extravagant height of impiety and debauchery, whose example had a most powerful influence on the manners of the people. He was far from being acquainted with their conduct, but he reproved them with such gentleness as was highly reprehensible, and but ill calculated to produce any change on the behaviour of his sons.

The deity was so justly offended with this deportment of Eli, that a sacred seer was commissioned to upbraid him for his ingratitude and want of resolution. Young Samuel likewise was favored with a vision of the approaching ruin of Eli's family, which he related to the otherwise venerable old man, on being solemnly assured not to conceal a single circumstance. When Eli heard the declaration of the young prophet, being fully convinced that his conduct had been highly reprehensible, he exclaimed, "It is the Lord; let him do what seemeth him good." Soon after this the Israelites sustained a considerable loss in attempting to procure their emancipation, carrying the ark of God into their camp to animate the people, and intimidate their enemies; but the ark was captured by the Philistines, and Hopnui and Phineas were slain. This intelligence having been brought to Eli, he no sooner heard that the ark of God was taken, than he fell backwards from his seat, broke his neck, and died in the 58th year of his age.

ELIAS, the prophet, memorable for having escaped the common catastrophe of mankind; being taken up alive into heaven, in a fiery chariot, about 893 B.C. See the Bible.

ELIJAH, who is sometimes denominated Elias, was one of the most distinguished of the Jewish prophets, and surnamed the Tabbite, probably from the district in which he was born. He began his prophetic office about 930 years before Christ, in the reign of wicked Ahab, by whom the Sidian idolatry was introduced among the Israelites. The prophet was commissioned to appear before this impious prince, and threaten the country with a long drought as a punishment for his crimes. The indignation of Ahab was so great against the prophet for this prediction, that he resolved to punish him in a signal manner; but Elijah withdrew to
a secret place from his fury, at the divine command, where he was sustained in a miraculous manner. He was afterwards ordered to go to Sarepta, in the territory of Sidon, where a miraculous interposition of heaven, in the house of an indigent widow, sustained him for some time, whose son the prophet restored to life.

When the three years of famine, occasioned by the drought, were expired, the prophet was ordered to appear before the king, and exhort him to that genuine repentance which an interposition of the deity so very remarkably unquestionably demanded. He had an interview with Obadiah, the governor of the king's house, who was a religious man, and had frequently seen many from the vengeance of Jezebel the queen, at the hazard of his own life. Fired with undaunted fortitude, the prophet said to Obadiah, "Go, tell thy lord, behold Elijah is here." The good man's regard for the prophet was so great, that he was afraid to deliver this message, since he knew that Ahab had used every effort to discover the prophet's retreat. The king was informed of his coming; and the first interview was distinguished by invectives on the part of the intestipid prophet and the proud sovereign, the former giving a promise of rain on the following terms. The priests of the Sidonian gods, and an assembly of the people of Israel, were to meet on Mount Carmel, where the prophet Elijah intended to give an incontrovertible proof of the almighty power of the God of Israel, and the total insignificance of the Sidonians divinities. For a detailed account of this memorable experiment, we must refer our readers to the book of Kings, as an abridgment of such a beautiful narration would do it manifest injury. It produced the fullest conviction in the minds of the Israelites; that Jehovah alone was entitled to adoration; and the priests of Baal were instantaneously put to death, as the most abominable perverters of the divine law.

This was followed by abundance of rain, in answer to the devout prayers of the prophet; but his glorious triumph over idolatry so exasperated Jezebel, that she resolved to murder the prophet, to avoid whose rage he fled into the wilderness, till the deity again employed him in the honourable, but often hazardous, duties of a prophet. He afterwards foretold that Hazael should be king of Syria, Jehu king over Israel; and he appointed Elisha the son of Shaphat to be his own successor. He denounced dreadful judgments against Ahab and his wicked queen Jezebel; but those which respected the king were not executed during his life, on account of the genuine repentance which he discovered. The successor of Ahab having been confined to bed in consequence of a malady, the god of Ekron was attributed relative to his recovery, which induced the prophet to declare that he should assuredly die. The king being informed that it was Elijah who dared to send such a message, he dispatched a captain and 10 men to force him into the royal presence; but they were destroyed by fire from heaven, and a second company shared the same fate. A third company confessed the visible interference of heaven in the prophet's behalf, and the captain throwing himself on the mercy of Elijah, went with him to the king. In the royal presence he undauntedly repeated the same denunciation against the idolatrous monarch, which was very soon accomplished; and not long after this the holy prophet, at the divine command, divided asunder the waves of Jordan, dropped his prophetic mantle to the astonished Elisha, took the flaming chariot commissioned for his reception, and rode in majesty to heaven.

ELIQUATION, in Chemistry, an operation by which a more fusible substance is separated from one that is less so, by means of a heat sufficiently intense to melt the former, but not the latter. Thus an alloy of copper and lead may be separated by a heat capable of melting the latter, but not the former.

ELIS. See ELA.

Elis, in Ancient Geography, the capital of the district of that name in Peloponnesus, situated on the Peneus, which ran through it. It was the country of Phaedo the philosopher, scholar of Socrates, and friend of Plato; who inscribes with his name the dialogue on the immortality of the soul. Pyrrho also was of this city, at the head of the sect called after him Pyrrhonists.

The city of Elis owed its origin to an union of small towns after the Persian war. It was not encompassed immediately with a wall; for it had the care of the temple at Olympia, and its territory was solemnly consecrated to Jupiter. To invade or not protect it was deemed impiety; and armies, if marching through, delivered up their weapons, which, on their quitting it, were restored. Amid warring states the city enjoyed repose, was resorted to by strangers, and flourished. The region round about it was called xerik or holone, from the inequalities. The country was reckoned fertile, and particularly fit for the raising of flax. This, which grew nowhere else in Greece, equalled the produce of Judaea in fineness, but was not so yellow. Elis was a school, as it were, for Olympia, which was distant 37 miles. The athletic exercises were performed there, before the more solemn trial, in a gymnasion, by which the Peneus ran. The heliodromes or precepts of the games paired the rival combatants by lot, in an area called Plathron or The Areo. Within the wall grew lofty plane trees; and in the court, which was called the Xystus, were separate courses made for the foot races. A smaller court was called the Quadrangle. The precepts, when chosen, resided for ten months in a building erected for their use, to be instructed in the duties of their office. They attended before sunrise to preside at the races; and again at noon, the time appointed for the pentathlum or five sports. The horses were trained in the agora or market-place, which was called the Hippodrome. In the gymnasion were altars and a cenotaph of Achilles. The women, besides other rites, best their bosoms in honour of this hero, on a fine day towards sunset. There also was the town-hall, in which extraordinary hatcheries were spoken and compositions recited. It was hung round with bucklers for ornaments. A way led from it to the baths through the Street of Science; and another to the market-place, which was planned with streets between porticoes of the Doric order adorned with altars and images. Among the temples, one had a circular peristyle or colonnade; but the image had been removed and the roof was fallen in the time of Panamass. The theatre was ancient, as was also a temple of Bacchus, one of the deities principally adored at Elis. Minerva had a temple in the citadel, with an image of ivory and gold, made...
ELISHA the prophet, famous for the miracles he performed, died about 830 B.C. See the Bible.

ELISION, in Grammar, the cutting off or suppressing a vowel at the end of a word, for the sake of sound or measure, the next word beginning with a vowel.

Elisions are pretty frequently met with in English poetry, but more frequently in the Latin, French, &c. They chiefly consist in suppressions of the a, e, and i, though an elision supersedes any of the other vowels.

ELIXATION, in Pharmacy, the extracting the virtues of ingredients by boiling or stewing.

ELIXIR, in Medicine, a compound tincture extracted from many efficacious ingredients. Hence the difference between a tincture and an elixir seems to be this, that a tincture is drawn from one ingredient, sometimes with an addition of another to open it and to dispose it to yield to the menstruum; whereas an elixir is a tincture extracted from several ingredients at the same time.

ELIZABETH, queen of England, daughter of Henry VIII. and Anne Boleyn, was born at Greenwich, September 7, 1533. According to the humour of the times, she was early instructed in the learned languages, first by Grindal, who died when she was about 17, and afterwards by the celebrated Roger Ascham. She acquired likewise considerable knowledge of the Italian, Spanish, and French languages. Dr Grindal was also her preceptor in divinity, which she is said to have studied with uncommon application and industry. That Elizabeth became a Protestant, and her sister Mary a Papist, was the effect of that cause which determines the religion of all mankind; namely, the opinion of those by whom they were educated: and this difference of opinion, in their tutors, is not at all surprising, when we recollect, that their father Harry was of both religions, or of neither.

But the studies of Elizabeth were not confined merely to languages and theology: she was also instructed in the political history of the ancients; and was so well skilled in music, as to sing and play "artfully and sweetly."

After the short reign of her brother Edward, our heroine being then about 20 years of age, her firebrand sister acceding to the crown, Elizabeth experienced a considerable degree of persecution, so as to be not a little apprehensive of a violent death. She was accused of nobody knows what; imprisoned; and, we are told, inhumanly treated. At last, by the interces-

Elision of King Philip of Spain, she was set at liberty; Elizabeth, which she continued to enjoy, till, on the death of her cousin sister, she, on the 17th of November 1558, ascended the throne of England. Her political history as a queen, is universally known and admired: but it is seen (Heber's History of England) that attention to the government of her kingdom did not totally suspend her pursuit of learning. Ascham, in his Scholemaster, tells us, that, about the year 1566, five years after her accession, she being then at Windsor, besides her perfect readiness in Latin, Italian, French, and Spanish, she read more Greek in one day than some prebendaries of that church did read Latin in a whole week, (p. 21.) She employed Sir John Fortescue to read to her Thucydides, Xenophon, Polybius, Euripides, Æschines, and Sophocles. (Ballard, p. 219.) That the Latin language was familiar to her, is evident from her speech to the university of Oxford, when she was near sixty; also from her spirited answer to the Popish ambassador in the year 1598. And that she was also skilled in the art of poetry, appears not only from the several scraps which have been preserved, but likewise from the testimony of a contemporary writer, Puttenham, in his Art of Engi. Poetry (a very scarce book). These are his words: "But, last in recital, and first in degree, is the queen, whose learned, delicate, noble muse, easily surmounteth all the rest, for sense, sweetness, or subtilty, be it in ode, elegy, epigram, or any other kind of poem," &c. In this author are to be found only a specimen of 16 verses of her English poetry. "But," says Mr. Walpole, "a greater instance of her genius, and that too in Latin, was her extempore reply to an insolent prohibition delivered to her from Philip II. by his ambassa-

dor, in this tetrastich:

Te veto ne pergas bello defendere Belgas:
Que Dracus eripuit, nunc restituantur oportet:
Quas pater evertit, jubeo te condere cellas:
Religio papae fac restituant ad unguem.

"She instantly answered him, with as much spirit as she used to return his invasions;"

Ad Greecas, bone rex, sement mandata kalendas."

Being earnestly pressed by a Romish priest, during his persecution, to declare her opinion concerning the real presence of Christ's body in the wafer, she answered,

Christ was the word that spake it;
He took the bread, and brake it:
And what that word did make it,
That I believe and take it.—Fuller's Holy State.

She gave the characters of four knights of Nottinghamshre in the following distich:

Gervas the Gentle, Stanhope the stout,
Markham the lion, and Sutton the lout. Wulp. Cat.

Coming into a grammar-school, she characterized three classic authors in this hexameter:

Persius a crab-staff; bawdy Martial; Ovid a fine wag.

Full. Worth. of Warw. 126.

Sir
Sir Walter Raleigh having wrote on a window,
Fain would I climb, yet fear I to fall;
She immediately wrote under it,
If thy heart fail thee, climb not at all.

Worth of Devonsh. 261.

Doctress, she was a woman of singular capacity and extraordinary acquirements: and if we could forget the story of the Scottish Mary, and of her favourite Essex, together with the burning of a few Anabaptists; in short, could we forbear to contemplate her character through the medium of religion and morality, we might pronounce her the most illustrious of illustrious women. See further the articles England, Mary, and Scotland.

She died in her palace at Richmond, the 24th of March 1602, aged 70, having reigned 44 years; and was interred in the chapel of Henry VII. in Westminster Abbey. Her successor James erected a magnificent monument to her memory.—She wrote, 1. The Mirror, or Glass of the Sinful Soul. This was translated out of French verse into English prose, when she was eighteen years old. It was dedicated to Queen Catharine Parr. Probably it was never printed; but the dedication and preface are preserved in the Spiloga epistolariun, in Hearne's edition of Livii Flori. Julianus, p. 161. 2. Prayers and Meditations, &c. Dedicated to her father, dated at Hatfield, 1545. Manuscript, in the royal library. 3. A Dialogue out of Xenophon, in Greek, between Hiero a King, yet some time a private person, and Simonides a Poet, as touching the life of the Prince and Private Man. First printed from a manuscript in her majesty's own handwriting, in the Gentleman's Magazine for 1743. 4. Two Orations of Isocrates, translated into Latin. 5. Latin Oration at Cambridge. Preserved in the king's library: also in Hollinshed's Chron. p. 1206.; and in Fuller's Hist. of Cambr. p. 138. 6. Latin Oration at Oxford. See Wood's Hist. and Antiq. of Ox. lib. 1. p. 293. also in Dr. Jebb's Append. to his Life of Mary Queen of Scots. 7. A Comment on Plato. 8. Boethius de consolatione philosophiae, translated into English anno 1593. 9. Sallust de bello Jugurthinio, translated into English anno 1592. 10. A play of Euripides, translated into Latin, (Cat. of Royal Auth.). 11. A Prayer for the use of her fleet in the great expedition in 1566. 12. Part of Herace's Art of Poetry, translated into English anno 1598. 13. Plutarch de curiositate, translated into English. 14. Letters on various occasions to different persons: several speeches to her parliament; and a number of other pieces.

ELIOT, the Right Honourable George Augustus, Lord Heathfield, was the youngest son of the late Sir Gilbert Elliot, Baronet, of Stobbe (A) in Roxburghshire; and was born about the year 1718. He received the first rudiments of his education under a private tutor: and at an early time of life was sent to the university of Leyden, where he made considerable progress in classical learning, and spoke with fluency and elegance the German and French languages. Being designed for a military life, he was sent from thence to the celebrated Ecole Royale du Gemi Miltaire, conducted by the great Vauban at La Fere in Picardy; where he laid the foundation of what he so conspicuously exhibited at the defence of Gibraltar. He completed his military course on the continent by a tour, for the purpose of seeing in practice what he had studied in theory. Prussia was the model for discipline, and he continued some time as a volunteer in that service.

Mr Elliot returned in the 17th year of his age to his native country, Scotland; and was the same year, 1735, introduced by his father Sir Gilbert to Lieutenant-Colonel Peers of the 23rd regiment of foot, then lying at Edinburgh, as a youth anxious to bear arms for

(A) The ancient and honourable family of Elliot of Stobbe, as well as the collateral branch of Elliot of Minto in the same county, and of Elliot of Port-Elliot in Cornwall, are originally from Normandy. Their ancestor, Mr Aliott, came over with William the Conqueror, and held a distinguished rank in his army. There is a traditional anecdote in the family relating to an honourable distinction in their cost, which, as it corresponds with history, bears the probability of truth. When William set foot on English land, he slipped and fell on the earth. He sprang up, and exclaimed that it was a happyomen—he had embraced the country of which he was to become the lord. Upon this Aliott drew his sword, and swore by the honour of a soldier, that he would maintain, at the hazard of his blood, the right of his lord to the sovereignty of the earth which he had embraced. On the event of his conquest, King William added to the arms of Aliott, which was a baton or, on a field sable, an arm and sword as a crest, with the motto, Per sano, per ignem, fortiter et recte.
Elliot for his king and country. He was accordingly entered as a volunteer in that regiment, where he continued for a year or more. From the 23rd regiment he went into the engineer corps at Woolwich, and made great progress in that study, until his uncle Colonel Elliot brought him in his adjutant of the second troop of horse grenadiers. With these troops he went upon service to Germany, and was with them in a variety of actions. At the battle of Dettingen he was wounded. In this regiment he bought the rank of captain and major, and afterwards purchased the lieutenant-colonelcy from Colonel Brewerton, who succeeded to his uncle. By arriving at this rank, he resigned his commission as an engineer, which he had enjoyed along with his other rank, and in which service he had been actively employed very much to the advantage of his country. He received the instructions of the famous engineer Bellidor, and made himself completely master of the science of gunnery. Had he not so disinterestedly resigned his rank in the engineer department, he would long before his death, by regular progression, have been at the head of that corps. Soon after this he was appointed aide-de-camp to George II. and was distinguished for his military skill and discipline. In the year 1759, he quitted the second troop of horse grenadier guards, being selected to raise, farm, and discipline, the first regiment of light horse, called after him Elliot's. As soon as they were raised and formed, he was appointed to the command of the cavalry in the expedition on the coasts of France, with the rank of brigadier-general. After this he passed into Germany, where he was employed on the staff, and distinguished himself by the enormity of the enemy against the troops and discipline with which he conducted them. In the year 1762, he was made a major general, and in the expedition against Gravelines, he exhibited his soldierly talents and discipline with great success. In the year 1763, he was made Adjutant-General, and in 1768, he was appointed a member of the War Office.

On the peace, his gallant regiment was reviewed by the king, when they presented to his majesty the standard which they had taken from the enemy. Gratified with their fine discipline and high character, the king asked General Elliot what mark of his favour he could bestow on his regiment equal to their merit? He answered that his regiment would be proud if his majesty should think, that, by their services, they were entitled to the distinction of Regiment. It was accordingly made a royal regiment, with this flattering title, "The 1st, or King's Royal Regiment of Light Dragoons." At the same time the king expressed a desire to confer some honour on the general himself; but the latter declared, that the honour and satisfaction of his majesty's approbation of his services was his best reward.

During the peace he was not idle. His great talents in the various branches of the military art gave him ample employment. In the year 1775, he was appointed to succeed General A'Court as commander-in-chief of the forces in Ireland; but did not continue long in this station, not even long enough to unpack all his trunks; for finding that interferences were made by petty authority derogatory of his own, he resisted the practice with becoming spirit; and not choosing to disturb the government of the sister kingdom on a matter personal to himself, he solicited to be recalled. He accordingly was so, and appointed to the command of Gibraltar in a fortunate hour for the safety of that important fortress. The system of his life, as well as his education, peculiarly qualified him for this trust. He was perhaps the most abstemious man of the age; neither indulging himself in animal food or wine. He never slept more than four hours at a time; so that he was up later and earlier than most other men. He so insured himself to habits of hardness, that the things which are difficult and painful to other men, were to him daily practice, and rendered pleasant by use. It could not be easy to starve such a man into a surrender, nor possible to surprise him. The example of the commander in chief in a besieged garrison has the most persuasive efficacy in forming the manners of a soldiery. Like him his brave followers came to regulate their lives by the most strict rules of discipline, before there arose a necessity for so doing; and severe exercise, with short diet, became habitual to them by their own choice. The military system of discipline which he introduced, and the preparations which he made for his defence, were contrived with so much judgment, and executed with so much address, that he was able with a handful of men to preserve his post against an attack, the constancy of which, even without the vigour, had been sufficient to exhaust any common set of men. Collected within himself, he in no instance destroyed, by premature attacks, the labours which had cost the enemy the greatest expense to complete; he deliberately observed their approaches, and seized on the proper moment, with the keenest perspicacity, in which to make his attack with success. He never spent his ammunition in useless parade or in unimportant attacks. He never relaxed from his discipline by the appearance of security, nor hazarded the lives of his garrison by wild experiments. By a cool and temperate demeanour, he maintained his station for three years of constant investment, in which all the powers of Spain were employed. All the eyes of Europe were on this garrison; and his conduct has justly exalted him to the most elevated rank in the military annals of the day. On his return to England, the gratitude of the British senate was as forward as the public voice in giving him that distinguished mark of his merit deserved. Both houses of parliament voted an unanimous address of thanks to the general. The king conferred on him the honour of Knight of the Bath, with a pension during his own and a second life of his own appointment; and on June 5, 1787, his majesty advanced him to the peerage, by the title of Lord Heathfield, Barons Gibraltar, permitting him to take, in addition to his family arms, the arms of the fortress he had so bravely defended, to perpetuate to futurity his noble conduct.

His lordship died on the 6th of July 1790, at his chateau at Aix-la-Chapelle, of a second stroke of the palsy, after having for some weeks preceding enjoyed tolerable good health and an unusual flow of spirits. His death happened two days before he was to have set out for Leghorn on his way to Gibraltar; of which place he was once more appointed to the defence,
ELM

ELM, See Ulmus, Botany Index.

ELMACINUS, GEORGE, author of a History of the Saracens, was born in Egypt towards the middle of the 13th century. His history comes down from Mahomet to the year of the Hegira 574, answering to the year of our Lord 1134; in which he sets down year by year, in a very concise manner, whatever regards the Saracen empire, intermixed with some passages relating to the eastern Christians. His abilities must have been considerable; since, though he professed Christianity, he held an office of trust near the persons of the Mahometan princes. He was son to Xasir.

ELF

Al Amid, secretary to the council of war under the sultans of Egypt for 45 years; and in 1238, when his father died, succeeded him in his place. His history of the Saracens was translated from Arabic into Latin by Erpinius; and printed in these two languages in folio, at Leyden, in 1625. Erpinius died before the publication; but Golius took care of it, and added a preface. It was dedicated by Erpinius's widow to Dr Andrews, bishop of Winchester.

ELOCUTION. See Oratory, Part III.

ELOGY, a praise or panegyric bestowed on any person or thing, in consideration of its merit. The beauty of eloogy consists in an expressive brevity. Eulogiums should not have so much as one epithet, properly so called, nor two words synonymous: they should strictly adhere to truth; for extravagant and improbable elogies rather lessen the character of the person or thing they would extol.

ELOHI, ELOI, or Elohim, in scripture, one of the names of God. But it is to be observed, that angels, princes, great men, judges, and even false gods, are sometimes called by this name. The sequel of the discourse is what assists us in judging rightly concerning the true meaning of this word. It is the same as Eloah. One is the singular, the other the plural. Nevertheless Elohim is often construed in the singular number, particularly when the true God is spoken of: but when false gods are spoken of, it is construed rather in the plural.

ELOINED, in Law, signifies restrained or hindered from doing something: thus it is said, that if those within age be elained, so that they cannot use personally, their next friend shall sue for them.

ELONGATION, in Astronomy, the digression or recess of a planet from the sun, with respect to an eye placed on our earth. The term is chiefly used in speaking of Venus or Mercury, the arch of a great circle intercepted between either of these planets and the sun being called the elongation of that planet from the sun.

ELONGATION, in Surgery, is an imperfect luxation, occasioned by the stretching or lengthening of the ligaments of any part.

ELOPEMENT, in Law, is where a married woman departs from her husband, and cohabits with an adulterer; in which case the husband is not obliged to allow her any alimony out of her estate, nor is he chargeable for necessities for her of any kind. However, the bare advertising a wife in the gazette, or other public paper, is not a legal notice to persons in general not to trust her; though a personal notice given by the husband to particular persons is said to be good. An action lies, and large damages may be recovered, against a person for carrying away and detaining another man's wife.

ELOQUENCE, the art of speaking well, so as to affect and persuade. See Oratory.

ELPHINSTON, WILLIAM, a Scotch prelate and statesman of considerable eminence, who flourished in the end of the 17th and commencement of the 18th century, was born at Glasgow in the year 1631. At the university of this city he received his education, and in the learning which distinguished this period he made extraordinary proficiency. His studies being completed, he went over to France, to make himself master-
of the civil and canon law in the university of Paris, where he afterwards became a professor, and for the space of six years acquired considerable reputation in the discharge of his duty. On his return to Scotland, he entered into holy orders, was soon appointed official of Glasgow, and afterwards of St Andrews. He was admitted a member of the king's council; and on a misunderstanding taking place between James III. of Scotland and Louis XI. of France, his powerful mediation at the latter court, in conjunction with the bishop of Dunkeld and the earl of Buchan, effected an amicable reconciliation. As Elphinston on this occasion displayed such prudence and eloquence, the king was so grateful for his meritorious services, that he rewarded him with the see of Ross, from which he was translated to the diocese of Aberdeen about the year 1484, and also appointed to the high office of chancellor of the kingdom, which he managed with so much moderation and equity, that all parties esteemed and admired him. When the civil wars broke out between James and the discontented nobility, Bishop Elphinston appears to have declined all interference with public affairs of a political nature, and confined himself to the discharge of his ministerial duties. But when James IV. ascended the throne, his abilities as a statesman were again called forth, and he was chosen ambassador to the emperor Maximilian, in order to bring about a marriage alliance between his royal master and the emperor's daughter; but she had been previously promised to another. Yet the bishop's mission was not without its salutary effects, as he was the means of terminating an enmity which had long existed between the Dutch and Scots. This he conducted in such a masterly manner, that James undertook any thing of importance, without first procuring the sanction of his approbation. He was equally the zealous patron of learning; and it is generally believed that the establishment of a university at Aberdeen was entirely owing to his influence with the Pope, from whom he obtained a bull for that purpose; and by his exertions was King's college undertaken and completed. He begat, during the term of his deaconage, large sums of money for its support. He terminated his mortal career in 1514, about 83 years of age, at which advanced period his constitutional vigour was very little impaired, and all the faculties of his mind were in full force; but the serious losses at the memorable battle of Flodden had broken his heart. He wrote a history of his native country, which is among the manuscripts of Sir Thomas Fairfax, in the Bodleian library at Oxford. 

Edshemier, Adam, a celebrated painter, born at Francfort on the Maine, in 1574. He was first a disciple of Pauw, a German; but his desire of improvement carrying him to Rome, he soon became a most excellent artist in landscapes, history; and nightmares, with small figures. His works are but few; and the great pains he bestowed in finishing them raised their prices so high, that they are hardly anywhere to be found but in the cabinets of princes. He was of a melancholy turn, and sunk under the embarrassments of his circumstances in 1610. James Ernest Thomas of Landau was his disciple; and imitated his style so nicely, that their performances are not easily distinguished. 

Elshenburg, a port town of Sweden, in the province of Gothland, and territory of Schonen, seated on the side of the Sound, over against Elsinore. It was formerly a fortress belonging to the Danes; but all the fortifications were demolished in 1679, and there is only one tower of a castle which remains undemolished. It now belongs to Sweden. E. Long. 13. 20. N. Lat. 56. 2. 

Elzinore, or Elsinore, a port town of Denmark, seated on the Sound, in the isle of Zealand. E. Long. 13. 23. N. Lat. 56. 0. — It was a small village, containing a few fisher men's huts, until 1445, when it was made a staple town by Eric of Pomerania; who bestowed upon the new settlers considerable immunities, and built a castle for their defence. From that period it gradually increased in size and wealth, and is now the most commercial place in Denmark next to Copenhagen. It contains about 7000 inhabitants, among whom are a considerable number of foreign merchants, and the consuls of the principal nations trading to the Baltic. The passage of the Sound is guarded by the fortress of Cronborg, which is situated upon the edge of a peninsular promontory, the nearest point of land from the opposite coast of Sweden. It is strongly fortified towards the shore by ditches, bastions, and regular entrenchments; and towards the sea by several batteries, mounted with 60 cannon, the largest whereof are 48 pounders. Every vessel, as it passes, lowers her top-sails, and pays a toll at Elsinore. It is generally asserted, that this fortress guards the Sound; and that all the ships must, on account of the shoal waters and currents, steer near the batteries as to be exposed to their fire in case of refusal. This is a mistaken notion. On account of the numerous and opposite currents in the Sound, the safest passage lies near the fortress; but the water in any part is of sufficient depth for vessels to keep at a distance from the batteries, and the largest ships can even sail close to the coast of Sweden. The constant discharge, however, of the toll, is not so much owing to the strength of the fortress as to a compliance with the public law of Europe. Many disputes have arisen concerning the right by which the crown of Denmark imposes such a duty. The kings of Sweden, in particular, claiming an equal title to the free passage of the Strait, were for some time exempted by treaty from paying it; but in 1720, Frederic I. agreed that all Swedish vessels should for the future be subject to the usual imposts. All vessels, beside a small duty, are rated at 1 1/2 per cent. of their cargoes, except the English, French, Dutch, and Swedish, which pay only one per cent.; and in return the crown takes the charge of constructing light-houses, and erecting signals to the shoals and rocks, from the Castle to the entrance into the Baltic. The tolls of the Sound, and of the two Belts, supply an annual revenue of 120,000l. or according to others 150,000l. 

Elvas, a large town, and one of the best and most important in Portugal, seated in the province of Alentejo, a few miles from the frontiers of Estremadura in Spain. It is built on a mountain, and is strongly fortified with works of free-stone. The streets of the town are handsome, and the houses neat; and there is a cistern so large, that it will hold water enough to supply the whole town six months. The water is conveyed to it by a magnificent aqueduct, three
Ely, three miles in length, sustained in some places by four or five high arches, one upon another. It was, however, battered by the French and Spaniards in 1706, but without effect. It has generally a garrison of 100 men. The king founded an academy here, in 1733, for young gentlemen. W. Long, 7. 28. N. Lat. 38.

ELUDING, the act of evading or rendering a thing vain and of no effect; a denunciation getting clear, or escaping out of an affair, difficulty, embarrassment, or the like. We say, to elucidate a proposition, &c. The design of chicanery is, to elude the force of the laws: this doctor has not resolved the difficulty, but eluded it. Alexander, says the historian, in cutting the Grecian knot, either eluded the oracle or fulfilled it: Ile mequequam lactatam cum longitudinis nodis, Nikil, inquisit, interret, quomodo solvatur; gladiisque rapit omnius laxis, oraculi sortem vel eludit vel temptavit.

ELVELA, a genus of plants belonging to the cryptogamia class, and order of fungi. The fungus is turbinated, or like an inverted cone. See Botany Index.

ELUL, in ancient chronology, the 11th month of the Jewish civil year, and the sixth of the ecclesiastical: it consisted of only 29 days, and answered pretty nearly to our August.

ELUTRIATION, in Chemistry, an operation performed by washing solid substances with water, stirring them well together, and hastily pouring off the liquid, while the lighter part remains suspended in it, that it may thereby be separated from the heavier part. By this operation metallic ores are separated from earth, stones, and other unmetallic particles adhering to them.

ELY, a city and bishop's see of Cambridgeshire, situated about 13 miles north of Cambridge. E. Long. 51. N. Lat. 52. 23. It is a county of itself, including the territory around; and has a judge who determines all causes civil and criminal within its limits. The church hath undergone various alterations since it was first established by Etheldreda, the wife of Egfride, king of Northumberland, who founded a religious house here, and planted it with vines, and became the first abbot of it herself. The Danes entirely ruined this establishment; then Ethelwald, the 27th bishop of Winchester, rebuilt the monastery, and filled it with monks; to whom King Edgar, and many succeeding monarchs, bestowed many privileges, and great grants of land; so that this abbey became in process of time the best of any in England. Richard, the 11th abbot, wishing to free himself of the bishop of Lincoln, within whose diocese his monastery was situated, and not liking so powerful a superior, he made great interest with King Henry I. to get Ely erected into a bishopric; and spared neither purse nor prayers to bring this about. He even brought the bishop of Lincoln to consent to it, by giving him and his successors the mansions of Breden, Biggleswade, and Spalding, which belonged to the abbey, in lieu of its jurisdiction; but he lived not to taste the sweets of his industry and ambition, he dying before his abbey was erected into a see. His successor was the first bishop of Ely: but the great privileges the bishop enjoyed were almost wholly taken away, or much restricted, by the act of parliament, 27th Henry VIII. regarding Vol. VIII. Part I. the restoring to the crown the ancient royalties: So, instead of being palatine of the isle of Ely, the bishop and his temporal stewart were by that act declared to be from thenceforth justices of the peace in the said island. This diocese contains all Cambridgeshire, and the isle of Ely, excepting Isleham, which belongs to the see of Rochester, and 15 other parishes, that are in the diocese of Norwich; but it has a parish in Norfolk, viz. Emmeth. The number of parishes in this diocese are 145, whereas 75 are innsipriate. It hath but one archdeacon, viz. of Ely. It is valued in the king's books at 2134l. 18s. 1yd. The clergy's tent amounting to the sum of 384l. 14s. 6d. The bishopric is computed to be worth annually 8000l. The church is dedicated to St Etheldreda. The building, as it now appears, has been the work of several of its bishops. The west parts were rebuilt by Bishop Ridel; the choir and lanterns were begun by Bishop Norwood, and finished by Bishop Frodsham. This see hath given two saints and two cardinals to the church of Rome; and to the English nation nine lord chancellors, seven lord treasurers, one lord privy seal, one chancellor of the exchequer, one chancellor to the university of Oxford, two masters of the rolls, and three almoners. To this cathedral belong a bishop, a dean, an archdeacon, eight prebendaries, with vicars, lay-clerks, choristers, a schoolmaster, usher, and 26 king's scholars.

ELYMAIS, the capital city of the land of Elam, or ancient Persia. We are told (1 Mac. vi. 1.) that Antiochus Epiphanes, having understood that there were very great treasures lodged in a temple at Elymais, determined to go and plunder it: but the stonemasons getting intelligence of his design, made an insurrection, forced him out of the city, and obliged him to fly. The author of the second book of Maccabees (ix. 2.) calls this city Persepolis, in all probability because formerly it was the capital of Persia; for it is known from other accounts, that Persepolis and Elymais were two very different cities, the latter situated upon the Eulaeus, the former upon the Araxes.

ELYMUS, a genus of plants belonging to the triandra class, and in the natural method ranking under the fourth order, Graminae. See Botany Index.

ELYOT, Sir Thomas, a gentleman of eminent learning into the 16th century, was educated at Oxford, travelled into foreign countries, and upon his return was introduced to court. His learning recommended him to Henry VIII. who conferred the honour of knighthood on him, and employed him in several embassies: particularly in 1532, to Rome, about the divorce of Queen Catharine, and afterwards to Charles V. about 1556. He wrote, The Castle of Health, the Governor, Bonnet of Sapphrye, Of the Education of Children, De rebus memorabilibus Angliae, and other books; and was highly esteemed by all his learned contemporaries.

ELYSIUM (Paradisus), in the ancient theology, or rather mythology, a place in the inferi or lower world, furnished with fields, meads, agreeable woods, groves, shades, rivers, &c. whither the souls of good people were supposed to go after this life.

Orpheus, Hercules, and Æneas, were supposed to have
Elysiun, Elysiun.

have descended into Elysiun in their life time, and to
have returned again; (Virg. lib. vi. ver. 629 & c.).

Tibullus (lib. i. eleg. 3.) gives us fine descriptions of the
Elysiun fields.

Virgil opposes Elysiun to Tartarus; which was
the place where the wicked underwent their punish-
ment.

Hic locus est, partes ubi se via fudit in ambas:
Dextero, qua Ditis magni sub mansia tendit:
Hac ster Elysiun nobis: at leva malorum
Exercit pacis, et ad impia Tartara mitit.

He assigns Elysiun to those who died for their coun-
try, to those of pure lives, to truly inspired poets, to the
inventors of arts, and to all who have done good to
mankind.

Some authors take the fable of Elysiun to have been
borrowed from the Phoenicians; as imagining the name
Elysiun formed from the Phoenician य अ ल ब, or य अ ल,
or य अ ल, or य अ ल, "to rejoice," or "to be in joy;" the
letter a being only changed into e, as we find done in
many other names; as in Enakim for Anakim, &c.
On which footing, Elysiun fields should signify the
same thing as a place of pleasure; or

Locos letos, et amosa virreta
Fortunaturum nemorum, sedebeque beatas. Virg.

Others derive the word from the Greek ἀλης, ἄλους, "I
deliver, I let loose or disengage;" because here men's
souls are freed or disencumbered from the fetters of the
body. - Berosus, and Horius (Hist. Philosoph.
lib. iii. cap. 2.) take the place to have derived its name
from Eliza, one of the first persons who came into
Greece after the deluge, and the author and father of
the Ελευθεριαν.

The Elysiun fields were, according to some, in the
Ελευθεριαν islands on the coasts of Africa, in the Aτlan-
tic. Others place them in the island of Lucus; and,
according to the authority of Virgil, they were situated
in Italy. According to Lucian, they were near the
moon; or in the centre of the earth, if we believe Plu-
tarch. Olaus Wormius contends that it was in Sweden
the Elysiun fields were placed.

ELZEVIRS, celebrated printers at Amsterdam
and Leyden, who greatly adorned the republic of let-
ters with many beautiful editions of the best authors
of antiquity. They fell somewhat below the Stephenses
in point of learning, as well as in their editions of Greek and
Hebrew authors; but as to the choice of good
books, they seem to have equalled, and in the neatness
and elegance of their small characters, greatly to have
exceeded them. Their Virgil, Terence, and Greek
Testament, have been reckoned their masterpieces; and
are indeed so very fine, that they unjustly gained the
reputation of being the first printers in Europe.
There were five of these Elzevirs, namely, Lewis, Bu-
naventure, Abraham, Lewis, and Daniel. Lewis began
to be famous at Leyden in 1575, and was remarkable
for being the first who observed the distinction between
the w-consonant and w-vowel, which had been recom-
manded by Ramus and other writers long before, but
never regarded. Daniel died in 1680 or 1681; and
though he left children who carried on the business,
nevertheless for the last of his family who excel-
ed in it. The Elzevirs have printed several catalogues
of their editions; but the last, published by Daniel
is considerably enlarged, and abounds with new books.
It was printed at Amsterdam, 1674, in 12mo, and di-
vided into seven volumes.

EMANATION, the act of flowing or proceeding
from some source or origin. Such is the emanation
of light from the sun; or that of effluvia from odorous,
&c. bodies; of wisdom from God, &c.—The word is
formed of the Latin em, "out of," and manare, "to flow
or stream."

EMANATION is also used for the thing that pro-
ceeds, as well as the act of proceeding. The power
given a judge is an emanation from the regal power;
the reasonable soul is an emanation from the Divinity.

EMANCIPATION; in the Roman law, the setting
free a son from the subjection of a father; or
that whatever moveables he acquires belongs in pro-
erty to him, and not his father, as before emancipa-
tion.

Emancipation puts the son in a capacity of man-
aging his own affairs, and of marrying without his fa-
ther's consent, though a minor. Emancipation differs
from manumission, as the latter was the act of a master
in favour of a slave, whereas the former was that of a
father in favour of his son.

There were two kinds of emancipation: the one ta-
it, which was by the son's being promoted to some
dignity, by his coming of age, or by his marrying; in
all which cases he became his own master of course.
The other, express; where the father declared before
a judge, that he emancipated his son. In performing
this, the father was first to sell his son imaginarily to
another, whom they called pater-fiduciaris, father in
trust; of whom being bought back again by the natu-
ral father, he manumitted him before the judge by a
verbal declaration.

Emancipation formerly obtained in France with re-
gard to minors or pupils, who were hereby set at liberty
to manage their own effects, without the advice or
direction of their parents or tutors.

EMARGINATED, among botanists. See Bot-
any Index

EMASCULATION, the act of castrating or de-
priving a male of those parts which characterize his sex.
See Castration and Eunuch.

EMAUS, EMAUS, or ANNAUS, in Ancient Geo-
graphy, a village, 60 stadia to the north-west of Jeru-
salem, or about seven miles: it afterwards became a
town and a Roman colony, Nicopolis, (Jerome). Re-
land has another Emmaus towards Lydda, 22 miles
to Jerusalem, (Itinerary); a third, near Tiberias.

EMBALMING, is the opening a dead body, tak-
ing out the intestines, and filling the space with ode-
riferous and desiccative drugs and spices, to prevent
it putrefying. The Egyptians excelled all other na-
tions in the art of preserving bodies from corruption;
for some that they have embalmed towards of 2000
years ago, remain whole to this day, and are often
brought into other countries as great curiosities. Their
manner of emballing was thus: they scooped the
brain with an iron scoop out at the nostrils, and threw
in medicaments to fill up the vacuum: they also took
out the entrails, and having filled the body with myrrh,
cassia, and other spices, except frankincense, proper to
dry up the humours, they pickled it in nitre, where it
lay
EMBARGO. (Embarrasment), a French term, though now naturalized; denoting a difficulty or obstacle which perplexes or confounds a person, &c.

EMBASSADOR. See AMBASSADOR.

EMBASSY, the office or function of an AMBASSADOR.

EMBDEN, a port-town and city of Germany, capital of a country of the same name, now in possession of the king of Prussia. It is situated at the mouth of the river Ena. E. Long. 6° 45'. N. Lat. 53° 50'.

EMBER-WEEKS, are those wherein the ember or embers days fall.

In the laws of King Alfred, and those of Canute, those days are called umbres, that is, circular days, from whence the word was probably corrupted into ember-days: by the canonists they are called quattuor annui tempora, the four cardinal seasons, on which the circle of the year turns: and hence Henssow takes the word to have been formed, viz. by corruption from tempor, of tempora.

The ember-days are, the Wednesday, Friday, and Saturday, after Quadragesima Sunday, after Whit-sunday, after Holy-ROOD day in September, and after St. Lucius's day in December: which four times answer well enough to the four quarters of the year, Spring, Summer, Autumn, and Winter.

Mr Sonner thinks they were originally fasts, instituted to beg God's blessing on the fruits of the earth. Agreeable to which, Skinner supposes the word ember taken from the ashes, embers, then strewed on the head.

These ember-weeks, are now chiefly taken notice of, on account of the ordination of priests and deacons; because the canon appoints the Sundays next succeeding the ember-weeks, for the solemn times of ordination: Though the bishop, if they please, may ordain on any Sunday or holiday.

EMBERIZA, a genus of birds belonging to the order of passerers. See Ornithology Index.

EMBLEM, a kind of painted ænigma, which, representing some obvious history, with reflections underneath, instructs us in some moral truth or other matter of knowledge. See DEVISE, ÄNIGMA, &c.

Such is that very significant image of Scævola holding his hand in the fire; with the words, Agere et pati fortior Romanum est, "To do and suffer courageously is Roman."

The word is pure Greek, formed of the verb ἐμπαθαίνει, "to cast in, to insert." Suetonius relates, that Tiberius made the word be erased out of the decree of the Roman senate, because borrowed from another language.

The emblem is somewhat plainer and more obvious than the ænigma. Gale defines emblem an ingenious picture, representing one thing to the eye, and another to the understanding.

The Greeks also gave the name EMBLEMS, ἐμπαθάνατα, to inlaid or mosaic works, and even to all kinds of ornaments of vases, moveables, garments, &c. And the Latins used emblem in the same sense. Accordingly, Cicero reproving Verres with the statues and fine wrought works he had plundered from the Sicilians, calls
calls the ornament fixed thereby (and which on occasion might be separated from them) emblematum. Add, that Latin authors frequently compare the figures and ornaments of discourse to these emblematum. Thus, an ancient Latin poet praising an orator, says, that all his words were ranged like the pieces in mosaic:

Quam lepide texta composite, ut tesserae omnes, 
At si per leviter, utque emblematum vermiculato.

With us emblem ordinarily signifies no more than a painting, basse-relievo, or other representation, intending to hold forth some moral or political instruction.

What distinguishes an emblem from a devise is, that the words of an emblem have a full complete sense of themselves; nay, all the sense and signification which they have, together with the figure. But there is a yet further difference between emblem and devise: for a devise is a symbol appropriated to some person, or that expresses something which concerns him particularly; whereas an emblem is a symbol that regards all the world alike.

These differences will be more apparent, from comparing the emblem above quoted, with the devise of a candle lighted, and the words Jesuado consumet, "I waste myself in doing good." See Devise.

EMBOLISMUS, αἰμοθερμία, in Chronology, signifies "intercalation." The word is formed of ψαλλων, "to insert."

As the Greeks made use of the lunar year, which is only 354 days; in order to bring it to the solar, which is 365 days, they had every two or three years an embolism, i.e. they added a 13th lunar month every two or three years, which additional month they called embolistos, αἰμοθερμία, because inserted, or intercalated.

EMBOSSING, or IMBOSING, in Architecture and Sculpture, the forming or fashioning works in relieve, whether cut with a chisel or otherwise.

Embosseing is a kind of sculpture, wherein the figure sticks out from the plane whereon it is cut: and according as the figures are more or less prominent, they are said to be in alto, mezzo, or basse relievo; or high, mean, or low relief. See Encausting.

EMBOTHRIUM, a genus of plants belonging to the tetrandria class. See Botany Index.

EMBUS, in Architecture, the enlargement made of the aperture of a door or window on the inside of the wall; its use being to give the greater play for the opening of the door or casement, or to admit the more light.

EMBROCACTION, in Surgery and Pharmacy, an external kind of remedy, which consists in an irrigation of the part affected, with some proper liquor, as oils, spirits, &c. by means of a woollen or linen cloth, or a sponge, dipped in the same.

EMBROIDERY, a work in gold, or silver, or silk thread, wrought by the needle upon the cloth, stuffs, or muslin, into various figures. In embroidering stuffs, the work is performed in a kind of loom; because the more the piece is stretched, the easier it is worked. As to muslin, they spread it upon a pattern ready designed; and sometimes, before it is stretched upon the pattern, it is starched, to make it more easy to handle. Embroidery on the loom is less tedious than the other, in which, while they work flowers, all the threads of the muslin, both lengthwise and breadthwise must be continually counted; but, on the other hand, this last embroidery is much easier in points, and susceptible of greater variety. Clothes too much milled are scarce susceptible of this ornament, and in effect we seldom see them embroidered. The thinnest muslins are left for this purpose; and they are embroidered to the greatest perfection in Saxony; in other parts of Europe, however, they embroider very prettily, and especially in France.

There are several kinds of embroidery: 1. Embroidery on the stamp, where the figures are raised and rounded, having cotton or parchment put under them to support them. 2. Low embroidery; where the gold and silver lie low upon the sketch, and are stitched with silk of the same colour. 3. Guimped embroidery: this is performed either in gold or silver; they first make a sketch upon the cloth, then put on ent villum, and afterwards sew on the gold and silver with silk thread; on this kind of embroidery they often put gold and silver cord, tinsel, and spangles. 4. Embroidery on both sides; that which appears on both sides of the stuff. 5. Plain embroidery; where the figures are flat and even, without cords, spangles, or other ornaments.

By Stat. 23 Geo. I. c. 25, no foreign embroidery, or gold and silver brocade, shall be imported, upon pain of being forfeited and burnt, and penalty of 100l. for each piece. No person shall sell, or expose to sale, any foreign embroidery, gold and silver thread, lace, fringe, brocade, or make up the same into any garment, on pain of having it forfeited and burnt, and penalty of 100l. All such embroidery, &c. may be seized and burnt; and the merchant, &c. in whose custody it was found, shall forfeit 100l.

EMBRUN, or AMBROIN, a city of Dauphiny, in France, near the confines of Piedmont. E. Long. 6. 6. N. Lat. 44. 35.

EMBRYO, in Physiology, the first rudiments of an animal in the womb, before the several members are distinctly formed; after which period it is denominated a fetus. See Generation and Fetus.

EMERALD, a precious stone belonging to the genus of silicious earth. The word is derived, according to some, from the French semouillé, and that from the Latin semusius, signifying the same thing; others it is said to be derived from the Italian semorello, or the Arabian semorad. According to Cronstedt the emerald is the softest of all the precious stones, though other naturalists place it the next after the diamond in this respect. It is perhaps the most beautiful of all the gems, and, according to Wallerius, when heated in the fire, changes its colour to a deep blue, and becomes phosphorescent; but recovers its green colour when cold. When pulverized it has a white appearance, and, with borax, melts to a very thin and colourless glass. It becomes electric by being rubbed, and some have the property of the tourmaline, viz. of being electrified by heat, and in that state attracting asbes or other light substances; though the emeralds are less powerful than the tourmaline, and after having attracted the asbes, they retain them without any signs of repulsion.

Pliny mentions twelve different kinds of these precious stones; though it appears, from the vast size of some of them, that they must have been only certain kinds of green spar, or other green stone, which at that time...
time went under the name of emerald among the ancients. The true emerald is found only in very small crystals, from the size of a nut in diameter to that of a walnut. Theophrastus, however, mentions one four cubits long and three broad; likewise an obelisk composed of only four emeralds, the whole length being 40 cubits, and the breadth from four to two.

Eustachio informs us, that the emeralds, in their rough or native state, consist of hexagonal columns mostly truncated at both ends; and that he had some in his possession, which in a gentle heat became colourless, but in a strong heat white and opaque, without any mark of fusion. Brunick distinguishes them into two classes. 1. The pale green emerald, which comes from the east and from Peru, the figure being that of an hexagonal truncated prism, and the basis a vein of white quartz. 2. The dark green emerald, which is also columnar, but very dark coloured, striped longitudinally, and has little transparency. The points are generally broken off longitudinally, though Davila mentions one resembling a blunt triangular pyramid; and in the imperial cabinet at Vienna there is one with a five-sided pyramid. These are the emeralds which become electrical by heat; though all of them do not; and those which do so cannot be known but by actual experiment. The finest specimen of the former kind of emeralds is to be seen in the treasury of the holy chapel of Loretto, containing upwards of 100 of these precious stones great and small. A fellow to this was made by us, and both were presents to the king of Sicily, designed to represent two Mount Calvaries.

Emeralds are distinguished by the jewellers into two kinds the oriental and occidental. The true oriental emerald is very scarce, and at present only found in the kingdom of Cambay. So great indeed is the scarcity of them, that an opinion prevailed that there are no oriental emeralds. This opinion is adopted, among others, by Mr. Bruce; who informs us, that he made an excursion to the island of emeralds in the Red sea, and endeavours to show that there never were any emeralds but what came from America, and that those said to have been found in the East Indies were imported from that continent. It is probable, indeed, that in former times any kind of crystal tinged of a green colour might be called an emerald, and hence the green cockle spar brought from Egypt may have obtained the name of mother of emeralds; but of late some emeralds have been brought from Cambay into Italy, which greatly excelled those of America. The best emeralds of the western continent come from Peru, and are called oriental by the jewellers: some are found in Europe, principally in the duchy of Silesia in Germany.

Rough emeralds—Those of the first and coarsest sort, called phæneus, for grinding, are worth 27 shillings sterling the stone, or 8 ounces. The demi-morills, filtering per measure. Great morills, which are the little pieces, but of fine colour, from 32l. to 13l. per merc. Emeralds, larger than morills, and called of the third colour or sort, are valued at from 50l. to 60l. the stone. Emeralds, called of the second sort, which are in larger and finer pieces than the preceding, are worth from 62l. to 72l. per merc. Lastly, those of the first colour, otherwise called augrus curtes, are worth from 210l. to 215l.

Emeralds ready cut, or polished and not cut, being emeralds of good stone, and a fine colour, are worth—L. 1. 3.

To counterfeit emeralds: Take of natural crystal, four ounces; of red lead, four ounces; verdigris, forty-eight grains; crocus maris, prepared with vinegar, eight grains: let the whole be finely pulverised and sifted: put this into a crucible, leaving one inch empty: lute it well, and put it into a potter's furnace, and let it stand there as long as they do their pots. When cold, break the crucible; and you will find a matter of a fine emerald colour, which, after it is cut and set in gold, will surpass in beauty an oriental emerald.

Emersion, in Physics, the rising of any solid above the surface of a fluid specifically heavier than itself, into which it has been violently immerged or thrust. It is one of the known laws of hydrostatics, that a lighter solid being forced down into a heavier fluid, immediately endeavours to emerge; and that with a force or moment equal to the excess of weight of a quantity of the fluid above that of an equal bulk of the solid. Thus, if a solid be immerged in a fluid of double its specific gravity, it will emerge again till half its bulk or body be above the surface of the fluid.

Emersion, in Astronomy, is when the sun, moon, or other planet, begins to re-appear, after its having been eclipsed, or hid by the interposition of the moon, earth, or other body.

The difference of longitude is sometimes found by observing the immersions and emersions of the first of Jupiter's satellites. The immersions are observed from the time of Jupiter's being in conjunction with the sun to his opposition; and the emersions, from the opposition to the conjunction; which two intervals are usually six months a-piece, and divide the year between them. But when Jupiter is in conjunction with the sun, and 15 days before and afterwards, there is nothing to be observed; the planet, with his satellites, being then lost in the light of the sun.

Emersion is also used when a star before hid by the sun, as being too near him, begins to re-appear and to get out of his rays.

Emerson, William, an eminent mathematician, was born in June 1701, at Hurworth, a village about three miles south of Darlington; at least it is certain that he resided here from his childhood. His father Dudley Emerson was a tolerable proficient in mathematics; and without his books and instructions, perhaps his own genius (most eminently fitted for mathematical disquisitions) would have never been unfolded. He was instructed in the learned languages by a young clergyman, then curate of Hurworth, who
EMERSON was boarded at his father's house. In the earlier part of his life he attempted to teach a few scholars: but whether from his concise method (for he was not happy in explaining his ideas), or the warmth of his natural temper, he made no progress in his school: he therefore soon left it off; and satisfied with a moderate competence left him by his parents, he devoted himself to a studious retirement. Towards the close of the year 1798 (being sensible of his approaching dissolution), he disposed of the whole of his mathematical library to a bookseller at York; and on May 20th 1799, he died of a lingering and painful disorder at his native village, aged near 55 years.

Mr Emerson in his person was rather short, but strong and well made, with an open countenance and ruddy complexion. He was exceedingly singular in his dress. He had but one coat, which he always wore open before, except the lower button; no waistcoat; his shirt quite the reverse of one in common use, no opening before, but buttoned close at the collar, behind; a kind of flaxen wig which had not a crooked hair in it, and probably had never been tortured with a comb from the time of its being made. He always walked up to London when he had anything to publish, revising sheet by sheet himself. — Trusting no eyes but his own, was always a favourite maxim with him. He never advanced any mathematical proposition that he had not first tried in practice, constantly making all the different parts himself on a small scale, so that his house was filled with all kinds of mechanical instruments together or disjointed. He would frequently stand up to his middle in water while fishing, a diversion he was remarkably fond of. He used to study incessantly for some time, and then for relaxation take a ramble to any pot-alley where he could get any body to drink with and talk to. The duke of Manchester was highly pleased with his company, and used often to come to him in the fields and accompany him home, but could never persuade him to get into a carriage. On these occasions he would sometimes exclaim, "Damn your whim-wham! I had rather walk." He was a married man; and his wife used to spin on an old-fashioned wheel, whereof a very accurate drawing is given in his Mechanics. He was deeply skilled in the science of music, the theory of sounds, and the various scales both ancient and modern, but was a very poor performer.

The following is a list of Mr Emerson's works.


EMERY, in Natural History, a rich iron ore found in large masses of no determinate shape or size, extremely hard, and very heavy. It is usually of a dusky brownish red on the surface; but when broken, is of a fine bright iron-gray, but not without some tinge of redness; and is spangled all over with shining specks, which are small flakes of a foliated tale, highly impregnated with iron. It is also sometimes very red, and then usually contains veins of gold. It makes no effervescence with any of the acid menstrums; and is found in some of the Greek islands, in Tuscany, and some parts of Germany.

Dr Lewis is of opinion, that some kinds of emery may contain the metal called platina, and on this subject has the following curious observations. "Alonso Barba mentions a substance called chumps; which is a hard stone of the emery kind, participating of iron, of a gray colour, shining a little, very hard to work, because it resists the fire much, found in Potosi, Chocaya, and other places, along with blackish and reddish ores that yield gold. If platina is really found in large masses, either generally or only now and then, one might reasonably expect those masses to be such as are here described."

"Of the same kind perhaps also is the mineral mentioned by several authors under the name of Spanish emery, smiriris Hispanicus, which should seem, from the accounts given of it, to be no other than platina or its matrix. The smiriris is said to be found in the gold mines, and its exportation prohibited; to contain films or veins of native gold; to be in great request among the alchemists; to have been sometimes used for the adulteration of gold; to stand, equally with the noble metal, cepellation, quattartion, antimony, and the regal cement; and to be separable from it by amalgamation with mercury, which throws out the smiriris and retains the gold; properties strongly characteristic of platina, and which do not belong to any known substance besides. This debasement of gold per extractum smiridis Hispanicus is mentioned by Becher in his Minera arenica, and several times hinted at in his Physica subterrae. Both Becher and Stahl indeed call the substance which the gold receives from the emery an earth, whereas platina is undoubtedly a metal; but this does not at all invalidate our supposition, for they give the name of earth also to the substance which copper receives from calamine in being made into brass, which is now known to be metallic."

"From these observations I have been led to suspect, that the European emeries likewise might possibly participate of this quality. If it were certain, it would account satisfactorily for the use, which some of the alchemists are said to have made of emeries and other ferruginous ores; and we should no longer doubt, or wonder, that by treating gold with these kinds of minerals, they obtained a permanent augmentation; but this augmentation, though it resisted lead, antimony, aquafortis, and the regal cement, was separable, as Becher owns it, by quicksilver; and that, when it exceeded certain limits, it rendered the gold pale and brittle."

"If emery contains platina, I imagined it might
This title was first given to the caliphs; but when they assumed the title of Sultans, that of emir remained to their children; as that of Caesar among the Romans. At length the title came to be attributed to all who were educated to descend from Mahomet by his daughter Fatimah, and who wear the green turban instead of the white. The Turks make an observation, that the emirs, before their fortieth year, are men of the greatest gravity, learning, and wisdom; but after this, if they are not great fools, they discover some signs of levity and stupidity. This is interpreted by the Turks as a sort of divine impulse in token of their birth and sanctity. The Turks also call the vizirs, bashaws, or governors of provinces, by this name.

EMISSARY, in a political sense, a person employed by another to sound the opinions of people, spread certain reports, or act as a spy over other people's actions.

EMISSARY Vesicle, in Anatomy, the same with those more commonly called EXCRETORY.

EMISSION, in Medicine, a term used chiefly to denote the evacuation of the runners seed in the act of coition. See COITON and GENERATION.

EMMANUEL, or IMMANUEL, a Hebrew word, which signifies 'God with us.' Isaiah (viii. 14.), in that celebrated prophecy, wherein he declares to Ahaz the birth of the Messiah, who was to be born of a virgin, says, This child shall be called, and really be, Emmanuel, that is, God with us. The same prophet (viii. 8.) repeats the same thing, while he is speaking of the enemy's army, which, like a torrent, was to overflow Judea. 'The stretching out of his wings shall fill the breadth of thy land, O Emmanuel.' The evangelist Matthew (i. 23.) informs us, that this prophecy was accomplished in the birth of Christ, born of the virgin Mary, in whom the two natures divine and human were united, and so in this sense, he was really Emmanuel, or 'God with us.'

EMMERICK, a rich fortified town of Germany, in the circle of Westphalia, and duchy of Cleves. It carries on a good trade with the Dutch, and both Protestants and Catholics have free exercise of their religion. The streets are neat and regular, and the houses tolerably built. It was taken by the French in 1672, but not retained. Since 1815 it has been subject to the king of Prussia. It is seated near the Rhine. E. Long. 5° 20'. N. Lat. 52° 5'.

EMMIUS, Umbro, born at Gretha in East Friesland in 1547, was a very learned professor, and chosen rector of the college of Norden in 1579. This seminary flourished exceedingly under his care; and declined as visibly after he was ejected, in 1587; for refusing to subscribe the Confession of Augsburg. The year after, he was made rector of the college of Leer; and when the city of Groningen confederated with the United Provinces, the magistrates appointed him rector of that college: which employment he filled with the highest repute near 20 years; until the college being erected into an university, he was the first rector, and one of the chief ornaments of it by his lectures, till his infirmities prevented his public appearance. His wisdom was equal to his learning; so that the governor of Friesland and Groningen often consulted him, and seldom failed to follow his advice. He wrote...
Fetus Graecia illustrata, 3 vols.; Decades Rerum Presicarum; and many other valuable works. He died in 1625.

EMMENAGOGUES, ἐμμεναγωγοί, in Medicine, such remedies as promote the menstrual discharge. They are thus called from a "in," μεθ "month," ἄνευ ἀνωτίας, "I lead," because their natural periods of flowing are once a-month.

EMOLLIENTS, in Medicine and Pharmacy, are such remedies as sheath and soften the asperity of the humours, and relax and supple the solids at the same time.

EMOLUMENT is properly applied to the profits arising daily from an office or employ. The word is formed of the Latin emolumentum, which, according to some, primarily signifies the profits redounding to the seller from his mill; of mole, modern, "to grind."—
The patent, or other instrument, whereby a person is preferred to an office, gives him a right to enjoy all the duties, honours, profits, and emoluments belonging thereto.—Emolument is also used, in a somewhat greater latitude, for profit or advantage in the general.

EMOTION and PASSION, in the mind, are thus distinguished by a celebrated writer*. An internal motion or agitation of the mind, when it passeth away without desire, is denominated an emotion: when desire follows, the motion or agitation is denominated a passion. A fine face, for example, raiseth in me a pleasant feeling: if that feeling vanish without producing any effect, it is in proper language an emotion; but if the feeling, by reiterated views of the object, becomes sufficiently strong to occasion desire, it loses its name of emotion, and acquires that of passion. The same holds in all the other passions. The painful feeling raised in a spectator by a slight injury done to a stranger, being accompanied with no desire of revenge, is termed an emotion; but that injury raiseth in the stranger a stronger emotion, which being accompanied with desire of revenge, is a passion. External signs of distress produce in the spectator a painful feeling, which being sometimes so slight as to pass away without any effect, is an emotion; but if the feeling be so strong as to prompt desire of affording relief, it is a passion, and is termed pity. Envy is emulation in excess: if the emulation of a competitor be butbearly disagreeable, the painful feeling is an emotion; if it produce desire to depress him, it is a passion. See PASSION.

EMOY, or HIA MENG, an island and port of China, under the jurisdiction of the province of Fokien. The port is properly but an anchoring-place for ships, inclosed on one side by the island from which it takes its name, and on the other by the main-land: but it is so extensive, that it can contain several thousands of vessels; and the depth of its water is so great, that the largest ships may lie close to the shore without danger.

In the beginning of the present century it was much frequented by European vessels; but few visit it at present, as all the trade is carried on at Canton. The emperor keeps here a garrison of 6 or 7000 men, commanded by a Chinese general. In entering this road, a large rock must be doubled which stands at the mouth of it, and divides it almost as the Mingant divides the harbour of Brest. This rock is visible, and rises several feet above the surface of the water.

The island of Emouy is particularly celebrated on account of the magnificence of its principal pagod, consecrated to the deity Fo. This temple is situated in a plain, terminated on one side by the sea, and on the other by a lofty mountain. Before it the sea, flowing through different channels, forms a large sheet of water, which is bordered with turf of the most beautiful verdure. The front of this edifice is 180 feet in length, and its gate is adorned with figures in relief, which are the usual ornaments of the Chinese architecture. On entering, you find a vast portico, with an altar in the middle, on which is placed a gigantic statue of gilt brass, representing the god Fo, sitting cross-legged. Four other statues are placed at the corners of this portico, which are 10 feet high, although they represent people sitting. Each of these statues is formed from a single block of stone. They bear in their hands different symbols which mark their attributes, as formerly in Athens and Rome the trident and caduceus distinguished Neptune and Mercury. One holds a serpent in his arms, which is twisted round its body in several folds; the second has a bowl and a quiver; the two others present, one a kind of battle-axe, and the other a guitar, or some instrument of the same kind.

After crossing this portico, you enter a square outer court paved with large grey stones, the least of which is ten feet in length and four in breadth. At the four sides of this court arise four pavilions, which terminate in domes, and have a communication with one another by means of a gallery which runs quite round it. One of these contains a bell ten feet in diameter; the wooden-work which supports this heavy mass cannot be sufficiently admired. In the other is kept a drum of an enormous size, which the bonzes use to proclaim the days of new and full moon. It must be observed, that the class of the Chinese is divided into two forms, the one of a small pagod in the form of a steeple; the other pavilions contain the ornaments of the temple, and often serve to lodge travellers, whom the bonzes are obliged to receive. In the middle of this court is a large tower, which stands by itself, and terminates also in a dome, to which you ascend by a beautiful stone stair-case that winds round it. This dome contains a temple remarkably neat; the ceiling is ornamented with mosaic work, and the walls are covered with stone figures in relief, representing animals and monsters. The pillars which support the roof of this edifice are of wood varnished; and on festivals are ornamented with small flags of different colours. The pavement of the temple is formed of little shells, and its different compartments present birds, butterflies, flowers, &c.

The bonzes continually burn incense upon the altar, and keep the lamps lighted, which hang from the ceiling of the temple. At one extremity of the altar stands a bronze urn, which, when struck sends forth a mournful sound: on the opposite side is a hollow machine of wood, of an oval form, used for the same purpose, which is to accompany with its sound their voices when they sing in praise of the tutelary idol of the pagod. The god Poussa is placed on the middle of this altar, on a flower of gilt brass, which serves as a base, and holds...
EMP holds a young child in his arms; several idols, which are no doubt subaltern deities, are ranged around him, and show by their attitudes their respect and veneration.

The boxes have traced out on the walls of this temple several hieroglyphical characters in praise of Poussa; there is also to be seen an historical or allegorical painting in fresco, which represents a burning lake, in which several men appear to be swimming, some carried by monsters, others surrounded by dragons and winged serpents. In the middle of the gulf rises a steep rock, on the top of which the god is seated, holding in his arms a child, who seems to call out to those who are in the flames of the lake; but an old man, with hanging ears and horns on his head, prevents them from climbing to the summit of the rock, and threatens to drive them back with a large club. The boxes are at a loss what answer to give, when any questions are asked concerning this painting. Behind the altar is a kind of library, containing books which treat of the worship of idols.

On descending from this dome you cross the court, and enter a kind of gallery, the walls of which are lined with boards; it contains 24 statues of gilt brass, representing the same number of philosophers, ancient and modern, the names of whom, however, are not inscribed on the figure. At the end of this gallery you find a large ball, which is the refectory of the boxes; and after having traversed a spacious apartment, you at length enter the temple of Io, to which there is an ascent by a large stone staircase. It is ornamented with vases full of artificial flowers (a work in which the Chinese excel); and here also are found the same kind of musical instruments as those mentioned before. The statue of the god is not to be seen but through a piece of black gauze, which forms a kind of veil or curtain before the altar. The rest of the pagod consists of several large chambers, exceedingly neat, but badly disposed; the gardens and pleasure grounds are on the declivity of the mountain; and a number of delightful grottoes are cut out in the rock, which afford an agreeable shelter from the excessive heat of the sun.

There are several other pagods in the island of Emory; among which is one called The Pagod of the Ten Thousand Stones, because it is built on the brow of a mountain where there is a like number of little rocks, under which the boxes have formed grottoes and very pleasant covered seats. A certain rural simplicity reigns here, which captivates and delights.

Strangers are received by these boxes with great politeness, and may freely enter their temples; but they must not attempt to gratify their curiosity fully, nor to enter those apartments into which they are not introduced, especially if they are accompanied by suspicious persons; for the boxes, who are forbidden under pain of severe punishment to have any intercourse with women, and who often keep them in private, might, from fear of being discovered, revenge themselves for too impertinent a curiosity.

EMPALEMENT, an ancient kind of punishment, which consisted in thrusting a stake up the fundament. The word comes from the French empaler, or the Italian impalare; or rather, they are all alike derived from the Latin palus, "a stake," and the proposition in, "in or into." We find mention of empalement in Ju.

Vol. VIII. Part I.
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EMPIRE, or *The empire*, used absolutely and without any addition, signifies the empire of Germany; called also, in juridical acts and laws, the holy Roman empire. It had its beginning with the ninth century; Charlemagne being created first emperor by Pope Leo III who put the crown on his head in St Peter’s church on Christmas-day in the year 800.

Authors are at a loss under what form of government to range the empire. Some of them maintain it to be a monarchical state, because all the members thereof are obliged to ask the investiture of their states of the emperor, and to take an oath of fidelity to him. Others consider it as a republic, or aristocratic state, because the emperor cannot resolve or determine any thing without the concurrence of suffrages of the princes. It is added, that if they require investiture from, and swear fealty to him, it is only as head of the republic, and in the name of the republic, and not in his own; just as at Venice everything is transacted in name of the doge. Others will have the empire to be a monarchical-aristocratic state, i.e. a mixture of monarchy and aristocracy, because, though the emperor in many cases seems to adjudge, yet his decrees and resolves have no force, in case the state refuse to confirm them. Lastly, it has been called an aristocratic-democratic state, because the diet, wherein the sovereignty is lodged, is composed of princes and the deputies of the cities, and is divided into three orders or bodies, called colleges, viz. the college of electors, the college of princes, and the college of cities.

We say, diet of the empire, circles of the empire, states of the empire, estates of the empire, members of the empire, capitulations of the empire. See Diet, Circle, Prince, Capitulation, &c.

The states or estates of the empire are of two kinds, mediate and immediate. The immediate states are those who hold immediately of the empire: Whereof, again, there are two kinds; the first, such as have seats and voices in the imperial diet; the second, such as have none. The mediate states are those who hold of the immediate states.

The states which now compose the empire are, the princes of the empire, the counts of the empire, the free barons of the empire, the prelates of the empire, the princes, and abbesses of the empire, the nobles of the empire, and the imperial cities.

EMPIRIC, an appellation given to those physicians who conduct themselves wholly by their own experience, without studying physic in a regular way. Some even use the term, in a still worse sense, for a quack who prescribes at random, without being at all acquainted with the principles of the art.

EMPIST, a genus of insects belonging to the order Diptera. See Entomology Index.

EMPLASTER. See Plaster.

EMPORIE, a double city of the Hither Spain, near the Pyrenees; separated by a wall; one part occupied by the Greeks of Phocca, whence originally are the Maslenenses; the other, by native Spaniards, to whom was added by Augustus a Roman colony. Now Ampurias, in Catalonia. E. Long. 2. 50. N. Lat. 42. 15.

EMPORIUM, in Medicine, is often used for the common sensory in the brain. See Brain.

EMPORIUM, in Ancient Geography, two cities near Emporium Placentia; one well fortified, and guarded by a strong garrison, at which Hannibal met a repulse; the other, Hannibal took and plundered. Now thought to be Pont-Nua, in the duchy of Placentia.

EMPRESS, the spouse of an emperor, or a woman who governs an empire. See Emperor.

EMPHEROCLITOS, a species of convulsion, wherein the head bends forward.

EMPIREA, or *The empire*, which Dr Priestley calls *dephlogisticated* air, and other philosophers *vital* or *pure* air.

EMPYREUM, a term used by divines for the highest heaven, where the blessed enjoy the beatific vision. The word is formed of ε, and πυρ, *fire*, because of its splendour.

EMPYREUMA, in Chemistry, signifies a very disagreeable smell produced from burnt oils. It is often perceived in distillations of animal as well as vegetable substances, when they are exposed to a quick fire.

EMRODS. See Hemorrhoids.

EMULATION, a generous ardour kindled by the praise-worthy examples of others, which impels us to imitate, to rival, and, if possible, to excel them. This passion involves in it esteem of the person whose attainments or conduct we emulate, of the qualities and actions in which we emulate him, and a desire of resemblance, together with a joy springing from the hope of success. The word comes originally from the Greek *emulare*, dispute, contest; whence the Latin *emulus*, and thence our emulation.

Plato observes of emulation, that it is the daughter of envy; if so, there is a great difference between the mother and the offspring; the one is a virtue and the other a vice. Emulation admires great actions, and strives to imitate them; envy refuses them the praises that are due; emulation is generous, and only thinks of surpassing a rival; envy is low, and only seeks to lessen him. Perhaps, therefore, it would be more just to suppose emulation the daughter of admiration; admiration, however, is a principal ingredient in the composition of it.

EMULGENT, or Renal, Arteries, those which supply the kidneys with blood; being sometimes single, sometimes double, on each side. See Anatomy Index.

EMULSION, a soft liquid remedy, of a colour and consistence resembling milk. See Pharmacy.

EMUNCTORY, in Anatomy, a general term for all those parts which serve to carry off the excrementitious parts of the blood and other humours of the body. Such more especially are the kidneys, bladder, and most of the glands.

ENALLAGE, in Grammar, is when one word is substituted for another of the same part of speech: A substantive for an adjective; as exercitus victor, for *victorius*; sectus, for *sectatus*; A primitive for a derivative; as *Dardana arma*, for *Dardons*: An active for a passive; as *now humida cadit precipitam*, for *precipitatur*, &c.

ENAMEL, in general, is a vitrified matter between the
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the parts of which is dispersed some unmixed matter, hence enamel ought to have all the properties of glass except transparency.

Enamels have for their basis a pure crystal glass or frit, ground up with a fine calx of lead and tin prepared for the purpose, with the addition usually of white salt of tartar. These ingredients baked together are the matter of all enamels, which are made by adding colours of this or that kind of powder to this matter, and melting or incorporating them together in a furnace.

For white enamel, Nerë (De Arte Vitriar.) directs only manganese to be added to the matter which constitutes the basis. For azure, zaffre mixed with calx of brass. For green, calx of brass with scales of iron, or with crocus maris. For black, zaffre with manganesë or with crocus maris; or manganese with tartar. For red, manganese, or calx of copper and red tartar. For purple, manganese with calx of brass. For yellow, tartar and manganesë. And for violet-coloured enamels, manganese with trios-calcinèd brass.

In making these enamels, the following general caution is necessary to be observed. 1. That the pots must be glazed with white glass, and must be such as will bear the fire. 2. That the matter of enamels must be very nicely mixed with the colours. 3. When the enamel is good, and the colour well incorporated, it must be taken from the fire with a pair of tongs. 4. The general way of making the coloured enamel is this: Powder, sift, and grind, all the colours very nicely, and first mix them with one another, and then with the common matter of enamels: then set them in pots in a furnace; and when they are well mixed and incorporated, cast them into water; and when dry, set them in a furnace again to melt; and when melted, take a proof of it. If too deep-coloured, add more of the common matter of enamels; if too pale, add more of the colours.

Enamels are used either in counterfeiting or imitating precious stones, in painting in enamel; or by enamellers, jewelers, and goldsmiths, in gold, silver, and other metals. The two first kinds are usually prepared by the workmen themselves, who are employed in these arts. That used by jewelers, &c., is brought to us chiefly from Venice or Holland, in little cakes of different sizes, commonly about four inches diameter, having the mark of the maker struck upon it with a punch. It pays 1s. 7d. per pound on importation, and draws back 1s. 5d. at the rate of 45s. per pound.

ENAMELLING, the art of laying enamel upon metals, as gold, silver, copper, &c. and of melting it at the fire, or of making divers curious works in it at a lamp. It signifies also to paint in enamel.

The method of painting in enamel. This is performed on plates of gold or silver, and most commonly of copper, enamelled with the white enamel; whereon they paint with colours which are melted in the fire, where they take a brightness and lustre like that of glass. This painting is the most prized of all for its peculiar brightness and vivacity, which is not permanent, the force of its colours not being effaced or sullied with time as in other painting, and continuing always as fresh as when it came out of the workmen's hands. It is usual in miniature; it being the more difficult the larger it is, by reason of certain accidents it is liable to in the operation. Enamelling should only be practised on plates of gold, the other metals being less pure: copper, for instance, scales with the application, and yields flames; and silver turns the yellow white. Nor must the plate be made flat; for in such case the enamel cracks; to avoid which, they usually forge them a little round or oval, and not too thick. The plate being well and evenly forged, they usually begin the operation by laying on a couch of white enamel (as we observed above), on both sides, which prevents the metal from swelling and blistering; and this first layer serves for the ground of all the other colours. The plate being thus prepared, they begin at first by drawing out exactly the subject to be painted with red vitriol, mixed with oil of spike, marking all parts of the design very lightly with a small pencil. After this, the colours (which are to be before ground with water in a mortar of agate extremely fine, and mixed with oil of spike somewhat thick) are to be laid on, observing the mixtures and colours that agree to the different parts of the subject; for which it is necessary to understand painting in miniature. But here the workman must be very cautious of the good or bad qualities of the oil of spike he employs to mix his colours with; for it is very subject to adulterations.

Great care must likewise be taken, that the least dust imaginable come not to your colours while you are either painting or grinding them; for the least speck, when it is worked upon with it, and when the work comes to be put into the reverberatory to be made red-hot, will leave a hole, and so deface the work.

When the colours are all laid, the painting must be gently dried over a slow fire to evaporate the oil, and the colours afterwards melted to incorporate them with the enamel, making the plate red hot in a fire like what the enamellers use. Afterwards that part of the painting must be passed over again which the fire hath any thing effaced, strengthening the shade and colours, and committing it again to the fire, observing the same methods as before, which is to be repeated till the work be finished.

Method of Enamelling by the Lamp. Most enamelled works are wrought at the fire of a lamp, in which, instead of oil, they put melted horse-grease, which they called caballine oil. The lamp, which is of copper, or white iron, consists of two pieces; in one of which is a kind of oval plate, six inches long, and two high, in which they put the oil and the cotton. The other part, called the box, in which the lamp is inclosed, serves only to receive the oil which boils over by the force of the fire. This lamp, or, where several artists work together, two or three more lamps are placed on a table of proper height. Under the table, about the middle of its height, is a double pair of organ-bellows, which one of the workmen moves up and down with his foot to quicken the flame of the lamps, which are by this means excited to an incredible degree of vehemence. Grooves made with a gauge in the upper part of the table, and covered with parchment, convey the wind of the bellows to a pipe of glass before each lamp; and that the enamellers must not be incensed with the heat of the lamp, every pipe is covered at six inches distance with a little tin plate, fixed into the table by a wooden handle. When the works do not require a long blast,
This ancient art, after having been long lost, was restored by Count Caylus, a member of the Academy of Inscriptions in France; and the method of painting in wax was announced to the Academy of Painting and Belles Lettres in the year 1755; although M. Bachelier, the author of a treatise *De l'Histoire et du Secret de la Peinture en Cire*, had actually painted a picture in wax in 1749; and he was the first who communicated to the public the method of performing the operation of inaction, which is the principal characteristic of the encaustic painting. The Count kept his method a secret for some time, contending himself with exhibiting a picture at the Louvre in 1754, representing the head of Minerva, painted in the manner of the ancients, which excited the curiosity of the public, and was very much admired. In the interval of suspense, several attempts were made to recover the ancient method of painting. The first scheme adopted was that of melting wax and oil of turpentine together, and using this composition as a vehicle for mixing and laying on the colours. But this method did not explain Pliny’s meaning, as the wax is not burnt in any way of managing it. In another attempt, which was much more agreeable to the historian’s description of encaustic painting, the wax was melted with strong spirit of salt of tartar, and with this the colours were ground. When the picture was finished, it was gradually presented to the fire, so as to melt the wax; which was thus diffused through all the particles of the colours, so that they were fixed to the ground, and secured from the access of air or moisture. But the method of Count Caylus is much more simple: the cloth or wood which he designed for the basis of his picture, is waxed over, by only rubbing it simply with a piece of bees-wax; the wood or cloth, stretched on a frame, being held horizontally over, or perpendicularly before a fire, at such a distance, that the wax might gradually melt, whilst it is rubbed or, diffuse itself, penetrate the body, and fill the interstices of the texture of the cloth, which, when cool, is fit to paint upon; but as water colours, or those that are mixed up with common water, will not adhere to the wax, the whole picture is to be first rubbed over with Spanish chalk or white lead, and then the colours are applied to it; when the picture is dry, it is put near the fire, whereby the wax melts, and absorbs all the colours.

Mr J. H. Muntz, in a treatise on this subject, has proposed several improvements in the art of encaustic painting. When the painting is on cloth, he directs it to be prepared by stretching it on a frame, and rubbing one side several times over with a piece of bees-wax, or virgin wax, till it is covered with a coat of wax of considerable thickness. In fine lines, this is the only operation necessary previous to painting; but coarse cloth must be rubbed gently on the unwaxed side with a pumice-stone, to take off all the knots which would prevent the free and accurate working of the pencil. Then the subject is to be painted on the unwaxed side with colours prepared and tempered with water; and when the picture is finished, it must be brought near the fire, that the wax may melt and fix the colours. This method, however, can only be applied to cloth or paper, through the substance of which the wax may pass; but in wood, stone, metals,
Encaustic Painting.

Mr. Munthe has also discovered a method of forming grounds for painting with crayons, and fixing these, as well as with-colours employed with the pencil. On the unwaxed side of a linen cloth, stretched and waxed as before, lay an even and thick coat of the colour proper for the ground; having prepared this colour by mixing some proper pigment with an equal quantity of chalk, and tempering them with water. When the colour is dry, bring the picture to the fire, that the wax may melt, pass through the cloth, and fix the ground. An additional quantity of wax may be applied to the back of the picture, if that which was first rubbed on should not be sufficient for the body of colour; but as this must be laid on without heat, the wax should be dissolved in oil of turpentine, and applied with a brush, and the canvas be again exposed to the fire, that the fresh supply of wax may pass through the cloth, and be absorbed by the colour; and thus a firm and good body will be formed for working on with the crayons. If cloth and paper are joined together, the cloth must be first fixed to the straining frame, and then the paper must be pasted to it with a composition of paste made with wheaten flour, or starch and water, and about a twelfth part of its weight of common turpentine. The turpentine must be added to the paste when it is almost sufficiently boiled, and the composition well stirred, and left to simmer over the fire for five or six minutes: let wax be dissolved in oil of turpentine to the consistency of a thin paste: and when the cloth and paper are dry, let them be held near a fire; and with a brush lay a coat of the wax and turpentine on both sides the joined cloth and paper, in such a degree of thickness, that both surfaces may shine throughout without any appearance of dull spots. Then expose the cloth to the fire, or to the sun; by which means the oil will evaporate, and the wax become solid, and then fix to receive any composition of colour for a ground, which is to be laid on as above directed in the case of cloth without paper.

Almost all the colours that are used in oil-painting may be also applied in the encaustic method. Mr. Munthe objects, indeed, to brown, light pink, and unburnt terra di Sienna; because these, on account of their gummy or stony texture, will not admit such a cohesion with the wax as will properly fix them; but other colours which cannot be admitted in oil-painting, as red lead, red orpiment, crystals of verdigris, and red precipitate of mercury, may be used here. The crayons used in encaustic painting are the same with those used in the common way of crayon painting, excepting those that in their composition are too tenacious; and the method of using them is the same in both cases.

The encaustic painting has many peculiar advantages: though the colours have not the natural varnish or shining which they acquire with oil, they have all the strength of paintings in oil, and all the airiness of water-colours, without partaking of the apparent character or defects of either: they may be looked at in any light and in any situation, without any false glare: the colours are firm, and will bear washing; and a picture, after having been smoked, and then exposed to the dew, becomes as clean as if it had been but just painted. It may also be retouched at pleasure without any detriment to the colours; for the new colours will unite with the old ones, without spots, as is the case in common size painting; nor is it necessary to rub the places to be touched with oil as in oil-pictures; it is not liable to crack, and easily repaired, if it should chance to suffer any injury. The duration of this painting is also a very material advantage; the colours are not liable to fade and change; no damp can affect them, nor any corrosive substance injure them; nor can the colour fall off in shivers from the canvas. However, notwithstanding all these and other advantages enumerated by the Abbe Mazes and Mr. Munthe, this art has not yet been much practised. Many of these properties belong to a much higher species of encaustic painting afterwards discovered in England, the colours of which are fixed by a very intense heat; nor are the colours or grounds on which they are laid liable to be dissolved or corroded by any chemical menstruum, nor like the glassy colours of enamel, to run out of the drawing on the fire. What this method consists in will appear from the following account communicated in a letter from Josiah Colebrook to the Earl of Macclesfield, President of the Royal Society in 1756.

"The art of painting with burnt wax (says he) has long been lost to the world. The use of it to painters in the infancy of the art of painting was of the utmost consequence. Drying oil being unknown, they had nothing to preserve their colours entire from the injury of damp and the heat of the sun: a varnish of some sort was therefore necessary; but they being unacquainted with distilled spirits, could not, as we now do, dissolve gums to make a transparent coat for their pictures: this invention therefore of burnt wax supplied that defect to them; and with this manner of painting the chambers and other rooms in their houses were furnished: this Pliny calls encaustum, and we encaustic painting.

"The following experiments, which I have the honour to lay before your Lordship and the Society, were occasioned by the extract of a letter from the Abbe Mazes, translated by Dr. Parsons, and published in the second part of the 49th volume of the Philosophical Transactions, No. 100, concerning the ancient method of painting with burnt wax, revived by Count Caylus.

"The count's method was. 1. To rub the cloth or board designed for the picture simply over with beeswax. 2. To lay on the colours mixed with common water: but as the colours will not adhere to the wax, the whole picture was first rubbed over with (A) Spanish

(A) "Spanish chalk is called by Dr. Parsons, in a note, Spanish white. This is a better kind of whitening than the common, and was the only-white that had the name of Spanish annexed to it that I could procure, though I inquired for it at most if not all the colour shops in town."
Essastic nish chalk, and then the colours are used. 3. When Painting, the picture is dry it is put near the fire, whereby the wax melts, and absorbs all the colours.

"Exp. 1. A piece of oak board was rubbed over with bees-wax, first against the grain of the wood, and then with the grain, to fill up all the pores that remained after it had been planed, and afterwards was rubbed over with as much dry Spanish white as could be made to stick on it. This, on being painted (the colours mixed with water only), so clogged the pencil, and mixed so unequally with the ground, that it was impossible to make an even outline, but what was much thicker in one part than another, that it would not bear as much as the name of painting; neither had it any appearance of a picture. However, to pursue the experiment, this was put at a distance from the fire, on the hearth, and the wax melted by slow degrees: but the Spanish white (though laid as smooth as it was laid on), on melting the wax into it, was not sufficient to hide the grain of the wood, nor show the colours by a proper whiteness of the ground; the wax, in rubbing on the board, was unavoidably thicker in some parts than in others, and the Spanish white the same: on this I suspected there must be some mistake in the Spanish white, and made the inquiry mentioned in the note (A).

"To obviate the inequality of the ground in the first experiment.

"Exp. 2. A piece of old wainscot (oak-board) 4th of an inch thick, which, having been part of an old drawer, was not likely to shrink on being brought near the fire; this was smoothened, then dried, so it would dry before the fire; and then, with a brush dipped in white wax, melted in an earthen pipkin, smeared all over, and applied to the fire again. That the wax might be equally thick in all parts of the board, a ground was laid (on the waxed board) with levigated chalk mixed with gum-water (viz. gum-arabic dissolved in water): When it was dry, I painted it with a kind of landscape; and pursuing the method laid down by Count Caylus, brought it gradually to the fire. I fixed the picture on a fire screen, which would preserve the heat and communicate it to the back part of the board. This was placed first at the distance of three feet from the fire, and brought forwards by slow degrees, till it came within one foot of the fire, which made the wax swell and blister the picture; but as the chalk did not absorb the wax, the picture fell from the board and left it quite bare.

"Exp. 3. I mixed three parts white wax, and one part white resin, hoping the tenacity of the resin might preserve the picture. This was laid on a board heated with a brush as in the former; and the ground was chalk prepared as before. This was placed horizontally on an iron box, charged with a hot water, shifting it from time to time, that the wax and resin might penetrate the chalk; and hoping from this position, that the ground, melted by melting the wax, would subside into its proper place; but this, like the other, came from the board, and would not at all adhere.

"Exp. 4. Prepared chalk four drams, white wax, white resin, of each a dram, burst alabaster half a dram, were all powdered together and sifted, mixed with spirit of molasses instead of water, and pot for a ground on a board smeared with wax and resin, as in Exp. 3. This was also placed horizontally on a box-iron as the former: the picture blistered, and was cracked all over; and though removed from the box-iron to an oven moderately heated (in the same horizontal position), it would not subside, nor become smooth. When it was cold, I took an iron spatula made warm, and moved it gently over the surface of the picture, as if I were to spread a plaster. (This thought occurred, from the board being prepared with wax and resin, and the ground having the same materials in its composition, the force of the spatula might make them unite.) This succeeded so well, as to reduce the surface to a tolerable degree of smoothness; but as the ground was broke off in many places, I repainted it with flake white, mixed up with the yolk of an egg and milk, and repainted it with molasses spirit (instead of water), and then put it into an oven with a moderate degree of heat. In this I found the colours fixed, but darker than when it was at first painted; and it would bear being washed with water, not rubbed with a wet cloth.

"Exp. 5. A board (that had been used in a former experiment) was smeared with wax and resin, of each equal parts; was wetted with molasses spirit, to make whitening (or Spanish white) mixed with gum water adhere. This, when dry, was scraped with a knife, to make it equally thick in all parts of the picture. I fixed it on a fire screen, which would preserve the heat and communicate it to the back part of the board. This was placed first at the distance of three feet from the fire, and brought forwards by slow degrees, till it came within one foot of the fire, which made the wax swell and blister the picture; but as the chalk did not absorb the wax, the picture fell from the board and left it quite bare.

"Exp. 6. Having miscarried in these trials, I took a new board, planed smooth, but not polished either with a fish skin or rusher: I warmed it, and smeared it with wax only; then took cimolia (tobacco-pipe clay) divested of its sand, by being dissolved in water and poured off, leaving the coarse heavy parts behind. After this was dried and powdered, I mixed it with a small quantity of the yolk of an egg and cow's milk, and made a ground with this on the waxed board, on which I was induced to try, by knowing that the yolk of an egg will dissolve almost all unctuous substances, and make them incorporate with water; and I apprehended, that a ground thus prepared, would adhere so much more firmly to the board than the former had done, as to prevent its flaking off. The milk, I thought, might
might answer two purposes; first, by melting the ground with the wax; and secondly, by annealing the end of size or gum-water, and prevent the colours from sinking too deep into the ground, or running into another. When the ground was near dry, I smoothed it with a pallet knife, and washed with milk and egg where I had occasion to make it smooth and even: when dry I painted it, mixing the colours with common water; this, on being placed horizontally in an oven only warm enough to melt the wax, flaked from the board; but held so much better together than any of the former, that I pasted part of it on paper.

"Exp. 7. Flake-white (or the purest sort of white-lead) mixed with egg and milk, crumbled to pieces in the oven, put on the waxed board, as in the last experiment.

"The bad success which had attended all the former experiments, led me to consider of what use the wax was in this kind of painting: and it occurred to me, that it was only as a varnish to preserve the colours from fading.

"In order to try this:

"Exp. 8. I took what the brick-layers call fins stuff, or putty (b); to this I added a small quantity of burnt alabaster, to make it dry: this it soon did in the open air; but before I put on any colours, I dried it gently by the fire, lest the colours should run. When it was painted, I warmed it gradually by the fire (to prevent the ground from cracking) till it was very hot. I then took white wax three parts, white resin one part; melted them in an earthen pipkin, and with a brush spread them all over the painted board, and kept it close to the fire in a perpendicular situation, that what wax and resin the plaster would not absorb might drop off. When it was cold, I found the colours were not altered, either from the heat of the fire, or passing the brush over them. I then rubbed it with a soft linen cloth, and thereby procured a kind of gloss, which I afterwards increased by rubbing it with a hard brush; which was so far from scratching or leaving any marks on the picture, that it became more smooth and polished by it.

"After I had made all the foregoing experiments, in conversation with my honoured and learned friend Dr Kidby, a fellow of this society, I said I had been trying to find out what the encaustic painting of the ancients was. Upon which he told me, that there was a passage in Vitruvius de Architectura relative to that kind of painting: and so good as to transcribe it for me from the 7th book, chap. 9. De juisio temperatura. Vitruvius's words are: At si quis subtilior fuerit, et viscult exsplicationem minimarum suuum colorum retinere, eam paries exposit et arduis fuerint, tunc ceram

((b) "Putty is lime slaked, and while warm, dissolved in water, and strained through a sieve.

(c) "The account of the method of polishing [painting] walls coloured with vermillion, gave me great satisfaction, as it proved the method I had taken in experiment 8. (which I had tried before I saw or knew of this passage in Vitruvius) was right. The use of the candle, as I apprehend, was to melt the wax on the walls where by accident the brush had put on too much, or afford wax where the brush had not put on enough, or had left any part bare.

"The rubbing the wall with a linen cloth, while warm, will do very well where there is only one colour to be preserved; but where there are many, as in a landscape, it will be apt to take off some, or render the colouring rather faint; which I found by wiping the wax off from a painting while it was hot.

Penicem legantur igni, paulo elctetemperatura, subito inducat, dividere posta carbonibus in ferris sive composita, eam ceram opprime eum parieti, solefectando aliorum cognot, factaque ut pervenisset, dividere eum cincto tititique pars subiecta, ut sita marmorosa, modo curandum. Hoc autem suum Græci dictur. Ista obstant vera Penicem torrens non nastur, nec linea splendorem, nec sole radia lambendo eripere en his positionibus colorum.

"Which I thus translated: 'But if any one is more wary, and would have the polishing [painting] with vermillion hold its colour, when the wall is painted and dry, let him take Carthaginian [Barbary] wax, melted with a little oil, and rub it on the wall with a hair-pencil; and afterwards let him put live coals into an iron vessel [chafing-dish], and hold it close to the wax, when the wall, being heated, begins to sweat; then let it be made smooth: afterwards let him rub it with a (c) candle and (b) clean linen rag, in the same manner as they do the naked marble statues. This the Greeks call 

The coat of Carthaginian wax (thus put on) is so strong, that it neither suffers the moon by night, nor the sun-beams by day, to destroy the colour.'

"Being satisfied, from this passage in Vitruvius, that the manner of using wax in Exp. 8 was right, I was now to find if the wax-varnish, thus burnt into the picture, would bear washing. But here I was a little disappointed; for rubbing one corner with a wet linen cloth, some of the colour came off; but washing it with a soft hair-pencil dipped in water, and letting it dry without wiping, the colour stood very well.

"A board painted, as in Exp. 8, was hung in the most smoky part of a chimney for a day, and exposed to the open air in a very foggy night. In the morning the board was seemingly wet through, and the water ran off the picture. This was suffered to dry without wiping; and the picture suffered at all from the smoke or the dew, either in the ground or the colours; but when dry, by rubbing it, first with a soft cloth, and afterwards with a brush, it recovered its former gloss.

"Suspecting that some tallow might have been mixed with the white wax I had used, which might cause the colours to come off on being rubbed with a wet cloth, I took yellow wax which had been melted from the honeycomb in a private family, and consequently not at all adulterated: to three parts of this I added one part resin, and melted them together.

"Exp. 9. Spanish white, mixed with fish glue, was put for a ground on a board, and painted with water-colours only. The board was made warm; and then the wax and resin were put on with a brush, and kept close to the fire till the picture had imbibed all the varnish,
Encrust varnish, and looked dry. When it was cold, I rubbed it first with a linen cloth, and then polished it with a hard brush.

"In these experiments I found great difficulties with regard to colours. Many water colours being made from the juices of plants, have some degree of an acid in them; and these when painted on an alkaline ground, as chalk, whitening, cineria, and plaster, are totally changed in their colours, and from green become brown; which contrariwise is to make experiments tedious. I would therefore advise the use of mineral or metallic colours for this sort of painting, as most likely to preserve their colour: for although I neutralized Spanish white, by fermenting it with vinegar, and afterwards washed it very well with water, it did not succeed to my wish.

"These experiments, and this passage from Vitruvius, will in some measure explain the obliquity of part of that passage in Pliny, which Dr Parson, in his learned comment on the encrust painting with wax, seems to despise of.

"Coris pingere, was one species of encrust painting. Remover, inuentum, may be translated, "forced in by the means of fire; burnt in;" for whatever is forced in by the help of fire can be rendered into Latin by no other significant word that I know of but inuentum. If this is allowed me, and I think I have the authority of Vitruvius (a writer in the Augustan age) for it, who seems to have wrote from his own knowledge, and not like Pliny, who copied from others much more than he knew himself, the difficulty with regard to this kind of painting, is solved, and the encrust with burnt wax recovered to the public.

"What he means by the next kind he mentions, in eborre castro id est varicule, I will not attempt to explain at present.

"The ship-painting is more easily accounted for, the practice in part continued to this time; and is what is corruptly called breaming, for burning or burning.

"This is done by reeds set on fire, and held under the side of a ship till it is quite hot; then resin, tallow, tar, and brimstone, melted together, and put on with a hair brush while the planks remain hot, make such a kind of paint as Pliny describes: which, he says, nec sole, nec sole ventique corrumpit. As they were ignorant of the use of oil painting, they mixed that colour with the wax, &c., which they intended for each particular part of the ship, and put it on in the manner above described.

In the pictures painted for these experiments, and now laid before your lordship and the society, I hope neither the design of the landscape, nor the execution of it, will be so much taken into consideration as the varnish (which was the thing wanted in this inquiry): and I think that will evince, that the encrust painting with burnt wax is fully restored by these experiments; and though not a new invention, yet having been lost for so many ages, and now applied further, and to other purposes, than it was by Vitruvius (who confined it to vermillion only), may also amount to a new discovery, the use of which may be a means of preserving many curious drawings to posterity; for this kind of painting may be on paper, cloth, or any other substance that will admit a ground to be laid on it. The process is very simple, and is not attended with the disagreeable smell unavoidable in oil-painting, nor with some inconveniences inseparable from that art; and as there is no substance we know more durable than wax, it hath the greatest probability of being lasting."

Still, however, there seem to have been some defects or inconveniences attending these and other subsequent attempts; for we find the ancient or some similar methods of painting in wax remaining a desideratum upwards of 25 years after the publication of the preceding experiments; when in 1787 a method was communicated to the Society of Arts by Miss Greenland, for which she was rewarded with a prize. The ground of her information she received at Florence, through the acquaintance of an amateur of painting, who procured her the satisfaction of seeing some paintings in the ancient Grecian style, executed by Signora Parenti, a professor at that place, who had been instructed by a Jesuit at Pavia, the person who made the farthest discoveries in that art. Miss Greenland's friend knowing she was fond of painting, informed her what were the materials the paintress used, but could not tell her the proportions of the composition; however, from her anxiety to succeed in such an acquisition, she made various experiments, and at last obtained such a sufficient knowledge of the quantities of the different ingredients as to begin and finish a picture, which she afterwards presented to the Society for their inspection.

Her method is as follows: "Take twelve ounces of white wax, and the same weight of gum mastich powdered. Put the wax in a glazed earthen vessel over a very slow fire; and when it is quite dissolved, strew in the mastich, a little at a time, stirring the wax continually until the whole quantity of gum is perfectly melted and incorporated: then throw the paste into cold water, and when it is hard, take it out of the water, wipe it dry, and beat it in one of Mr Wedgewood's mortars, observing to pound it at first in a linen cloth to absorb some drops of water that will remain in the paste, and would prevent the possibility of reducing it to a powder, which must be so fine as to pass through a thick gauss. It should be pounded in a cold place and kept a little while at a time, as after long beating the friction will in a degree soften the wax and gum, and instead of their becoming a powder they will return to a paste.

"Make some strong gum-arabic water; and when you paint, take a little of the powder, some colour, and mix them together with the gum-water. Light colours require but a small quantity of the powder, but more of it must be put in proportion to the body and darkness of the colours; and to black there should be almost as much of the powder as colour.

"Having mixed the colours, and no more than can be used before they grow dry, paint with fair water, as is practised in painting with water-colours, a ground on the wood being first painted of some proper colour prepared in the same manner as is described for the picture; walnut-tree and oak are the sorts of wood commonly made use of in Italy for this purpose. The painting should be very highly finished; otherwise, when varnished, the tints will not appear united.

"When the painting is quite dry, with rather a hard brush, passing it over, varnish it with white wax, which is put into an earthen vessel, and kept melted over a very slow fire till the picture is varnished, ta-
king great care, the wax does not boil. Afterwards
hold the picture before a fire, near enough to melt the
wax, but not make it run; and when the varnish is en-
tirely cold and hard, rub it gently with a linen cloth.
Should the varnish blister, warm the picture again very
slowly, and the bubbles will subside. When the picture
is dirty, it need only be washed with cold water.

The opinion given by the society upon the above is:
the method used by Miss Greeneland provides
against all inconveniences; and the brilliancy of the
colours in the picture painted by her, and exhibited to
the Society, fully justifies the opinion, that the art of
painting in wax, as above described, highly merited
the reward of a gold pallet voted to her on this occa-
sion.

ENCEINTE, in Fortification, is the wall or ramp-
art which surrounds a place, sometimes composed of
bastions or curtains, either faced or lined with brick or
stone, or only made of earth. The enceinte is some-
times only flanked by round or square towers, which
is called a Roman wall.

ENCEPHALI, in Medicine, worms generated in
the head, where they cause so great a pain as some-
times to occasion distraction.

The encephali are very rare; but there are some dis-
cases wherein they swarm: from whence we are told
perniuential fevers have wholly arisen. Upon the dis-
cussion of one, who died of this fever, a little, short,
red worm was found in the head, which malmsey wine,
wherein horse-radish had been boiled, could alone de-
stroy. This medicine was afterwards tried on the sick,
most of whom it cured.

The like worms have also been taken out by tro-
paning, and the patient cured. Those worms that
generate in the nose, ears, and teeth, are also called
cercephali.

ENCHANTER, a person supposed to practise en-
chantment or fascination. See Fascination, Witch-
craft, &c.

Enchanter's Nightshade. See Circum, Botany

INDEX.

ENCHASING, INCHASING, or CHASING, the art of
enriching and beautifying gold, silver, and other
metal-work, by some design or figures represented there-
on in low relief.

Enchasing is practiced only on hollow thin works,
as watch-cases, cane-heads, drawer-cases, or the like.
It is performed by punching or driving out the metal,
to form a figure, from within, so as to stand out
prominent from the plane or surface of the metal. In
order to this, they provide a number of fine steel blocks
or pincers of divers sizes; and the design being
drawn on the surface of the metal, they apply the in-
side upon the heads or tops of these blocks, directly
under the lines or parts of the figures; then, with a
fine hammer, striking on the metal, sustained by the
block, the metal yields, and the block makes an in-
denture or cavity on the inside, corresponding to which
there is a prominence on the outside, which is to stand
for that part of the figure.

Thus the workman proceeds to chase and finish all
the parts by the successive application of the block
and hammer to the several parts of the design. And it is
wonderful to consider with what beauty and justness,
by this simple piece of mechanism, the artist in this
kind will represent sculapes, grotesques, animals, his-
tories, &c.

ENCLITICA, in Grammar, particles which are so
nearly united with other words as to seem part of them,
as in circum, &c. There are thirteen enclitic particles
in Latin, viz. quid, quae, etc.

ENCRATITES, church-history, heretics who
appealed towards the end of the second century; they
were called Encratites, or Continentes, because they
gloried in abstaining from marriage and the use of wine
and animal food.

ENCURECK, in Natural History, a venomous in-
sect found in Persia, and said to be a kind of tarantula.
According to Olearius, as quoted by Mr Boyle, it
neither stings nor bites; but lets fall its venom like a
drop of water, which causes insufferable pain in the
part for a time, and afterwards so profound a sleep
that, as report says, nothing can awoke the patient ex-
cept crushing one of the creatures on the part affected.
It is nevertheless said, that the sheep eat these insects
without damage.

ENCYCLOPAEDIA, a term nearly synonymous
with Cyclopedia; but adopted in preference to it
in denominating the present work, as being more definite
and of better authority. According to an observation
of the late learned printer Mr Bowyer, the proposition
makes the meaning of the word more precise.

For Cyclopedia may denote “the instruction or a
circle,” as Cycropedia is “the instruction of Cyrus,”
whereas in Encyclopaedia the proposition determines
the word to be from the nature of clyclos, “instruction in
a circle.” And Vossius, in his book De visis sermones,
has observed, “That Cyclopedia is used by some au-
thors, but Encyclopaedia by the best.”

ENDEMIC, or ENDEMICAL, Diseases, those to
which the inhabitants of particular countries are sub-
ject more than others, on account of the air, water,
situation, and manner of living.

ENDIVE. See Chicory, Botany and Gar-
dening Index.

ENDLESS, something without an end; thus au-
thors mention endless rolls, the endless screw, &c.

ENDOR, in Ancient Geography, a town of Gallia,
four miles to the south of Mount Tabor, in the tribe of
Masaeus, where the Pythoness was consulted by Saul:
at this day, says Jerome, a large village.

ENDORSED, in Heraldry, an ordinary, containing
the eighth part of a pale, which Leigh says is only
used when a pale is between two of them.

ENDORSED, in Heraldry, is said of things borne
back to back, more usually called Adler.

ENDORESEMENT, in Law and Commerce. See
Indorsement.

ENDOWMENT, in Law, denotes the settling a
dower on a woman; though sometimes it is used fig-
uratively, for settling a provision upon a person, on the
building of a church; or the severing a sufficient por-
tion of tithes for a vicar, when the benefice is appro-
priated.

ENDYMION, in fabulous history, a shepherd, son
of Æthlius and Calycse. It is said that he required of
Jupiter to grant to him to be always young, and to
sleep as much as he would; whence came the proverb of
Endymionic somnus dormere, to express a long sleep.
Diana saw him naked as he slept on Mount Latmos;
ENFIELD, William, LL. D. an elegant and very justly admired writer, was born in the year 1741, at Sudbury. His original destination was for the sacred office of the ministry, and he was educated among the protestant dissenters at Daventry, where the high polish which he gave to his compositions, distinguished him from many of his contemporaries. The congregation of Benn's-garden of Liverpool made choice of him for their minister in the year 1763, when he was not more than 22 years of age; and in this situation he was soon taken notice of as an amiable member of society, and an engaging preacher. While he resided in Liverpool, he published two volumes of sermons, 12mo, as well as a collection of hymns and family prayers, which met with a very favourable reception. In the year 1770, he was appointed tutor and lecturer in the belles lettres at Warrington academy, which he filled for some years with general approbation and unwearied diligence. He was the compiler of many useful books, among the most popular of which we may rank his "Speeche," composed of pieces of recitation from the best and most approved English authors. At the beginning of this collection there is an excellent essay on elocution. The Preacher's Directory; the English Preacher, a collection of sermons in 9 vols 12mo, from the most celebrated authors; Biographical Sermons on the principal characters in the Old and New Testament, with a number of single sermons on particular occasions, were also the productions of his pen. The controversy relative to literary property also engaged his attention, and on this he wrote a quarto pamphlet. He likewise published, in one volume 4to, Institutes of Natural Philosophy, theoretical and experimental; and during the time of his residence at Warrington, as teacher in the academy, the university of Edinburgh conferred on him the degree of L.L. D. Warrington academy was dissolved in 1783. Dr Enfield continued for two years at Warrington in the capacity of a private tutor, after which he was chosen pastor of the Octagon meeting-house at Norwich, in the year 1785. He at length gave up his private tuition, and entirely devoted his time to literary labours, and the peculiar duties of his pastoral charge. About this time he lost his eldest son, who had been appointed to the office of town-clerk of Nottingham. This event would have been productive of very serious effects on his health and spirits, had it not been for the consolation of religion and philosophy, which are sufficient to support the human mind under the pressure of the severest calamities. He undertook and executed the laborious task of abridging Brucker's History of Philosophy, which in 1791 he published in 2 vols 4to. It has been allowed that the tenets of the different sects of philosophers were never before exhibited to the world with such perspicuity and elegance; qualifications for which Dr Enfield was undoubtedly eminent. He contributed largely to the Biographical Dictionary, published under the inspection of Dr Aiken and others.

An unsuspected distemper hastened the termination of his useful life, and on the 3d of November 1797, he expired in the 57th year of his age. The general love of mankind which Dr Enfield possessed, falls to the lot of few; nor does it often happen that an individual dies so universally lamented. It was essential to him to be amiable in every station and condition of life. His posthumous sermons, in 3 vols 8vo, had a very numerous list of subscribers, a strong proof of the estimation in which he was held by all who knew him, either personally or by report. In these discourses he treats chiefly on moral topics, which he discusses with the nicest discrimination, and in a train of the most pleasing and manly eloquence.

ENFILADE, in the art of war, is used in speaking of trenches, or other places, which may be secured by the enemy's shot along their whole length. In conducting the approaches at a siege, care must be taken that the trenches be not enfiladed from any work of the place.

ENFINE, formerly ANTINUS, a city of Egypt, built by Adrian in honour of his favourite Antinous. It is situated towards the middle of the Said, or Upper Egypt, and still contains several stately monuments of antiquity. In ancient times this city was very magnificent. It was about half a league in circumference, having two principal streets 45 feet wide, intersecting each other at right angles, and running through its whole length. The others were more narrow, but equally straight; the two largest having gates at each end, part of which still remain. According to the Nubian geographer, it was called the city of the Magi, because Pharaoh is said to have caused the magicians...
ENF

ENGLAND.

England, the southern division of the island of Great Britain. Including Wales, it is of a triangular form, and lies between the 50th and 57th degrees of north latitude, extending about 450 miles in length from south to north, and in some places it is 350 miles in breadth. It is bounded by Scotland on the north; by the English Channel on the south, dividing it from France; by the German sea on the east; and on the west by St. George's or the Irish channel.

At what time the island of Britain was peopled is uncertain; nor do we know whether the southern or northern parts were first inhabited. We have no accounts that can be depended upon before the arrival of Julius Caesar, and it is certain he found the southern parts full of people of a very warlike disposition. These people, according to Caesar, were a colony of the Gauls; and this opinion is embraced by most of the ancient as well as modern writers. It is chiefly founded on the agreement observed by the Romans between the two nations in their customs, manners, language, religion, government, way of fighting, &c. The more northern inhabitants, according to Tacitus, came from Germany. This heinfers from the make of their limbs; but Caesar simply calls them Aborigines.
England, including the principality of Wales, when first invaded by the Romans, was divided into 17 petty states. 1. The Durnuci, called also Domnuni and Domnuni, inhabited the counties of Cornwall and Devonshire. 2. The Durotriges, who inhabited the tract now called Dorsetshire. 3. The Belgi possessed Somersetshire, Wiltshire, and Dorsetshire. 4. The Atrebati, or inhabitants of Berkshire. 5. The Regni, whose country bordered on that of the Atrebati, and compassed Surrey, Sussex, and part of the sea-coast of Hampshire. 6. The Catuvellauni, inhabiting the county now called Kent. 7. The Dobuni are placed by Ptolemy on the north side of the Thames, near its head, in the counties of Gloucestershire and Oxfordshire. 8. The Catuvellauni, Callevienses, Catuvellauni, and Catuvellauni, inhabited Buckinghamshire, Bedfordshire, and Hertfordshire. 9. The Trinobantes, who possessed the counties of Essex and Middlesex. 10. The Iceni, whose country compassed Suffolk, Norfolk, Cambridgeshire, and Huntingdonshire. These are by Ptolemy called Simeci, and by others Tigur. Camden is of opinion, that they were the same whom Caesar calls Cunomorus. 11. The Cantii, whose country compassed Northamptonshire, Leicestershire, Rutlandshire, Lincolnshire, Northamptonshire, and Derbyshire. 12. The Cornovii possessed Warwickshire, Worcestershire, Staffordshire, Shropshire, and Cheshire. 13. The Silures inhabited the counties of Radnorshire, Brecknockshire, Glamorganshire, with Herefordshire and Monmouthshire. 14. The Demetae inhabited part of Caermarthenshire, Pembroke, and Cardiganshire. 15. The country of the Ordovices compassed Montgomeryshire, Merionethshire, Caernarvonshire, Denbighshire, and Flintshire. 16. The Brigantes possessed the counties of Yorkshire, the bishopric of Durham, Lancashire, Westmoreland, and Cumberland. 17. The county of Northumberland was held by the Picts; though the most common opinion is, that it reached only to the Tweed.

The above-mentioned names of these nations are plainly Roman, but the etymology of them is not easily ascertained. Some attempt to derive them from words in the old British language; but as this subject at least must be very obscure and uncertain, we shall not enter into it.

Before the time of Julius Caesar, the Romans had scarcely any knowledge of Britain; but that conqueror having subdued most of the Gallic nations on the opposite side of the channel, began to think of extending his conquests by the reduction of Britain. The motive for this expedition, ascribed to him by Scenutianus, was a desire of enriching himself with the British pearls, which were then very much esteemed. The pretence, however, which he made use of in order to justify his invasion, was, that the Britons had sent assistance to the Gauls during their wars with them. Caesar undertook his first expedition against Britain when the summer was already far spent, and therefore he did not expect to finish the conquest of the country that campaign. His thought, however, that it would be a considerable advantage to view the island, and learn something of the manners and customs of the natives; after which he could more easily take such measures as would ensure a permanent conquest on his return. Having marched all his forces into the country of the Marini, now the province of Pictur, from whence was the shortest passage into Britain; he ordered at the same time all the vessels that lay in the neighbouring ports, and a fleet which he had built the year before for an expedition against the Marini, to attend him. The Britons, alarmed at his preparations, sent ambassadors with offers of submission; but Caesar, though he received them with great kindness, did not abandon his intended scheme of an invasion. He waited till the arrival of C. Volusenus, whom he had sent out with a single galley to make discoveries on the coast. Volusenus did not think proper to land; but, having made what observations he could, returned after five days absence, and Caesar immediately set sail for Britain. His force consisted of two legion, embarked on board 80 transports; and he appointed 18 more which lay wind-bound about eight miles off; to convey over the cavalry; but these last orders were too slowly executed, which occasioned some difficulty in his landing.

The Britons at this time, according to Caesar and other Roman historians, were very numerous, and had their country well stocked with cattle. Their houses resembled those of the Gauls; and they used copper or iron plates weighed by a certain standard instead of money. Their towns were a confused parcels of huts placed at a small distance from one another, generally in the middle of a wood, to which all the avenues were slightly guarded with ramparts of earth, or with trees. All the nations were in a state of the most wretched barbarism, even when compared with the barbarous Gauls on the continent. The use of clothes was scarcely known in the island. Only the inhabitants of the southern coast covered their nakedness with the skins of wild beasts; and this rather to avoid giving offence to the strangers who came to trade with them, than out of any principle of decency. It was a general custom among the Britons to paint their bodies with the juice of wood: but whether this was designed as ornament, or for any other purpose is not known. They shaved their heads all except their upper lip, and wore long hair. They also had their wives in common, a custom which made them detestable to all other nations.

The arms of the Britons were a sword, a short lance, and a shield. Breast-plates and helmets they looked upon rather to be incumbrances, and therefore made no use of them. They usually fought in chariots, some of which were armed with scythes at the wheels; they were fierce and cruel, and exceedingly blood-thirsty. When driven to distress, they could subsist themselves even on the bark and roots of trees; and Dio Cassius tells us, that they had ready, on all occasions, a certain kind of food, of which, if they took but the quantity of a bean, they were not troubled with hunger or thirst for a considerable time after. The southern nations, however, were somewhat more civilized; and the Catuani, or inhabitants of Kent, more so than any of the rest.

All the British nations at this time were very brave and resolute, owing to the continual dissensions among themselves. They proved therefore very formidable enemies to the Romans; but the same dissensions which had
ENGLAND.  

5 They oppose Caesar's landing.  

6 The Britons, surprised at the galleys, a sort of shipping they had never before seen, began to give ground. The fight, however, continued for some time, greatly to the disadvantage of the Romans; till at last Caesar, observing the distress of his men, caused several boats to be manned, and sent them to the assistance of those who were most exposed to the enemy’s assault. The Romans then soon got the better of the unskilled Britons, however, from their good landing; but they were unable to pursue the enemy for want of cavalry, which had not yet arrived.

7 Their treachery.  

The Britons were so disheartened with this bad success, that they immediately sent ambassadors to sue for peace; which was granted, on condition of their delivering a certain number of hostages for their fidelity. Part of these they brought immediately; and promised to return in a few days with the rest, who, they said, lived at some distance. But, in the mean time, the 18 transports which carried Caesar’s cavalry, being driven back by a violent storm, and the fleet which 4 day in the road being greatly damaged by the same, the Britons thought proper to break their engagements. Having therefore privately assembled their forces, they fell unexpectedly on the seventh legion while at a distance from the rest and baying in foraging. Caesar being apprised of their danger, hastened to their assistance with two cohorts, and at last repulsed the enemy. This, however, proved only a temporary deliverance; for the Britons, thinking it would be possible for them to cut off all the Romans at once, dispatched messengers to inform several of the neighbouring nations of the weakness of the enemy’s forces, and the happy opportunity that offered itself of destroying all these invaders at one blow. On this, they drew together a great body of horse and foot, which boldly advanced to the Roman entrenchments. But Caesar came out to meet them; and the undisciplined Britons being by no means able to cope with the Romans, were put to flight with great slaughter. Having burnt several towns and villages, the victors returned to their camp, where they were soon followed by new deputies from the Britons. Caesar being in want of horse, and afraid lest another storm should destroy the remainder of his fleet, granted them peace on condition of their sending him double the number of hostages into Gaul which they had before promised. The same night he set sail, and soon arrived safe in Gaul.

8 Defeat the Britons.  

The Britons made no opposition to his landing; but Caesar, getting intelligence that an army was assembled at no great distance, marched in quest of them. He found them encamped on the banks of a river, supposed to be the Stour, about 12 miles distant from the place where he had landed. They attempted to oppose his passage; but being briskly attacked by the Roman cavalry, they were obliged to retire into a wood, all the avenues of which were blocked up by trees cut down for that purpose. This fortification, however, proved insufficient to protect them. The seventh legion having cast themselves into a testudo, and thrown up a mound against their works, drove them from their asylum; but as the day was far spent, a pursuit was not thought advisable.

9 Next morning Caesar, with the greatest part of his army, which he divided into three bodies, marched out in quest of the enemy. But when he was already come in sight of their rear, he was overtaken by messengers, who informed him, that his fleet was greatly damaged by a violent storm which had happened the preceding night. This put an end to the pursuit for that time; but Caesar having employed all the carpenters he had with him, and sent for others from Gaul, in order to repair the damage, resolved to prevent misfortunes of this kind for the future. He therefore drew all his ships ashore, and enclosed them within the fortifications of his camp. This arduous undertaking employed his whole camp for 10 days; after which he again set out in quest of the enemy.

The Britons had made the best use they could of the respite afforded them by the storm. They were headed by Cassibelaunus, king of the Trinobatans. He had formerly made war upon his neighbours; and having rendered himself terrible to them, was looked upon by the most men as the common enemy; and as several states had now joined their forces, the British army was very numerous. Their cavalry and chariots attacked the Roman army while on their march; but were repulsed with loss, and driven into the woods. The Romans pursued them too eagerly, and thus lost some of their own men; which encouraged the Britons to make another fierce attack; but in this also they were finally unsuccessful, and obliged to retire, though their loss seems not to have been great.

Next day the Britons suddenly attacked the Roman legions as they were foraging; but meeting with a vigorous resistance, they soon beat them themselves to flight. The Romans pursued them so closely, that having neither time to rally nor get down from their chariots according to custom, great numbers of them were cut in pieces; and this overthrew bad such an effect upon the auxiliaries of Cassiobelaunus, that all of them abandoned him; nor did the Britons ever afterwards engage Caesar with united forces. Caesar, passing his victory, marched
England.

Caesar crossed the Thames.

Caesar was not at all dismayed at these difficulties, but he ordered the cavalry to enter first, and the foot to follow. His orders were obeyed, and the soldiers advanced with such resolution, that though the infantry were up to the chin in water, the enemy, unable to sustain their assault, abandoned the bank and fled. After this defeat, Cassibelanus himself despair’d of success, and therefore dismissed all his forces except about 4000 chariots, with which he observed the motions of the Romans, harrying them by cutting off straggling parties, &c. This, however, was not sufficient to keep up the spirits of his countrymen. On the contrary, they deposed him from the kingdom, and chose Mандubrius, whose father had been murdered by Cassibelanus, who thereupon usurped the kingdom. The young prince had fled to Caesar, who gave him protection; and the Trinobantes now offered to submit to the conqueror, provided he would give them Mandubrius for their king.

Caesar readily complied with the request of the Trinobantes upon their sending him 40 hostages; and the submission of the Trinobantes was soon followed by that of other states and tribes; for each of the 17 nations already mentioned was composed of several different tribes, of which no particular account can be given.

Cesar next marched to Verulamium, or Canterbury, which was Cassibelanus’s capital, and which he still kept possession of; but though the place was strongly fortified both by nature and art, the Britons were unable to bear the assault of the Romans, and therefore soon fled out at one of the avenues. Many were taken as they attempted to make their escape, and many more cut in pieces.

After this loss, Cassibelanus, as his last resource, found means to draw into confederacy with him four kings of the Cantii. But though Caesar gives them the title of kings, it is probable that they were only petty princes, tributary to the kingdom of that nation. Their names were Cingetorix, Corvulus, Tacimagus, and Segonax. These, having raised what forces they could, attacked the camp where the ships were laid up; but the Romans having made a sally, repulsed them with great slaughter, and then returned to their trenches without any loss; after which, Cassibelanus thought proper to submit to the conqueror. As the summer was already far spent, Caesar heartened to his proposals. A peace was concluded on the following terms, viz., that the Britons should pay an annual tribute to the Romans, that Cassibelanus should leaveMANDUBRIUS in peaceable possession of his dominions, that he should not molest the Trinobantes, and that his terms being agreed to, Caesar set sail with his whole fleet from Britain, to which he never returned.

Such is the account given by Caesar himself of his two expeditions into Britain; but other authors have spoken very doubtfully of his victories in this island. Dio Cassius tells us, that the Britons utterly defeated the Roman infantry, but were at last put in disorder by their cavalry. Horace and Tibullus, in many parts of their works, speak of the Britons as a people not yet conquered. Tacitus says, that Caesar rather showed the Romans the way to Britain, than put them in possession of it; and Lucan tells us plainly, that Caesar turned his back to the Britons and fled. This last, however, considering the consummate military genius of Caesar, is by no means probable. That he left Britain, during the winter, was, in all probability, to prevent insurrections among the Gauls, which might very readily have happened: and that he did not return to finish his conquest can be no wonder, seeing his ambition would certainly be more gratified by being called emperor of Rome, than conqueror of Britain.

The departure of Julius Caesar, which happened about 53 years before Christ, left the Britons without any fear of a foreign enemy. We are not, therefore, to imagine, that they would regard their promises of paying tribute; nor was it probably demanded for a good number of years afterwards. Augustus, however, when he had got himself fully established on the throne, had twice a design of invading Britain and forcing the inhabitants to pay the tribute promised to Julius Caesar. Both times, however, he was prevented by revolts in different provinces in the empire, so that the Britons still continued to enjoy their liberty. They thought proper, however, to court the favour of the Romans as much as they could by pretended submissions; but, in the reign of Claudius, the Romans set about reducing them to subjection in good earnest. The occasion of this war is related by Dio Cassius as follows.

“Caesar having got the nobelius, the third in succession from Cassibelanus, war with the Romans being dead, his two sons, Togodumnus and Caracalla, succeeded to the throne; but whether they reigned jointly or separately, is not known. In their reign one Baccius, of whom we also know very little, being driven out of the island for attempting to raise a sedition, fled with some of his partisans to Rome, and persuaded Claudius to make war on his countrymen. The Britons, on the other hand, resented the behaviour of Claudius in receiving these vagabonds, and therefore prohibited all intercourse with the Romans. A much smaller offence than this would have been sufficient at any time to provoke that haughty nation to declare war. An army was therefore immediately ordered into Britain, under the command of Plautius praetor in Gaul. The soldiers at first refused to embark, from a superstitious notion, that they were going to be sent without the compass of the world; and this mutiny being related to the Britons, they did not make the necessary preparations for their own defence. The Roman soldiers were soon brought to a sense of their duty; and set out from three different ports, in order to land in three different places of Britain at once.
ENGLAND.

England. Being driven back by contrary winds, their fears
began to return; but they resumed their courage on
the appearance of a meteor shooting from the east,
which they imagined was sent from heaven to direct
their course. They landed without opposition; and
the Britons, not having drawn together a sufficient
army, kept in small bodies behind their marshes, and
in woods, in order to spin out the war till winter;
which they thought Plautius, as Caesar had done, would
pass in Gaul.

The Roman general marched first in quest of the
two kings Togodumnus and Caractacus; both of whom
he found out, and defeated one after another. He then
reduced part of the Dobunii, at that time subject to the
Cattiischani; and leaving a garrison to keep them in
awe, he advanced to a river where the Britons lay
carelessly encamped, supposing that the Romans could
not pass it without a bridge. But the Germans in the
Roman army had been accustomed to swim across the
strongest currents with their heavy armour. They there-
fore passed the river first; and having, according to
their orders, fallen only upon the enemy’s horses which
drew their chariots, these formidable machines were
rendered entirely useless; and the Britons were put to
flight as soon as another part of the forces could pass
the river.

The Britons were not disheartened with this defeat,
but engaged the Romans next day with great bravery.
Victory continued long doubtful; but at length the
Romans prevailed, and the Britons were forced to be-
take themselves to flight. This battle is thought to
have been fought on the banks of the Severn. From
thence the Britons fled to the mouth of the Thames.
They were closely pursued by the Romans; but the
latter being unacquainted with the flats and shallow-
ness of the river, were often in great danger. The Ger-
mans, however, crossed by swimming as before, and
the rest on a bridge somewhat farther up the river; so
that the Britons were in a short time surrounded on all
sides, and great numbers of them cut in pieces. Many
of the Romans, also, pursuing the fugitives with too
great eagerness, were lost in the marshes.—In one of
these battles Togodumnus was killed; but the Britons
were so far from being disheartened, that they showed
more eagerness than ever to oppose the Romans, in
order to revenge his death. Plautius, therefore, did not
think proper to penetrate farther into the country, but
contented himself with putting garrisons in the places
he had already conquered. He then wrote to the em-
peror himself; who no sooner received an account of
his success, than he set out for Britain; where, having
landed after a short voyage, he joined Plautius on the
banks of the Thames.

Soon after the arrival of Claudius, the Romans
passed the Thames, attacked the British army, and to-
tally defeated it. The consequence of this was the
taking of Cunobelinus’s capital, and the submission of
several of the neighbouring states. The emperor,
however, did not make a long stay in the island, but
left Plautius to pursue his conquests. This he did with
such success, that on his return to Rome, he was met
without the gates by the emperor himself, who, at his
solemn entry, gave him the right hand.—The Brit-
ons seem to have made a very obstinate resistance to
the Roman arms about this time. Vespasian, who was
afterwards emperor, is said to have fought 30 battles
with them; and the exploits of Titus his son are also
much celebrated by the Roman historians.

In the ninth year of Claudius, P. Ostorius Scapula
was sent into Britain. By far the greater part of the
17 nations formerly mentioned were at this time un-
conquered. Some of these had broken into the Ro-
man territories; but Ostorius falling unexpectedly
upon them, put great numbers to the sword, and dispersed
the rest. To prevent them for the future from making
inroads into the territories of the Romans or their al-
lies, he built several forts on the Severn, the Avon,
and the Nene, reducing the country south of these ri-
ers to a Roman province. This so highly offended the
Iceni; that, being joined by the neighbouring na-
tions, they raised a considerable army, and encamped in
an advantageous situation, in order to prevent the
Romans from penetrating farther into the island. O-
storius, however, soon advanced against them. The
Romans, as usual, got the victory, and the enemy were
pursued with great slaughter. The Roman general
then, having quelled an insurrection among the Bri-
gantes, led his army against the Silures. They were
head by their king Caractacus, a most renowned
warrior. He showed his military talents by choosing
a very advantageous place for engaging the enemy. Ta-
citus tells us, “it was on the ridge of an ascending steep
mountains, and where the sides of it were inclining
and accessible, he reared walls of stone for a rampart.
At the foot of the mountain flowed a river dangerous
to be forded, and an army of men guarded his en-
trenchments.” This hill is thought to be one called
Cor-Caradoc in Shropshire, situated near the conflu-
ence of the rivers Colm and Teme, and where the remai-
ners of ancient entrenchments are still visible.—On the
approach of the enemy, Caractacus drew up his troops in
order of battle, animating them with the following
speech, according to Tacitus. “That from this day,
and this battle, they must date their liberty rescued,
or their slavery for every established. He then invoked
the shades of those heroes who had expelled Caesar the
dictator; those brave men by whose valour they still
enjoyed freedom from Roman tribute and taxes, and
by which their wives and children were as yet pre-
served from prostitution.” The whole army then took
a solemn oath either to conquer or die, and prepared
for the charge with the most terrible shouts. Ostorius
was somewhat dismayed when he considered the un-
common fierceness of the enemy, and the other difficul-
ties which he had to encounter. He led on his men,
however, to the charge; and the Romans were at-
tended with their usual good fortune. The Britons
were put to flight. Vast numbers fell on the field of
battle and in the pursuit, and many more were taken
prisoners. Among the latter were the wife, the daugh-
ter, and the brothers of Caractacus. The unfortunate
prince himself fled to Cartimandua queen of the Bri-
gantes, by whom he was delivered up to the Roman
general, who sent him in chains to Rome. Caractacus
bore his misfortunes with magnanimity; and when he
came before the emperor, addressed him in the follow-
ing terms. “If my moderation in prosperity, O His speech
Claudius! had been as conspicuous as my birth and
fortune, I should now have entered this city as a friend,
and not as a prisoner; nor would you have disdained
the
England.

The friendship of a prince descended from such illustrious ancestors, and governing so many nations. My present condition, I own, is to you honourable, to me humiliating. I was lately possessed of subjects, horses, arms, and riches. Can you be surprised that I endeavoured to preserve them? If you Romans have a desire to arrive at universal monarchy, must all nations, to gratify you, tamely submit to servitude? If I had submitted without a struggle, how much would it have diminished the lustre of my fall, and of your victory? And now, if you resolve to put me to death, my story will soon be buried in oblivion; but if you think proper to preserve my life, I shall remain a lasting monument of your clemency."—This speech had such an effect upon Claudius, that he immediately pardoned Caractacus and his whole family, and commanded them to be set at liberty.

The Silures, notwithstanding this terrible blow, continued the war with great vigour, and gained considerable advantages over the Romans; which so much affected Ostirius, that he died of grief. He was succeeded by A. Didius, who restrained the incursions of the Silures, but was not able to restore Cartamundius queen of the Brigantes, who had been deposed by her subjects. Didius was succeeded by Veranius, and he by Suetonius Paulinus, who reduced the island of Anglesey, as related under that article. But while Paulinus was employed in the conquest of this island, he was alarmed by the news of an almost universal revolt among those nations which had submitted to the Romans. The Britons, though conquered, had still a desire of returning to their former state of independence; and the Roman yoke became every day more unbearable to them, through the insolence and oppressions of the Roman soldiers. The Britons had been long discontented, and were already in a very proper disposition for a revolt, when an event happened which kindled these discontents into an open flame. Prasutagus king of the Iceni, a prince renowned for opulence and grandeur, had by his last will, left the Roman emperor, joint-heir with his two daughters, in hopes of obtaining his favour and protection by so great an obligation. But the event turned out very different. No sooner was he dead, than his houses and possessions were all plundered by the Roman soldiers. The queen Boadicea remonstrated against this injustice; but, instead of obtaining any redress, she herself was publicly whipped, her daughters ravished, and all the relations of the late king reduced to slavery. The whole country also was plundered, and all the chiefs of the Iceni deprived of their possessions.

Boadicea was a woman of too haughty a spirit tamely to bear such indignities. She therefore persuaded the Iceni to take up arms, which they very readily did. Then, being joined by the Trinobantes, and some other nations, they poured like a torrent on the Roman colonies. Every thing was destroyed with fire and sword. The ninth legion, which had been left for the defence of the country under Petilius Cerealis, was defeated, the infantry totally cut in pieces, and the commander himself with the cavalry escaped with the utmost difficulty. Suetonius, alarmed at this news, immediately left Anglesey, and marched with the greatest expedition to London. The inhabitants were overjoyed at his arrival, and used their utmost endeavours to detain him for their defence. But he refused to stay, and in a short time left the place, notwithstanding the intrigues of the inhabitants. The whole city lamented his departure; and they had reason. Suetonius was scarcely gone, when Boadicea with her Britons entered, and put all they found in it to the sword. None were taken prisoners, nor was any sex or age spared, and many were tortured in the most cruel manner. Seventy thousand persons are said to have perished on this occasion at London and other Roman colonies.

The Britons, now elated with success, assembled from all quarters in great numbers, so that Boadicea's army soon amounted to 230,000 men. They despised the Romans; and became so confident of victory, that they brought their wives and children along with them in wagons to be spectators of the destruction of their enemies. The event was what might naturally have been expected from such ill-judged confidence. The Britons were overthrown with most terrible slaughter, utterly doing no fewer than 80,000 being killed in the battle and pursuit; while the Romans had not above 400 killed, and not many more wounded. Boadicea, not able to survive so great a calamity, put an end to her life by poison.

By this overthrow the Britons, who had once been subdued, were thoroughly prevented from raising any more insurrections, and even those who had not yet, submitted to the Roman yoke seemed to be intimidated from making incursions into their dominions. Nothing remarkable therefore happened some time. In the time of Vespasian, Petilius Cerealis being appointed governor of Britain, attacked the Brigantes, defeated them in several battles, and reduced great part of their country. He was succeeded by Julius Frontinus; who not only maintained the conquests of his predecessor, but reduced entirely the warlike nation of the Silures. Frontinus was succeeded by the celebrated Cneius Julius Agricola, who completed the conquest of all the southern Britons.

Just before the arrival of Agricola, the Ordovices had cut in pieces a band of horse stationed on their conquered confines, after which the whole nation had taken arms by Agricola. The summer was pretty far spent, and the Roman army was quite separated and dispersed, the soldiers having assured themselves of rest for the remaining part of the year. Agricola, however, was no sooner landed, than, having drawn together his legions, he marched against the enemy without delay. The Britons kept upon the ridges of the mountains; but Agricola led them in person up the ascents. The Romans were victorious; and such a terrible slaughter was made of the Britons, that almost the whole nation of Ordovices was cut off. Without giving the enemy time to recover from the terror which this overthrow had occasioned, Agricola resolved upon the immediate reduction of Anglesey, which had been lost by the revolt of Boadicea. Being destitute of ships, he detached a chosen body of auxiliaries who knew the fords, and were accustomed to manage their arms and horses in the water. The Britons, who had expected a fleet and transports, were so terrified by the appearance of the Roman forces on their island, that they immediately submitted, and Anglesey was once more restored to the Romans.

With the conquest of Anglesey ended the first campaign.
ENGLAND.

England, paign of Agricola; and he employed the winter in reconciling the Britons to the Roman yoke. In this he met with such success, through his wise and equitable conduct, that the Britons, barbarous as they were, began to prefer a life of security and peace, to that independence which they had formerly enjoyed, and continually exposed them to the tumults and calamities of war. The succeeding campaigns of Agricola were attended with equal success; he not only subdued the 18 nations inhabiting England, but carried the Roman arms almost to the extremity of Scotland. He also caused his fleet to sail round the island, and discovered the Orkneys, or Orkney islands, which had before been unknown to the rest of the world. His expedition took him up about six years, and was completed in the year of Christ 84.

Had this commander been continued in Britain, it is probable that both Scotland and England would have been permanently subdued; but he was recalled by Domitian in the year 85, and we are then almost totally in the dark about the British affairs till the reign of the emperor Adrian. During this interval the Caledonians had taken arms, and not only refused submission to the Roman power themselves, but ravaged the territories of the Britons who continued faithful to them. Adrian, for what reason is not well known, abandoned to them the whole tract lying between the Tyne and the Forth. At the same time, in order to restrain them from making incursions into the Roman territories, he built a wall 80 miles in length from the river Eden in Cumberland to the Tyne in Northumberland. He was succeeded by Antoninus Pius, in whose reign the Britons revolted; and the Caledonians, having in several places broken down the wall built by Adrian, began anew to ravage the Roman territories. Against them the emperor sent Lellius Urbanus, who subdued the Britons; and having defeated the northern nations, confined them within narrower bounds by a new wall, extending probably between the friths of Forth and Clyde. From the time of Antoninus to that of Severus, the Roman dominions in Britain continued to be much infested by the inroads of the northern nations. That emperor divided Britain into two governments, the southern and northern; but the governor of the northern division was so harassed by continual incursions of the Caledonians, that he was at length obliged to purchase a peace with money. The Caledonians kept the treaty for 15 years; after which, breaking into the Roman territories anew, they committed terrible ravages. Virius Lupus, the governor, not being in a condition to withstand them, acquainted the emperor with his distress, intreating him to send powerful and speedy supplies. Upon this Severus resolved to put an end to the perpetual incursions of the enemy, by making a complete conquest of their country; for which purpose he set out for Britain, together with his two sons Caracalla and Geta, at the head of a numerous army. The Caledonians no sooner heard of his arrival, than they sent ambassadors, offering to conclude a peace upon honourable terms. But these the emperor detained till he was ready to take the field, and then dismissed them without granting their request.

As soon as the season was fit for action, Severus marched into the territories of the Caledonians, where he put all to fire and sword. He advanced even to the most northerly parts of the island; and though no battle was fought in this expedition, yet through the continual ambuscades of the enemy, and the inhospitable nature of the country, he is said to have lost 70,000 men. At last the Caledonians were obliged to sue for peace; which was granted them on condition of their yielding part of their country and delivering up their arms. After this the emperor returned to York, leaving his son Caracalla to command the army, and finish the new wall which had been begun between the friths of Forth and Clyde. But the emperor being taken ill at York, the Caledonians no sooner heard of his indisposition, than they again took up arms. This provoked Severus to such a degree, that he commanded his son Caracalla to enter their country anew with the whole army, and to put all he met to the sword without distinction of sex or age. Before these orders, however, could be put in execution, his two sons, having concluded a shameful peace with the Caledonians, returned to Rome.

A long chasm now takes place in the history of the Roman dominions in Britain. In the beginning of Diocletian's reign, Carausius a native of Gaul, passing over into Britain, took upon him the title of emperor, and was acknowledged by all the troops quartered here. He was, however, killed in a battle with one of Constantine's officers, after he had enjoyed the sovereignty for six or seven years. Constantine the Great began his reign in this island; and returned soon after he had left it, probably with a design to put a stop to the daily incursions of the Caledonians. He altered the division of that part of Britain subject to the Romans. Severus had divided it only into two provinces; but Constantine increased the number to three, viz. Britannia Prima, Britannia Secunda, and Maximia Cæsariensis; and this last was afterwards divided into two, viz. Maximia Cæsariensis and Flavia Cæsariensis. The removal of the imperial seat from Rome to Constantinople, which happened in the reign of Constantine, gave the northern nations an opportunity of making frequent incursions into the Roman provinces; the emperor having carried with him, first into Gaul, and then into the East, not only most of the Roman troops, but likewise the flower of the British youth.

About the latter end of the reign of Constantius son to Constantine the Great, the government of the province of Britain, and other western parts of the empire, was committed to Julian, afterwards called the Apostate. While he was in winter quarters at Paris, he was informed that the Scots and Picts, about this time first distinguished by these names, had broken into the Roman territories and committed everywhere dreadful ravages. Against them Julian dispatched a body of troops under the command of Lupicinus. He embarked from Boulogne in the depth of winter, but was no sooner arrived at London than he was recalled; the enemy having probably found means to appease Julian by their submissions. Till the reign of Valentinian I these nations still continued to infest the Roman territories in Britain, and had now reduced the country to a most deplorable condition, by their continual ravages. Valentinian sent against them Theodosius, father to the emperor of that name. That general...
ENGLAND.

England. ral having divided his forces into several bodies, advanced against the enemy, who were moving up and down the country. The Scots and Picts were obliged to yield to the superior valour and discipline of the Romans. Great numbers were cut in pieces; they were forced to abandon all the booty and prisoners they had taken, and to retire beyond the friths of Forth and Clyde. Theodosius then entered London in triumph, and restored that city to its former splendour, which had suffered greatly by the former incursions of the northern Britons. To restrain them from breaking anew into the provinces, Theodosius built several forts or castles between the two friths; and having thus recovered all the country between Adrian's wall and the friths of Forth and Clyde, he formed of it a fifth province, which he called Valentia.

Though Britain was now reduced to a state of temporary tranquillity, yet as the Roman empire was daily declining, it is not to be supposed that sufficient care could be taken to secure such a distant province. In the reign of the emperor Honorius, the provincial Britons and themselves were annoyed not only by the Scots and Picts, but also by the depredations of the Saxons, who began to commit ravages on the sea-coasts. By the care, however, of Stilicho, prime minister to Honorius, matters were once more settled, and a particular officer was appointed to guard the coast against the attempts of the Saxons, with the title of Comes limitis Saxonic. But, not long after, the empire being over run by barbarians, most of the Roman troops quartered in Britain were recalled, and the country left quite open to the attacks of the Scots and Picts.

Upon this the provincials expecting no more assistance from Honorius, resolved to set up an emperor of their own. Accordingly they invested with the imperial dignity one Mark, an officer of great credit among them. Him they murdered in a few days, and placed on the throne one Gratian a native of Britain. After a reign of four months, Gratian underwent the fate of his predecessor; and was succeeded by Constantine, a common soldier, who was chosen merely for the sake of his name. He seems, however, to have been a man of some knowledge and experience in war. He drove the Scots and Picts beyond the limits of the Roman territories; but being elated with this success, he would now be satisfied with nothing less than the conquest of the whole Roman empire. He therefore passed over into Gaul; and took with him not only the few Roman forces that had been left, but such of the provincial Britons as were most accustomed to arms. That unhappy people, being now left entirely defenceless, were harassed in the most cruel manner by their enemies; who broke into the country, and destroyed all with fire and sword. In this miserable situation they continued from the year 409, when the usurper Constantine passed over into Gaul, till the year 410. Having during the last three years frequently implored assistance from Rome without receiving any, they now resolved to withdraw their allegiance from an empire which was no longer able to protect them. Honorius himself applauded their conduct; and advised them by letters to provide for their own safety, which was in effect an implicit resignation of the sovereignty of the island.

The provincial Britons now regained their liberty; but they had lost the martial spirit which had at first rendered them so formidable to the Romans. They seem, however, to have met with some success in their first enterprises; for Zosimus tells us, that they delivered their cities from the insult of an haughty enemy. But being at last overpowered, they were again obliged to retreat beyond the friths of Forth and Clyde. Theodosius then entered London in triumph, and restored that city to its former splendour, which had suffered greatly by the former incursions of the northern Britons. To restrain them from breaking anew into the provinces, Theodosius built several forts or castles between the two friths; and having thus recovered all the country between Adrian's wall and the friths of Forth and Clyde, he formed of it a fifth province, which he called Valen-
E N G L A N D.

they began again to cultivate their lands; which, hav-

England.

ving lain fallow for a long time, now produced all

sorts of corn in the greatest plenty. This plenty, ac-

cording to the historian Gildas, occasioned the most

consummate wickedness and corruption of manners

among all ranks of men. The clergy, says he, who

should have reclaimed the laity by their example,

proved the ringleaders in every vice; being addicted
to drunkenness, contention, envy, &c.—It is possible,

however, that this description might be exaggerated

by Gildas, who was himself a monk. But, however this

was, the Britons had not long enjoyed peace, when

they were alarmed by a report that the Scots and

Picts were about to return with a far greater force

than before, utterly to extirpate the name of their

southern neighbours, and seize upon the country for

Are again themselves. This report threw them into a terrible

corruption; and to add to the rest of their misfor-
tunes, they were now visited by a dreadful plague,

which raged with such violence, that the living were

scarcely sufficient to bury the dead. The contagion

sooner ceased, than they found their country invaded

by the Scots and Picts, who destroyed every thing with

fire and sword; so that the provincials were soon re-
duced to the same miserable state they had formerly

been in.

At this time the chief, if not the only, king of the

southern division of Britain, was one Fortigern. He

is said to have been a cruel, debauched tyrant, regard-

less of the public welfare, and totally incapable of pro-
moting it. Being now roused from his insensibility,

however, by a sense of his own danger, he summoned

a council of the chief men of the nation, in order to

deliberate about the proper means for delivering the

country from those calamities under which it groaned.

In this council the most pernicious measure was ad-

opted that could possibly have been resolved on; namely, They re-
to invite to their assistance the Saxons, a people famous for

their piracies and cruelty, and justly dreaded by the

Saxons. This fatal expedient being agreed upon, ambassadors were immediately dis-

patched into Germany with advantageous proposals to

the Saxons in case they would come over to their as-

sistance.

The British ambassadors soon arrived in Germany,

and, according to Witichind, a Saxo-historian of the

ninth century, made the following speech before an

assembly of the Saxons.—"Illustrious Saxons, the fame of your victories having reached our ears, the distress-

ed Britons, harassed by the continual inroads of a

neighbouring enemy, send us to implore your assistance. We have a fertile and spacious country, which we

are commanded to submit to you. We have hitherto lived under the protection of the Roman empire; but our ancient master, having abandoned us, we know no nation more powerful than you, and bet-
ter able to protect us. We therefore recur to your

favour. Forsake us not in our distress, and we shall

readily submit to what terms you yourselves shall think fit to prescribe to us."—If this abject and shameful

speech was really made, it must give us a very strange

idea of the national spirit of the provincial Britons at

that time. It is, however, probable that the whole is

a fiction, designed only to excuse the perfidious treat-

ment which these Britons afterwards received from the

Saxons.
ENGLAND.

England. Saxons. The most respectable even of the Saxon historians make no mention of such a speech; and it is certain, that when the Saxons themselves wanted to quarrel with the Britons, they never insisted upon the promise made by the British ambassadors; which they most certainly would have done, had any such promise ever been made.

The British ambassadors were very favourably received by the Saxons. The latter embraced their proposal with joy; and the rather, because soothsayers foretold that they should plunder their British allies for 150 years, and reign over them for twice that time. Three long ships, in the Saxon language called chiudes, were therefore fitted out, under the conduct of Hengist and Horsa. These were two brothers much celebrated both for their valour and nobility. They were sons of Wittigild, said to be great-grandson to the Saxon god Woden; a circumstance which added much to their authority. Having embarked about 1600 men on board their three vessels, the two brothers arrived in the isle of Thanet, in the year 449 or 450. They were received by the inhabitants with the greatest demonstrations of joy; the isle in which they had landed was immediately appointed for their habitation; and a league was concluded, in virtue of which the Saxons were to defend the provincial Britons against all foreign enemies, and the provincials were to allow the Saxons pay and maintenance, besides the place allotted them for their abodes. Soon after their arrival, King Vortigern led them against the northern nations, who had lately broke into the kingdom, and advanced as far as Stanford in the county of Lincolnshire. Here a battle was fought, in which the Scots and Picts were utterly defeated, and obliged to relinquish their booty.

Vortigern was so highly pleased with the behaviour of his new allies, that he bestowed large possessions in the country they had newly delivered, upon the two commanders, Hengist and Horsa. It is said, that, even at this time, Hengist was taken with the wealth and fertility of the country; and at the same time observing the inhabitants to be quite enervated by luxury, began to entertain hopes of conquering part of it. He therefore, with Vortigern's consent, invited over some more of his countrymen; giving them notice at the same time of the fruitfulness of the country, the efficiency of the inhabitants, and how easily a conquest might be effected.

The Saxons readily complied with the invitation; and, in 452, as many more arrived in 17 vessels, as, with those already in Britain, made up an army of 5000 men. Along with these, according to Nennius, came over Rowena the daughter of Hengist. Vortigern fell in love with this lady; and in order to obtain her in marriage, divorced his lawful wife. Hengist pretended to be averse to the match; but Vortigern obtained his consent by investing him with the sovereignty of Kent. The Saxon historians, indeed, say no mention of Rowena; but rather insinuate, that their countrymen made themselves masters of Kent by force of arms. It seems most probable, however, that Vortigern had as yet continued in friendship with the Saxons, and even put more confidence in them than in his own subjects. For, not long after the arrival of this first reinforcement, Hengist obtained leave to send for a second, in order, as was pretended, to defend the king from the attempts of his rebellious subjects, as well as of the Scots and Picts. Those embarked in 40 ships, under the command of Octa and Ebussa, the son and nephew, or, according to some, the brother and nephew of Hengist. They landed, at the Orkney islands; and having ravaged them, as well as all the northern coasts of Scotland, they conquered several places beyond the Frith, and at last obtained leave to settle in Northumberland.

The pretence made for this settlement was, that the Saxons under Octa and Ebussa might defend the northern frontiers of the kingdom, as those under Hengist and Horsa did the southern parts. Many more Saxons were, under various pretences, invited over; till at last the countries from which they came were in a manner depopulated. And now their numbers being greatly increased, the Saxons began to quarrel with the natives. They demanded larger allowances of corn and other provisons; threatening to lay waste the whole country if their demands were not complied with. The Britons, instead of complying with these demands, desired them to return home, since their numbers exceeded what they were able to maintain. Upon this the Saxons concluded a peace with the Scots and Picts; and, turning their arms against the unhappy provincials, overran the whole country. The Saxons committed everywhere the greatest cruelties. All buildings, whether public or private, they levelled with the ground. The cities were pillaged and burnt; and the people massacred without distinction of sex or age, and that in such numbers, that the living scarce sufficed to bury the dead. Some of those who escaped the general slaughter, took refuge among inaccessible rocks and mountains; but there great numbers perished with hunger, or were forced to surrender themselves as slaves to their enemies. Some crossed the sea, and settled either in Holland or in Armorica, now the province of Brittany in France.

Vortigern, we are told by Nennius, was so far from being reclaimed by these calamities, that he added incest to his other crimes, and married his own daughter. At last, his own subjects, provoked at his enormous wickedness, and the partiality he showed to the Saxons, deposed him, and raised his son Vortimer to the throne. He was a young man of great valour. They are and willingly undertook the defence of this distressed defeated country. He first fell upon the Saxons with what troops he could assemble, and drove them into the isle of Thanet. Here they were besieged, till, being reinforced by fresh supplies from Germany, they opened themselves a way through the British troops. Vortimer, however, was not yet disheartened. He engaged the Saxons on the banks of the Derwent in Kent, where he obtained a complete victory, and cut in pieces great numbers of the enemy. Another battle was fought at Aylesford in Kent. Some ascribe the victory this time to the Saxons; and none to the Britons. It is certain, however, that Horsa the brother of Hengist was killed in this engagement. He is said to have been buried at a place in the neighbourhood, which from him obtained the name of Horsted.—A third battle was fought, in which the victory was uncertain, as is also the place where it happened. The fourth battle, however, according to Nennius, proved decisive.
Vortimer engaged his enemies, according to some, at Folkestone; according to others, at a place called Stonor, in the isle of Thanet. The Saxons were defeated with great slaughter, and driven back to their ships. So complete is the victory said to have been, that the Saxons quitted the island, without making any attempt upon it for five years afterwards. These battles, however, rests entirely upon the credit of Nennius, not the Saxons who have followed him. They are taken notice of neither by Gildas nor Bede. The former only acquaints us, that the Saxons retired. This, by most historians, is understood of their returning home; though it is possible he might mean no more, than that, after they had laid waste the country, they retired into the territories allotted them by Vortigern, in Kent and Northumberland.

Vortimer is said to have died after a reign of six years. On his death-bed, he desired his servants to bury him near the place where the Saxons used to land; being persuaded, that the virtue of his bones would effectually prevent them from ever touching the British shore. This command, however, was neglected; and Vortimer was buried at Lincoln, according to some, or London, according to others. Hengist was no sooner informed of his death, than he invaded Britain anew with a numerous body of Saxons. He was opposed by Vortigern, who had been restored to the throne after the death of his son Vortimer. Several battles were fought on this occasion; but at last the provincials being overthrown at a place called Crescentford, with the loss of 4000 men, were obliged to abandon Kent to their enemies, and retire to London. This happened about the year 458 or 459; and from this time most historians date the erection of the first Saxon kingdom in Britain, viz. that of Kent. Hengist assumed the title of king, and chose Esk his son for his colleague.

The Britons under Vortigern still continued the war. Hengist finding himself unable to gain a decisive advantage over them in the field, had recourse to treachery. He pretended to be desirous of concluding a peace with the British monarch, and of renewing his ancient friendship with him; and therefore required an interview. To this Vortigern readily consented, and accepted of an entertainment prepared for him by Hengist. The king was attended by 300 nobility all unarmed; but the Saxons had concealed daggers beneath their garments. The British nobility were all treacherously massacred in the height of their mirth; Vortigern himself was taken and put in fetters; nor could his liberty be procured, but by ceding to the Saxons those provinces now called Essex, Sussex, and Middlesex. Thus the Saxons got such a footing in Britain, that they could never afterwards be expelled. Vortigern, after being set at liberty, is said to have retired to a vast wilderness near the fall of the Wye in Radnorshire, where he was some time after consumed by lightning, together with a city called Kaer Gourtigern which he had built in that place.

On the retreat of Vortigern, the command of the British forces devolved upon Aurelius Ambrosius, or as Gildas calls him, Ambrosius Aurelianus. He was a Roman, and perhaps the last that remained in the island. He is said to have gained several victories over the Saxons. Notwithstanding this, however, they still continued to gain ground; and in the year 491, the foundation of a second Saxon kingdom was laid in Britain. This at first comprehended only the county of Sussex, but soon after extended over most of the counties lying south of the Humber. It was called the kingdom of the South Saxons.

The German nations being now informed of the great success which had attended the Saxons in Britain, new adventurers daily seeked over to share the good fortune of the others. They were chiefly composed of three nations, the Saxons, Angles, and Jutes. All these passed under the common appellation sometimes of Saxons, sometimes of Angles. They spoke the same language, and agreed very much in their customs and institutions, so that all of them were naturally led to combine against the natives. The most active of these adventurers was Cerdic a Saxon, said to be the tenth in descent from Woden. He landed with his son Cenric, and as many men as he could convoy in five ships, at Yarmouth in Norfolk. The provincials immediately attacked them with great vigour; but after a short engagement, they were totally defeated. Many other battles were fought, the event of which was always favourable to the Saxons, so that the Britons were forced to abandon their sea-coasts to them.

In 497, Porta, another Saxon, with his two sons, Beda and Maglo, arrived at Portsmouth, as called, as some imagine, from this chieftain. The provincials, under the command of a young prince a native of the country, attempted to oppose the landing of the Saxons; but his army was defeated with great slaughter, and he himself killed in the engagement; after which Porta made himself master of all the neighbouring country. The progress of Cerdic, however, alarmed the Britons more than that of all the other Saxon princes. About the year 508, therefore, Nazaled, styled, by Henry of Huntingdon, the greatest of all the British kings, assembled Britain and landed; and killed almost the whole strength of the provincial Britons in order to drive him out of the island. Cerdic, on the other hand, took care to strengthen himself by procuring assistance from all the Saxons already in the island. He then advanced against the Britons, commanding the right wing himself, and his son Cenric the left. As the two armies drew near each other, Nazaled perceived the enemy's right wing to be much stronger than the left. He therefore attacked it with the flower of his army; and after an obstinate resistance, obliged Cerdic to save himself by flight. Being too eager in the pursuit, however, Cenric fell upon his rear, and the battle was renewed with great vigour. The British army was at last entirely defeated; and 5000 men, among whom was Nazaled himself, were left dead on the spot.

Who succeeded Nazaled in the kingdom of Britain, is not known. The Welsh annals leave an interregnum of about six years, after which they place the beginning of the reign of Arthur, the most renowned British prince mentioned in history. The history of such a person as Arthur is so much obscured by fables, and many absurd, romantic, and ridiculous stories, that some have supposed that no such person ever existed. On this subject, Milton gives the following reasons against the existence of King Arthur: 1. He is not mentioned by Gildas,
kings frequent contentious new areas; by which England means the Britons enjoyed an uninterrupted tranquility for at least 44 years. This interval, however, according to Gildas, they employed only in corrupting their manners more and more, till at last they were roused from their security by the setting up of a sixth Saxon kingdom, called the kingdom of the East Angles. It was founded in 575, and comprised the counties of Norfolk, Suffolk, Cambridgeshire, and the Isle of Ely. The Saxons were more attacked by the Britons, and overthrew them in many battles. The war was continued for ten years; after which, another Saxon kingdom called Mercia was set up. It comprised 17 counties; viz. Gloucester, Hereford, Worcester, Warwick, Leicester, Rutland, Northampton, Lincoln, Huntingdon, Bedford, Buckingham, Oxford, Stafford, Nottingham, Derby, Shropshire, Cheshire, and part of Hertfordshire.

The provincial Britons were now confined within very narrow bounds. However, before they entirely gave up the best part of their country to their enemies, they once more resolved to try the event of a battle. At this time they were assisted by the Angles, who were jealously into some of the overgrown power of the West Saxons, Wales.

The battle was fought in Wilts, at Weden's Beath, a place near the ditch called Wodenech or Wodenech; which runs through the middle of the county. The battle was very obstinate and bloody; but at last the Saxons were entirely defeated, and almost their whole army cut off. The victory, however, proved of little service to the Britons; for being greatly inferior in number to the Saxons, and harried by them on one side, and by the Scots on the other, they were daily more and more confused; and at last obliged to take refuge among the craggy and mountainous places in the west of the island, where their enemies could not pursue them. At first they possessed all that country beyond the rivers Dee and Severn, which was anciently divided Cambria, or Wales, from England; the towns which stand on the eastern banks of these rivers having mostly been built in order to restrain the incursions of the Welsh. But the English, having passed the Severn, by degrees seized on the country lying between that river and the Wye. Nay, in former times, some parts of Flintshire and Denbighshire were subject to the kings of Mercia: for Uffa, the most powerful king of that country, caused a deep ditch to be drawn, and a high wall built, as a barrier between his dominions and the territories of the Welsh, from the mouth of the Dee, a little above Flint-castle, to the mouth of the Wye. This ditch is still to be seen in several places; and is called by the Welsh Clunet Uffo, or the Ditch of Uffa. The inhabitants of the towns on the east side of this ditch are called by the same people Gwyn y Mery; that is, the men of Mercia.

Thus, after a violent contest of near 150 years, the Accoast of Saxons entirely subdued the Britons whom they had the hepterarchy to defend, and had erected seven independent kingdoms in England, now commonly denominated the Saxons Heptarchy. By these conquerors the country was now reduced to a degree of barbarity almost as great as it had been in when first invaded by the Romans. The provincial Britons, during their subjection to that people, had made considerable advances in civilization.
England.

They had built 28 considerable cities, besides a number of villages and country-seats; but now these were all levelled with the ground, the native inhabitants who remained in England were reduced to the most abject slavery, and every art and science totally extinguished among them.

Before these fierce conquerors could be civilized in any degree, it was necessary that all the seven kingdoms should be reduced under one head; as long as they remained independent, their continual wars with each other still kept them in the same state of barbarity and ignorance.

The history of these seven kingdoms affords no event that can be in the least interesting. It consists only of a detail of their quarrels for the sovereignty. This was at last obtained by Egbert king of the West Saxons, or Wessex, in 827. Before this time, Christianity had been introduced in almost all the kingdoms of the heptarchy; and however much corrupted it might be by coming through the impure channel of the church of Rome, and misunderstood through the ignorance of those who received it, it had considerably softened the barbarous manners of the Saxons. It had also opened a communication between Britain and the more polite parts of Europe, so that there was now some hope of the introduction of arts and sciences into this country. Another effect was that, by the ridiculous notions of preserving inviolable chastity even between married people, the royal families of most of the kingdoms were totally extinct; and the people, being in a state of anarchy, were ready to submit to the first who assumed any authority over them.

All these things contributed to the success of Egbert in uniting the heptarchy under his own dominion. He was one of the royal family of Wessex; and a nearer heir than Britric, who had been raised to the kingdom in 784. As Egbert was a prince of great accomplishments, Britric, knowing that he had a better title to the crown than himself, began to look upon him with a very jealous eye. Young Egbert, sensible of his danger, privately withdrew to France; where he was well received by Charlemagne, the reigning monarch. The French were reckoned at this period the most valiant and polite people in Europe; so that this exile proved of great service to Egbert.

He continued at the court of France till he was recalled by the nobility to take possession of the kingdom of Wessex. This recall was occasioned by the following accident. Britric the king of Wessex had married Eadburga, natural daughter of Offa king of Mercia; a woman infamous for cruelty and incontinence. Having great influence over her husband, she often persuaded him to destroy such of the nobility as were obnoxious to her; and where this expedient failed, she herself had not scrupled to become their executioner. She had mixed a cup of poison for a young nobleman, who had acquired a great share of her husband's friendship; but, unfortunately, the king drank of the fatal potion along with his favourite, and soon after expired. By this and other crimes Eadburga became so odious to the people, that she was forced to fly into France, while Egbert was at the same time recalled, as above mentioned.

Egbert ascended the throne of Wessex in the year 799. He was the sole descendant of those conquerors who first invaded Britain, and who derived their pedigree from the god Woden. But though this circumstance might have given him great advantages in attempting to subdue the neighboring kingdoms, Egbert for some time gave them no disturbance; but turned his arms against the Britons, who had retired into Cornwall, whom he defeated in several battles. He was recalled from his conquests in that country, by hearing that Bernulf king of Mercia had invaded his dominions. Egbert quickly led his army against the invaders, whom he totally defeated at Ellendun in Wiltshire. He then entered their kingdom on the side of Oxfordshire with an army, and at the same time sent his eldest son Ethelwulf with another into Kent. The young prince expelled Baldred the tributary king of Kent, and soon made himself master of the country. The kingdom of Essex was conquered with equal ease; and the East Angles, who had been reduced under subjection by the Mercians, joyfully put themselves under the protection of Egbert. Bernulf himself marched against them, but was defeated and killed; and Ludecan his successor met with the same fate two years after.

These misfortunes greatly facilitated the reduction of Mercia. Egbert soon penetrated into the very heart of the Mercian territories, and gained an easy victory over a dispirited and divided people; but in order to engage them to submit with the less reluctance, he allowed Wigele, their countryman, to retain the title of king, whilst he himself exercised the real power of a sovereign. Northumberland was at present in a state of anarchy: and this tempted Egbert to carry his victorious arms into that kingdom also. The inhabitants, being desirous of living under a settled form of government, readily submitted, and owned him for their sovereign. To them, however, he likewise allowed the power of electing a king; who paid him a tribute, and was dependent on him.

Egbert became sole master of England about the year 827. A favourite opportunity was now offered first king of the Anglo-Saxons of becoming a civilized people, as they were at peace among themselves, and seemed free from any danger of a foreign invasion. But this flattering prospect was soon overcast. Five years after Egbert had established his new monarchy, the Danes landed in the Isle of Sheppey, plundered it, and then made their escape with safety. Encouraged by this success, next year they landed from a fleet of 35 ships. They were encountered by Egbert at Charmouth in Dorsetshire. The battle was obstinate and bloody. Great numbers of the Danes were killed, but the rest made good their retreat to their ships. They next entered into an alliance with the Britons of Cornwall; and landing two years after in that country, they made an irruption into Devonshire. Egbert met them at Henesdown, and totally defeated them; but before he had time to form any regular plan for the defence of the kingdom, he died, and left the government to his son Ethelwulf.

The new king was weak and superstitious. He began with dividing the kingdom, which had so lately been united, with his son Athelstan. To the young prince he gave the counties of Essex, Kent, and Sussex. But though this division might have been productive of
of bad consequences at another time, the fear of the
Danes kept every thing quiet for the present. These
barbarians had some how or other conceived such hopes
of enriching themselves by the plunder of England,
that they scarce ever failed of paying it an annual visit.
The English historians tell us, that they met with
many severe repulses and defeats; but on the whole it
appears that they had gained ground; for in 851 a
body of them took up their winter-quarters in Eng-
land. Next year they received a strong reinforcement
of their countrymen in 350 vessels; and advancing from
the isle of Thanet, where they had stationed them-
selves, they burnt the cities of London and Catterbury.
Having next put to flight Brictric the gov-
ernor of Mercia, they marched into the heart of Surry,
laying waste the whole country through which they
passed.

Ethelwulf, though naturally little fitted for military
enterprise, was now obliged to take the field. He
marched against the Danes at the head of the West
Saxons, and gained an indecisive and bloody victory
over his enemies. The Danes still maintained their
settlement in the isle of Thanet. They were attacked
by Ealber and Huda, governors of Kent and Surry:
both of whom they defeated and killed. Afterwards
they removed to the isle of Shepey, where they took
up their winter-quarters, with a design to extend their
ravages the next year.

The deplorable state of the kingdom did not hinder
Ethelwulf from making a pilgrimage to Rome, whither
he carried his fourth and favourite son Alfred, then
only six years of age. He passed a twelvemonth in that
city; made presents to the principal ecclesiastics there;
and made a grant of 500 mancuses (a silver coin about
the weight of our half-crown) annually to the see of
Rome. One-third of this was to support the lamps of
St Peter's, another those of St Paul's, and the third
was for the Pope himself. In his return to England,
Ethelwulf married Judith, daughter of the emperor
Charles the Bald; but when he landed, he found him-
selves deprived of his kingdom by his son Ethelbald.
That prince assumed the government of Athelstan's
dominions, who was lately dead; and, with many of
Ethelwulf's nobles, formed a design of excluding him
from the throne altogether, on account of his weaknesses
and superstitions. Ethelwulf, however, delivered the
people from the calamities of a civil war, by dividing
the kingdom with his son. He gave to Ethelbald the
government of the western, and reserved to himself that
of the eastern, part of the kingdom. Immediately after
this, he summoned the states of the whole kingdom,
and conferred on the clergy a perpetual donation of
tithes, for which they had long contended, and which
had been the subject of their sermons for several
centuries.

This concession was deemed so meritorious by the
English, that they now thought themselves sure of the
favour of heaven; and therefore neglected to use the
natural means for their safety which they might have
done. They even agreed, that notwithstanding the
desperate situation of affairs at present, the revenues
of the church should be exempted from all burdens,
though imposed for the immediate security and defence
of the nation. Ethelwulf died two years after he
had made the above-mentioned grant, and left the
kingdom to his two eldest sons Ethelbald and Ethel-
bert. Both these princes died in a few years, and left
the kingdom to Ethelbert their brother, in the year
A.D. 866.

The whole course of Ethelbert's reign was disturbed
by the irritations of the Danes. The king defended
himself against them with great bravery, being seconded
in all his military enterprises by his younger brother
Alfred, who afterwards ascended the throne. In this
reign, the Danes first landed among the East Angles.
That people treacherously entered into an alliance
with the common enemy; and furnished them with
horses, which enabled them to make an Irruption into
Northumberland. There they seized upon the city of
York. Osbritch and Ælla, two Northumbrians who
attempted to rescue the city, were defeated and killed.
Encouraged by this success, the Danes penet-
rated into the kingdom of Mercia, took up their
winter-quarters at Nottingham, and thus threatened
the kingdom with a final subjection. From this post,
however, they were dislodged by Ethelred and Alfred,
who forced them to retire into Northumberland. Their
restless and savage disposition, however, did not suffer
them to continue long in one place. They broke into
East Anglia; defeated and took prisoner Edmund the
tributary king of that country, whom they afterwards
murdered; and committed everywhere the most bar-
barous ravages. In 871, they advanced to Reading,
from whence they infested the neighbouring country
by their incursions. The Mercians, desirous of reco-
verying their independency, refused to join Ethelred
with their forces; so that he was obliged to march against
the Danes, attended only by the West Saxons, who
were his hereditary subjects. Several actions ensued,
in which the Danes are said to have been unsuccessful;
but being continually reinforced from their own coun-
try, they became every day more and more formidable
to the English. During the confusion and distress
in which the nation was now necessarily involved, King
Ethelred died of a wound he had received in an
attack on the Danes; and left to his brother Alfred the
kingdom almost totally subdued by a foreign power.

Alfred, who may properly be called the founder of Alfred
the English monarchy, ascended the throne in the year
Great
871, being then only 22 years of age. His great vir-
tues and shining talents saved his country from ruin,
which seemed almost unavoidable. His exploits against
the Danes, his dangers and distresses, are related under
the article ALFRED. Having settled the nation in a
much better manner than could have been expected,
he died in 901, leaving the kingdom to his second son
Edward the Elder.

The beginning of this monarch's reign was disturbed
by those intestine commotions from which the wise and
Elder
politic Alfred had taken so much pains to free the na-
tion. Ethelwald, son to King Ethelbert, Alfred's
elder brother, claimed a right to the throne. Having
armed his partisans, he took possession of Winburne,
where he seemed determined to hold out to the last
extremity. On the approach of Edward, however,
with a powerful army, he first fled into Normandy, and
afterwards into Northumberland. He hoped to find
the Northumbrians ready to join him, as most of them
were Danes, lately subdued by Alfred, and very im-
potent of peace. The event did not disappoint his ex-
pectations.
The Northumbrians declared for him; and Ethelwald having thus connected himself with the Danish tribes, went beyond sea, whence he returned with a great body of these banditti. On his return, he was joined by the Danes of East Anglia and Mercia. Ethelwald, at the head of the rebels, made an irruption into the counties of Gloucestor, Oxford, and Wilts; and having ravaged the country, retired with his booty before the king could approach him. Edward, however, took care to revenge himself, by conducting his forces into East Anglia, and ravaging it in like manner. He then gave orders to retire; but the Kentish men, greedy of more plunder, stayed behind, and took up their quarters at Bury. Here they were assaulted by the Danes; but the Kentish men made such an obstinate defence, that though their enemies gained the victory, it was bought by the loss of their bravest men, and, among the rest, of the usurper Ethelwald himself.

The king, now freed from the attempts of so dangerous a rival, concluded an advantageous peace with the East Angles. He next set about reducing the Northumbrians; and for this purpose equipped a fleet, hoping that thus they would be induced to remain at home to defend their own country, without attempting to invade his territories. He was disappointed in his expectations. The Northumbrians were more eager to plunder their neighbours than to secure themselves. Imagining that the whole of Edward's forces were embarked on board his fleet, they entered his territories with all the troops they could raise. The king, however, was better prepared for them than they had expected. He attacked them on their return at Tetehall in the county of Stafford, put them to flight, recovered all the booty, and pursued them with great slaughter into their own country.

The rest of Edward's reign was a scene of continued and successful action against the Northumbrians, East Angles, the Danes of Mercia, and those who came from their native country in order to invade England. He put his kingdom in a good posture of defence, by fortifying the towns of Chester, Eddesbury, Warwick, Cherbury, Buckingham, Tewcester, Maldon, Huntington, and Colchester. He vanquished Thurkettill a Danish chieftain, and obliged him to retire with his followers into France. He subdued the East Anglians, Northumbrians, and several tribes of the Britons; and even obliged the Scots to make submissions. He died in 925; and was succeeded by Athelstan his natural son.

This prince, notwithstanding his illegitimate birth, ascended the throne without much opposition, as the legitimate children of Edward were too young to rule a nation so much liable both to foreign invasions and domestic troubles as England at present was. One Alfred, however, a nobleman of considerable power, entered into a conspiracy against him. It is said, that this nobleman was seized upon strong suspicions, but without any certain proof. He offered to swear to his innocence before the pope; and in those ages it was supposed that none could take a false oath in presence of such a sacred person, without being visited by an immediate judgment from God. Alfred was accordingly conducted to Rome, and took the oath required of him before Pope John. The words were no sooner pronounced, than he fell into convulsions, of which he expired in three days. His body, fully convinced of his guilt, was consecrated to the altar, and made a present of to the monastery of Malmesbury.

This accident proved the means of establishing the authority of Athelstan in England. But finding the Northumbrians bore the English yoke with impatience, he gave Sithric, a Danish nobleman, the title of King of Northumberland; and in order to secure his friendship, gave him his own sister Editha in marriage. This was productive of bad consequences. Sithric died the year after his marriage with Editha; upon which Anlauf and Godfrid, Sithric's sons by a former marriage, assumed the sovereignty without waiting for Athelstan's consent. They were, however, soon obliged to yield to the superior power of that monarch. The former fled to Ireland; and the latter to Scotland, where he was protected by Constantine king of that country. The Scottish monarch was continually importuned by Athelstan to deliver up his guest, and even threatened with an invasion in case he did not comply. Constantine, detesting this treachery, advised Godfrid to make his escape. He did so, turned pirate, and died soon after. Athelstan, however, resenting this conduct of Constantine, invaded his kingdom, and reduced him, it is said, so low, that he was obliged to make the most humble submissions. This, however, is denied by all the Scottish historians.

Constantine, after the departure of Athelstan, entered into a confederacy with Anlauf, who insisted by hispiracies, and with some of the Welsh princes who were alarmed at the increase of Athelstan's power. All these confederates made an irruption into England at once; but Athelstan meeting them at Brumsbury in Northumberland, gave them a total overthrow. Anlauf perished, and Constantine made their escape with difficulty, leaving the greatest part of their men dead on the field of battle. After this period, Athelstan enjoyed his crown with tranquillity. He died in 941, after a reign of 16 years. He passed a remarkable law, for the encouragement of commerce: viz. that a merchant, who had made three long sea voyages on his own account, should be admitted to the rank of a thane or gentleman.

Athelstan was succeeded by his brother Edmund. On his accession, he found the kingdom disturbed by the restless Northumbrians, who watched for every opportunity of rising in rebellion. They were, however, soon reduced; and Edmund took care to ensure the peace of the kingdom, by removing the Danes from the towns of Mercia where they had been allowed to settle, because it was found that they took every opportunity to introduce foreign Danes into the kingdom. He also conquered Cumberland from the Britones. This country, however, he bestowed upon Malcolm king of Scotland, upon condition that he should do homage for it, and protect the north of England from all future incursions of the Danes.

Edmund was unfortunately murdered in Gloucester, Murdered by one Leolf a notorious robber. This man had been by Leolf, formerly sentenced to banishment; yet bad the boldness to enter the hall where the king himself dined, and to sit at table with his attendants. Edmund immediately ordered him to leave the room. The villain refused to obey; upon which the king leaped upon him.
him, and seized him by the hair. Leolf then drew a dagger, and gave the king a wound, of which he instantly died. A.D. 946, being the sixth year of his reign.

Edred.

As the children of Edmund were too young at the time of his decease, his brother Edred succeeded to the throne. The beginning of his reign, as well as those of his predecessors, was disturbed by the rebellions and incursions of the Northumbrian Danes, who looked upon the succession of every new king to be a favourable opportunity for shaking off the English yoke. On the appearance of Edred with an army, however, they immediately submitted; but before the king withdrew his forces, he laid waste their territories as a punishment for their offence. He was no sooner gone, than they rose in rebellion a second time. They were again subdued; and the king took effectual precautions against their future revolts, by placing English garrisons in all their towns, and appointing an English governor to watch their motions, and suppress their insurrections on the first appearance. In the reign of Edred, celibacy of the clergy began to be preached up under the patronage of St. Dunstan. This man had obtained such an ascendant over Edred, who was naturally superstitious, that he not only directed him in affairs of conscience, but in the most important matters of state. He was placed at the head of the treasury; and being thus possessed of great power at court, he was enabled to accomplish the most arduous undertakings. He professed himself a partisan of the rigid monastic rules; and having introduced celibacy among the monks of Olasenbury and Abingdon, he endeavoured to render it universal among the clergy throughout the kingdom. The monks in a short time generally embraced the pretended reformation; after which they inveighed bitterly against the vices and luxury of the age. When other topics of defamation were wanting, the marriages of clergy men became a sore object of invective. Their wives received the appellation of concubines or some other more opprobrious names. The secular clergy, on the other hand, who were numerous and rich, defended themselves with vigour, and endeavoured to retaliate upon their adversaries. The people were thrown into the most violent ferment; but the monks, being patronised by King Edred, gained ground greatly upon their opponents. Their progress, however, was somewhat retarded by the king's death, which happened in 955, after a reign of nine years. He left children; but as they were infants, his nephew Edwy, son to Edmund, was placed on the throne.

Edwy.

The new king was not above 16 or 17 years of age at the time of his accession. His reign is only remarkable for the tragic story of his queen Elfgiva. She was a princess of the royal blood, with whom Edwy was deeply enamoured. She was his second or third cousin, and therefore within the degrees of affinity prohibited by the canon law. Edwy, however, beseeching only to the dictates of his passion, married her, contrary to the advice of the more dignified ecclesiastics. The monks on this occasion were particularly violent; and therefore Edwy determined not to send his ambitious projects. He soon found reason to repent his having provoked such dangerous enemies. On his coronation day, while his nobility were indulging them-
The greatness of King Edgar, which is very much celebrated by the English historians, was owing to the harmony which reigned between him and his subjects; and the reason of this good agreement was, that the king sided with Dunstan and the monks, who had acquired a great ascendant over the people. He enabled them to accomplish their favourite scheme of disposing the secular canons of all the monasteries; and he consulted them not only in ecclesiastical but also in civil affairs. On these accounts, he is celebrated by the monkish writers with the highest praises; though it is plain, from some of his actions, that he was a man who could be bound neither by the ties of religion nor humanity. He broke into a convent, and carried off by force, and ravished, a nun called Editha. His spiritual instructor, Dunstan, for this offence, obliged the king, not to separate from his mistress, but to abstain from wearing his crown for seven years!

Edgar, however, was not to be satisfied with one mistress. He happened once to lodge at the house of a nobleman who had a very beautiful daughter. Edgar, inflamed with desire at the sight of the young lady, without ceremony asked her mother to allow her to pass a night with him. She promised compliance; but secretly ordered a waiting-maid, named Elfrida, to steal into the king's bed when the company were gone, and to retire before day-break. Edgar, however, detected her by force, till day-light discovered the defect. His love was now transferred to the waiting maid; who became his favourite mistress, and maintained a great ascendancy over him till his marriage with Elfrida.

The circumstances of this marriage were still more singular and criminal than those above mentioned. Elfrida was daughter and heiress to O Edgar earl of Devonshire. She was a person of such exquisite beauty, that her fame was spread all over England, though she had never been at court. Edgar's curiosity was excited by the accounts he had heard of her, and therefore formed a design of marrying her. He communicated his intention to Earl Athelwold his favourite; and ordered him, on some pretence or other, to visit the earl of Devonshire, and bring him a certain account concerning Elfrida. Athelwold went as he was desired; but fell so deeply in love with the lady himself, that he resolved to sacrifice his fidelity to his passion. He returned to Edgar, and told him that Elfrida's charms were by no means extraordinary, and would have been totally overlooked in a woman of inferior station. After some time, however, turning the conversation again upon Elfrida, he told the king that he thought her parentage and fortune made her a very advantageous match; and therefore, if the king gave his consent, he would make proposals to the earl of Devonshire on his own behalf. Edgar consented, and Athelwold was married to Elfrida. After his marriage, he used his utmost endeavours to keep his wife from court, that Edgar might have no opportunity of observing her beauty. The king, however, was soon informed of the truth; and told Athelwold, that he intended to pay him a visit in his castle, and be made acquainted with his new-married wife. The earl could make no objections; only he desired a few hours to prepare for the visit. He then confessed the whole to Elfrida, and begged of her to appear before the king as much to the disadvantage as possible. Instead of this, she dressed herself to the greatest advantage. Edgar immediately conceived a violent passion for her; and in order to gratify it, seduced Athelwold into a wood under pretence of hunting, where he stabbed him with his own hand, and afterwards married his widow.

The reign of Edgar is remarkable among historians for the encouragement he gave to foreigners to reside at his court and throughout the kingdom. These foreigners, it is said, corrupted the former simple manners of the nation. Of this simplicity, however, there seems to be no great reason to boast; seeing it could not preserve them from treachery and cruelty, the greatest of all vices: so that their acquaintance with foreigners was certainly an advantage to the people, as it tended to enlarge their views, and cure them of those illiberal prejudices and rustic manners to which islanders are often subject. Another remarkable incident is the extirpation of wolves from England. The king took great pleasure in hunting and destroying these animals himself. At last he found that they had all taken shelter in the mountains and forests of Wales. Upon this he changed the tribute imposed upon the Welsh princes by Athelstan, into an annual tribute of 500 wolves heads; and thus produced such diligence in hunting them, that the animal has never since appeared in England.

Edgar died in 977, after a reign of 16 years. He Edward left a son named Edward, whom he had by his first wife daughter of Earl Ordnoer; and another, named Ethelred, by Elfrida. The mental qualifications of this lady were by no means answerable to the beauty of her person. She was ambitious, haughty, treacherous, and cruel. The principal nobility, therefore, were greatly averse from the succession of her son Ethelred, which would unavoidably throw too much power into the hands of his mother, as he himself was only seven years of age. Edward, afterwards surnamed the Martyr, was therefore pitched upon: and was certainly the most proper person, as he was 15 years of age, and might soon be able to take the government into his own hands. Elfrida opposed his advancement with all her might: but Dunstan overcame every obstacle, by anointing and crowning the young prince at Kingston; upon which the whole kingdom submitted without further opposition.

The only remarkable occurrence in this reign was the complete victory gained by the monks over the secular clergy, who were now totally expelled from the convents. Though this had been pretty nearly accomplished by Edgar, the secular clergy still had partisans in England who made considerable opposition: but these were all silenced by the following miracles: In one synod, Dunstan, finding the majority of votes against him, rose up, and declared that he had that instant received from heaven a revelation in favour of the monks. The whole assembly were so much overawed by this intelligence, that they proceeded no farther in their deliberations. In another synod, a voice issued from the crucifix, acquainting the members, that the establishment of the monks was founded on the will of heaven, and could not be opposed without impiety. But the third miracle was still more alarming. In another
England.

A.D. 981.

Other synod the floor of the hall sunk, and great numbers of the members were killed or bruised by their fall. It was remarked that Dunstan had that day prevented the king from attending the synod, and that the beam on which his own chair stood was the only one which did not sink. These circumstances, instead of making him suspected as the author of the miracle, were regarded as proofs of the interposition of Providence in his favour.

Edward lived four years after he was raised to the throne, in perfect innocence and simplicity. Being incapable of any treacherous intention himself, he suspected none in others. Though his stepmother had opposed his succession, he had always behaved towards her with the greatest respect; and expressed on all occasions the most tender affection for his brother Ethelred. Being one day hunting in the neighbourhood of the castle where Elfrida resided, he paid her a visit unattended by any of his retainee. After mounting his horse with a design to return, he desired some liquor to be brought him. But while he was holding the cup to his head, a servant of Elfrida stabbed him behind. The king, finding himself wounded, clapped spurs to his horse; but soon becoming faint by the loss of blood, he fell from the saddle, and his foot being entangled in the stirrup, he was dragged along till he expired. His body was found and privately interred at Wareham by his servants. The English had such compassion for this amiable prince, that they bestowed on him the appellation of Martyr, and even fancied that miracles were wrought at his tomb. Elfrida built monasteries, and submitted to many penances, in order to atone for her guilt; but, even in that barbarous age, she could never regain the good opinion of the public.

After the murder of Edward, his brother Ethelred succeeded to the throne without opposition. As he was a minor when he was raised to the throne, and, even when he came to man's estate, never discovered any vigour or capacity of defending the kingdom against invaders, the Danes began to renew their incursions. Before they dared attempt any thing of importance, however, they first made a small incursion by way of trial. In the year 987, they landed in Southampton from seven vessels; and having ravaged the country, they retired with impunity, carrying a great booty along with them. In 987, they made a similar attempt on the west coast, and were attended with the like success. Finding that matters were now in a favourable situation for their enterprises, they landed in Essex under the command of two chief-tains; and, having defeated and killed Britneth duke of that country, laid waste all the neighbouring provinces. In this enterprise Ethelred, uncommon, on account of his preposterous conduct, the Unready, bribed the enemy with 20,000l. to depart the kingdom. This advice was given by Siricus archbishop of Canterbury, and some of the degenerate nobility; and was attended with the success that might have been expected. The Danes appeared next year off the eastern coast. But, in the mean time, the English had determined to assemble at London a fleet capable of repulsing the enemy. This failed of success through the treachery of Alfric duke of Mercia. Having been formerly banished the kingdom, and found great difficulty in getting himself restored to his former dignity, he trusted therefor,
England. the want of concert in all, frustrated every endeavour; their fleets and armies either came too late to attack the enemy, or were repulsed with disdain. The English, therefore, devoid both of prudence and unanimity in council, had recourse to the expedient which by experience they had found to be ineffectual. They offered the Danes a large sum if they would conclude a peace and depart the kingdom. These ravagers continually rose in their demands; and now required the payment of 24,000L. which the English submitted to give. The departure of the Danes procured them a temporary relief; which they enjoyed as if it was to be perpetual, without making any effectual preparations for giving them a more vigorous reception upon their next return.

Besides the receiving this sum, the Danes were at present engaged by another motive to depart from England. They were invited over by their countrymen in Normandy, who at that time were hard pressed by Robert king of France, and who found it difficult to defend their settlements against him. It is probable, also, that Ethelred, observing the close connection of all the Danes with one another, however they might be divided in government or situation, was desirous of procuring an alliance with that formidable people. For this purpose, being at present a widower, he made his addresses to Emma, sister to Richard II. duke of Normandy. He soon succeeded in his negotiations; the princess came over to England, and was married to the king in the year 1001.

Though the Danes had been for a long time established in England, and though the similarity of their language with the Saxon had invited them to an early coalition with the natives; they had as yet found so little example of civilized manners among the English, that they retained all their ancient ferocity, and valued themselves only on their national character of military bravery. The English princes had been so well acquainted with their superiority in this respect, that Athelstan and Edgar had been accustomed to keep in pay large bodies of Danish troops, who were quartered about the country, and committed many violences upon the inhabitants. These mercenaries had attained to such a height in luxury, according to the old English writers, that they combed their hair once a-day, bathed themselves once a-week, changed their clothes frequently; and by all these arts of effeminacy, as well as by their military character, had rendered themselves so agreeable to the fair sex, that they debauched the wives and daughters of the English, and had dishonoured many families. But what most provoked the inhabitants was, that, instead of defending them against invaders, they were always ready to betray them to the foreign Danes, and to associate themselves with every straggling party which came from that nation.

The animosities between the native English and the Danes, who inhabited among them, had from these causes risen to a great height; when Ethelred, from a policy commonly adopted by weak princes, took the cruel resolution of massacring the Danes throughout the kingdom. On the 15th of November 1002, secret orders were dispatched to commence the execution everywhere on the same day; and the festival of St Brice, which fell on Sunday, the day on which the Danes usually bathed themselves, was chosen for this purpose. These cruel orders were executed with the utmost exactness. No distinction was made between the innocent and the guilty; neither sex nor age was spared; nor were the cruel executioners satisfied without the tortures, as well as death of the unhappy victims. Even Gunilda, sister to the king of Denmark, who had married Earl Paling, and had embraced Christianity, was, by the advice of Edric earl of Wilts, seized and condemned to death by Ethelred, after seeing her husband and children butchered before her face. This unhappy princess foretold, in the agonies of despair, that her murder would soon be avenged by the total ruin of the English nation (A).

The prophecy of Gunilda was exactly fulfilled. In the new invasion by Sweyn and his Danes, who wanted only a pretence to renew their invasions, appeared off the western coast, and threatened revenge for the slaughter of their countrymen. The English took measures for repulsing the enemy; but these were defeated through the treachery first of Alfric, and then of Edric, a still greater traitor, who had married the king's daughter, and succeeded Alfric in the command of the British armies. The Danes therefore ravaged the whole country. Agriculture was neglected, a famine ensued, and the kingdom was reduced to the utmost degree of misery. At last the infamous expedient of buying a peace was resorted to; and the departure of the Danes was purchased, in 1007, at the expense of 30,000L.

The English endeavoured to employ this interval in making preparations against the return of the Danes, which they had reason soon to expect. A law was made, ordering the proprietors of eight hides of land to provide themselves of a horseman and a complete suit of armour; and those of 310 hides to equip a ship for the defence of the kingdom. By this means a formidable armament was raised. There were 243,600 hides in England; consequently the ships equipped must be 785. The cavalry was 30,450 men. All hopes of success from this equipment, however, were disappointed by the factions, animosities, and dissenions

(A) On the subject of this massacre, Mr Hume has the following observations: "Almost all the ancient historians speak of this massacre of the Danes as if it had been universal, and as if every individual of that nation throughout England had been put to death. But the Danes were almost the sole inhabitants in the kingdoms of Northumberland and East Anglia, and were very numerous in Mercia. This representation of the matter was absolutely impossible. Great resistance must have been made, and violent wars ensued: which was not the case. This account given by Wallington, though he stands single, must be admitted as the only true one. We are told that the term of lurdan, lord Dane, for an idle lazy fellow who lived at home people's expense, came from the conduct of the Danes who were put to death. But the English princes had been entirely masters for several generations; and only supported a military corps of that nation. It seems probable, therefore, that these Danes only were put to death."
England.

England. Brightric to advance an accusation of treason against Wolftho, governor of Sussex, the father of the famous Earl Godwin; and that nobleman, knowing the power and malice of his enemy, consulted his own safety by deserting with 20 ships to the Danes. Brightric pursu ed him with a fleet of 80 sail; but his ships being shattered in a tempest, and stranded on the coast, he was suddenly attacked by Wolftho, and all his vessels were burnt or otherwise destroyed. The treachery of Edric frustrated every plan of future defence; and the whole navy was at last scattered into the several harbours.

By these fatal miscarriages, the enemy had leisure to overrun the whole kingdom. They had now got such a footing, indeed, that they could hardly have been expelled though the nation had been ever so unanimous. But so far did mutual difference and dissen sion prevail, that the governors of one province refused to march to the assistance of another; and were at last terrified from assembling their forces for the defence of their own. At last the usual expedient was tried. A peace was bought with 48,000l.; but this did not procure even the usual temporary relief. The Danes, knowing that they were now masters of the kingdom, took the money, and continued their devastations. They levied a new contribution of 8000l. on the county of Kent alone; murdered the archbishop of Canterbury, who had refused to countenance this execution; and the English nobility submitted everywhere to the Danish monarch, swearing allegiance to him, and giving hostages for their good behaviour. At last, Ethelred himself, dreading equally the violence of the enemy and the treachery of his own subjects, fled into Normandy, whither he had already sent Queen Emma and her two sons Alfred and Edward. The duke received his unhappy guests with a generosity which does honour to his memory.

The flight of King Ethelred happened in the end of the year 1013. He had not been above six weeks in Normandy, when he heard of the death of Sweyn, which happened at Gainsborough before he had time to establish himself in his new dominions. At the same time he received an invitation from the prelates and nobility to resume the kingdom; expressing also their hopes, that, being now better taught by experience, he would avoid those errors which had been so fatal to himself and his people. But the misconduct of Ethelred was incurable; and, on his resuming the government, he behaved in the very same manner that he had done before. His son-in-law Edric, notwithstanding his repeated treasons, retained such influence at court, that he instilled into the king jealousies of Sigefert and Morcar, two of the chief nobles of Mercia. Edric enticed them into his house, where he murdered them; while Ethelred partook of the infamy of this action, by confiscating their estates, and confining the widow of Sigefert in a convent. She was a woman of singular beauty and merit; and in a visit which was paid her, during her confinement, by Prince Edmund the king's eldest son, she inspired him with so violent an affection, that he released her from the convent, and soon after married her without his father's consent.

In the mean time, Canute, the son and successor of Sweyn, proved an enemy no less terrible to the English than his father had been. He ravaged the eastern coast with marvellous fury; and put ashore all the English hostages at Sandwich, after having cut off their hands and noses. He was at last obliged, by the necessity of his affairs, to return to Denmark. In a short time, however, he returned, and continued his deprivations along the southern coast. He then broke into the counties of Dorset, Wilts, and Somerset; where an army was assembled against him under the command of Prince Edmund and Duke Edric. The latter still continued his perfidious machinations; and after endeavouring in vain to get the prince into his power, found means to dissipate the army, and then deserted to Cnut with 40 vessels.

Edmund was not disheartened by this treachery. He again assembled his forces, and was in a condition to give the enemy battle. Ethelred, however, had now seen the frequent experience of the treachery of his subjects, that he had lost all confidence in them. He remained in London, pretending sickness, but in reality from an apprehension they intended to buy their peace by delivering him into the hands of his enemies. The army called aloud for their sovereign to march at their head against the Danes; and on his refusal to take the field, they were so discouraged, that all the preparations which had been made became ineffectual for the defence of the kingdom. Edmund, deprived of all regular resources for the maintenance of the soldiers, was obliged to commit similar ravages to those practised by the Danes; and after making some fruitless expeditions into the north, which had submitted entirely to Cnut's power, he returned to London, where he found everything in confusion by the death of the king.

Ethelred died in 1016, after an unhappy reign of Edmund 33 years; and was succeeded by his eldest son Cnut, whom the Danes, surnamed Ironside on account of his great strength and valor. He possessed abilities sufficient to have with the saving his country from ruin, had he come sooner to the throne; but he was too late. He bravely opposed the Danes, however, notwithstanding every disadvantage; till at last the nobility of both nations obliged their kings to come to a compromise, and divide the kingdom between them by treaty. Canute reserved to himself, Mercia, East Anglia, and Northumberland, which he had entirely subdued. The southern parts were left to Edmund. This prince survived the treaty only about a month; being murdered at Oxford by two of his chamberlains, accomplices of Edric.

After the death of Edmund, nothing was left for Canute. The English but submission to Cnut. The least scrupulous of mankind, however, dare not at all times openly commit injustice. Canute, therefore, before he seized the dominions of Edwin and Edward, the two sons of Edmund, suborned some of the nobility to dispose, that, in the last treaty with Edmund, it had been verbally agreed, that, in case of Edmund's death, Canute should either be successor to his dominions, or tutor to his children; for historians differ with regard to this particular. This evidence, supported by the great power of Canute, was sufficient to get him elected king of England. Immediately after his accession to the throne, he sent the two sons of Edmund to the court of Sweden, on pretence of being there educated;
England:

but charged the king to put them to death as soon as
they arrived. The Swedish monarch did not comply
with this request but sent them to Solomon king of
Hungary, to be educated in his court. The elder
Edwin, was afterwards married to Solomon's sister:
but he dying without issue, that prince gave his sisterin-law, Agatha, daughter of the emperor Henry II.
in marriage to Edward, the younger brother; and
she bore him Edgar Atheling; Margaret, afterwards
queen of Scotland; and Christina, who retired into a
convent.

Canute was obliged at first to make great concessions
to the nobility; but he afterwards put to death many
of those in whom he could not put confidence; and,
among the rest, the traitor Edric himself, who was pub-
licly executed, and his body thrown into the Thames.
In order to prevent any danger from the Normans,
who had threatened him with an invasion, he married
Emma the widow of Ethelred, and who now came
over from Normandy; promising that he would leave
the children he should have by that marriage heirs to
the crown after his decease. The English were at first
displeased with Emma for marrying the mortal enemy
of her former husband; but at the same time were glad
to find at court a sovereign to whom they were accu-
customed, and who had already formed connections with
them: and thus Canute, besides securing by his mar-
rriage the alliance with Normandy, gradually acquir-
ed by the same means the confidence of his own
people.

The most remarkable transaction in this prince's
reign, besides those mentioned under the article Ca-
quete, is his expedition to Scotland against Malcolm
king of that country, whom he forced to do homage
for the county of Cumberland, which the Scots at that
time possessed. After this enterprise, Canute passed
four years in peace, and died at Shaftesbury; leaving
three sons, Sweyn, Harold, and Hardicanute. Sweyn,
whom he had by his first marriage with Alfwine,
daughter of the earl of Hampshire, was crowned in
Norway; Hardicanute, whom Emma had born, was
in possession of Denmark; and Harold, who was of
the same marriage with Sweyn, was at that time in
England.

Harold succeeded to the crown of England; though
it had been stipulated that Emma's son, Hardicanute,
should be heir to that kingdom. This advantage Ha-
rold obtained by being on the spot, and getting pos-
session of his father's treasures, while Hardicanute was
at a distance. As Hardicanute, however, was sup-
sported by Earl Godwin, a civil war was likely to en-
sue, when a compromise was made; by which it was
agreed, that Harold should enjoy London, and all the
provinces north of the Thames, while the possession of
the south should remain to Hardicanute: and till that
prince should appear and take possession of his domi-
nions, Emma fixed her residence at Winchester, and
ruled her son's part. Harold reigned four years; du-
ring which time the only memorable action he per-
formed was a most infamous piece of treachery.—Al-
fred and Edward, the two sons of Emma by Ethelred,
paid a visit to their mother in England. But, in the
mean time, Earl Godwin being gained over by Harold,
a plan was laid for the destruction of the two princes.
Alfred was accordingly invited to London by Harold,
with many professions of friendship; but when he had
reached Guildford, he was set upon by Godwin's vas-
sal; about 600 of his train were murdered in the most
cruel manner: he himself was taken prisoner, his eyes
were put out, and he was conducted to the monastery
of Ely, where he died soon after. Edward and Em-
ma, apprised of the fate which awaited them, fled be-
yond sea, the former into Normandy, the latter into
Flanders; while Harold took possession of all his bro-
ther's dominions without opposition. He died in April
1039.

Hardicanute succeeded his brother Harold without
opposition. His government was extremely violent
and tyrannical. However, it was but of short dura-
tion. He died, in 1041, of a debauch at the mar-
rriage of a Danish lord. After his death, a favourable
opportunity was offered to the English for shaking off
the Danish yoke. Sweyn, king of Norway, the el-
dest son of Canute, was absent; and as the two last
kings had died without issue, there appeared none of
that race whom the Danes could support as successor
to the throne. For this reason, the eyes of the nation
were naturally drawn towards Prince Edward, who
happened to be at court when the king died. There
were some reasons, however, to fear, that Edward's su-
cession would be opposed by Earl Godwin, on account
of the hand which the latter had in the murder of his brother Alfred; and this was thought
to be an offense of so grievous a nature, that Edward
could never forgive it. But here their common friends
intervened; and representing the necessity of their good
correspondence, obliged them to lay aside their animo-
sities, and to concur in restoring liberty to their native
country. Godwin only stipulated, that Edward, as a
pledge of his sincere reconciliation, should promise to
marry his daughter Editha. This proposal was agreed Edward the
to; Edward was crowned king of England, and married
Confessor.

Editha as he had promised. The marriage, however,
proved neither a source of discord than otherwise be-
tween the king and Godwin. Editha, though a very
amiable woman, could never obtain the confidence and
affection of her husband. It is even said that during the
whole course of her life he abstained from all matrimonial
converse with her; and this ridiculous behaviour was
highly celebrated by the monkish writers of the age, and
contributed to the king's acquiring the title of Saint and
Confessor.

Though the neglect of his daughter could not fail to
awaken Godwin's former enmity against King Ed-
ward, it was necessary to choose a more popular ground
before he could vent his complaints against the king
in a public manner. He therefore chose for his theme
Variance of
the influence which the Normans had on the affairs of the king-
government; and declared opposition took place be-
tween him and these favourites. In a short time, this
animosity openly broke out with great violence. En-
stage count of Boulogne having paid a visit to the king,
was sent by Dover on his return. One of his train be-
ing refused access to a lodging which had been ap-
pointed for him, attempted to make his way by force,
and wounded the master of the house in the contest.
The townspeople avenged this insult by the death of
the stranger; the count and his train took arms, and
murdered
ENGLAND.

England murdered the townsman in his own house. A tumult ensued; near 20 persons were killed on each side; and Eustace being overpowered with numbers, was at last obliged to fly. He complained to the king; who gave orders to Earl Godwin, in whose government Dover lay, to punish the inhabitants. But this nobleman refused to obey the command, and endeavoured to throw the whole blame on Count Eustace and his followers. The king was displeased; and threatened to make him feel the utmost effects of his resentment, in case he finally refused to comply. Upon this, Godwin assembled a powerful army, on pretence of repressing some disorders on the frontiers of Wales; but, instead of this, marched directly to Gloucester, where the king at that time was without any military force, as suspecting no danger.

Edward, perceiving his danger, applied to Siward duke of Northumberland, and Leofwine duke of Mercia, two very powerful noblemen. They hastened to him with such followers as they could assemble, issuing orders at the same time for all the forces under their respective governments to march without delay to the defence of the king. Godwin, in the mean time, suffered himself to be deceived by negotiations, till the king's army became so powerful, that he was not able to cope with it. He was therefore obliged to fly with his family to Flanders. Here he was protected by Baldwin earl of that country, together with his three sons, Gurth, Sweyn, and Tosti; the last of whom had married Baldwin's daughter. Harold and Leofwine, two other sons of Godwin, took shelter in Ireland.

After the flight of Earl Godwin, he was proceeded against as a traitor by King Edward. His estates, and those of his sons, were confiscated; his governments given to others; Queen Editha was confined in a monastery; and the great power of this family, which had become formidable to the crown itself, seemed to be totally overthrown. Godwin, however, soon found means to retrieve his affairs. Having hired some ships, and manned them with his followers, he attempted to make a descent at Sandwich. The king, informed of his preparations, equipped a fleet which Godwin could not resist, and he therefore retreated into the Flemish harbours. On his departure, the English dismissed their armament. This Godwin had expected, and therefore kept himself in readiness for the favourable opportunity. He immediately put to sea, and sailed to the isle of Wight, where he was joined by Harold with a squadron which he had collected in Ireland. Being thus master of the sea, Godwin entered the harbours on the southern coast; seized all the ships; and being joined by great numbers of his former vassals, he sailed up the Thames, and appeared before London.

The approach of such a formidable enemy threw every thing into confusion. The king alone seemed resolute to defend himself to the last extremity; but the interposition of many of the nobility, together with the submissions of Godwin himself, at last produced an accommodation. It was stipulated, that Godwin should give hostages for his good behaviour, and that all the foreigners should be banished the kingdom; after which, Edward, sensible that he had not power sufficient to detain the earl's hostages in England, sent them over to his kinsman the young duke of Normandy.

Soon after this reconciliation, Godwin died as he sat at table with the king. He was succeeded in the government of Wessex, Sussex, Kent, and Essex, and the office of steward of the household, to the place of great power, by his son Harold. The son was no less ambitious than his father had been; and as he was a man of much greater abilities, he became a more dangerous enemy to Edward than even Godwin had been. Edward knew no better expedient to prevent the increase of Harold's power, than by giving him a rival. This was Algar son of Leofric duke of Mercia, whom he invested with the government of East Anglia, which had formerly belonged to Harold. The latter, however, after some broils, finally got the better of his rival, and banished him the kingdom. Algar returned soon after, with an army of Norwegians, with whom he invaded East Anglia; but his death in a short time freed Harold from all further apprehensions from that quarter. His power was still further increased in a short time after by the accession of his brother Tosti to the government of Northumberland; and Edward now declining in years, and apprehensive that Harold would attempt to usurp the crown after his death, resolved to appoint a successor. He therefore sent a deputation into Hungary, to invite over his nephew, Edward, son to his elder brother, who was the only remaining heir of the Saxon line. That prince accordingly came over with his children, Edgar Atheling, Margaret, and Christina; but died a few days after his arrival. His death threw the king into greater perplexity than ever. Being resolved to exclude Harold if possible, he secretly cast his eye on his kinsman William duke of Normandy, a person of whose power, character, and capacity, he had justly a very high opinion. This advice had formerly been given him by Robert archbishop of Canterbury, who was himself a Norman, and had been banished along with the rest upon the return of Earl Godwin. But Edward finding that the English would more easily acquiesce in the restoration of the Saxon line, had in the mean time invited his brother's descendants from Hungary, as already mentioned. The death of his nephew, and the inexperience and unpromising qualities of young Edgar, made him resume his former intentions in favour of the duke of Normandy, though his aversion to hazardous enterprises engaged him to postpone the execution, and even to keep his purpose concealed from all his ministers.

Harold in the mean time increased his popularity by all possible means, in order to prepare his way for being advanced to the throne after the death of Edward, which now seemed to be fast approaching. He had no suspicion of the duke of Normandy as a rival; but he knew that a son so grandly born as Earl Godwin were in the hands of that prince as hostages, he feared that they might be made use of as checks upon his ambition, in case he attempted afterwards to ascend the throne. He therefore prevailed upon Edward to release those hostages unconditionally; and having obtained his consent, he set out for Normandy himself, attended by a numerous retinue. He was driven by a tempest on the territory of Guy count of Posthien,
England. Ponthieu, who detained him prisoner, and demanded an exorbitant sum for his ransom. Harold found means to acquaint William with his situation. The duke of Normandy, desirous of gaining Harold over to his party, commanded Guy to restore his prisoner to his liberty. Upon this Harold was immediately put into the hands of the Norman ambassador, who conducted him to Rouen. William received him with great demonstrations of respect and friendship; but soon took an opportunity of acquainting him with his pretensions to the crown of England, and asked his assistance in the execution of his scheme. Harold was surprised with this declaration of the duke; but being entirely in his power, he feigned a compliance with his desires, and promised to send to the utmost of his ability the will of King Edward. William, to secure him as much as possible to his interest, promised him his daughter in marriage, and required him to take an oath that he would fulfil his promises. Harold readily complied; but to make the oath more binding, William privately conveyed under the altar where the oath was taken relics of some of the most revered martyrs; and when Harold had taken the oath, he showed him the relics, and admonished him to observe religiously such a solemn engagement.

Harold was no sooner set at liberty, than he found himself master of casuistry sufficient to excuse the breaking of his oath, which had been extorted from him, and which, if kept, might be attended with the subjugation of his country to a foreign power. He continued to practise every art to increase his popularity; and about this time, two accidents enabled him to add much to that character which he had already so well established. The Welsh had for some time made incursions into the English territories, and had lately become so troublesome, that Harold thought he could not do a more acceptable piece of service to the public, than undertake an expedition against these invaders. Having therefore prepared some light-armed foot to pursue the natives into their forteresses, some cavalry to scour the open country, and a squadron of ships to attack the sea-coasts, he employed all these forces against the enemy at once; and thus reduced them to such distress, that they were obliged to purchase peace by sending their prince's head to Harold, and submitting to the government of two Welsh noblemen appointed by Edward.

The other incident was no less honourable to Harold. Tosti his brother had been created duke of Northumberland; but being of a violent tyrannical temper, he treated the inhabitants with such cruelty, that they rose in rebellion against him, and drove him from his government. Morcar and Edwin, two brothers, grandsons of the great Duke Leofric, joined in the insurrection; and the former being elected duke, advanced with an army to oppose Harold, who had been commissioned by the king to reduce and punish the Northumbrians. Before the armies engaged, Morcar endeavoured to justify his conduct, and represented to Harold, that Tosti had behaved in such a manner, that no one, not even a brother, could defend him without participating of the infamy of his conduct: that the Northumbrians were willing to submit to the king, but required a governor that would pay some attention to their privileges; and they trusted that Harold would not offend in another that violent conduct from which his own government had always kept at so great a distance. This speech was accompanied by such a detail of well supported facts, that Harold abandoned his brother's cause; and returning to Edward, persuaded him to pardon the Northumbrians, and confirm Morcar in his government. He even married the sister of that nobleman; and by his interest procured Edwin the younger brother to be chosen governor of Mercia. Tosti, in a rage, departed the kingdom, and took shelter in Flanders with Baldwin his father-in-law; while William of Normandy saw that now he had nothing to expect from Harold, who plainly intended to secure the crown for himself.

Edward died in 1066, and was succeeded by Harold with as little opposition as though he had been the lawful heir. The very day after Edward's death, he was anointed and crowned by the archbishop of York. The whole nation seemed joyfully to swear allegiance to him. But he did not long enjoy the crown, to obtain which he had taken so much pains, and which he seemed to have such capacity for wearing. His brother Tosti, provoked at his success, stirred up against him every enemy he could have any influence with. The duke of Normandy also was enraged to the last degree at the perdity of Harold; but before he commenced hostilities, he sent an embassy to England, uprising the king with his breach of faith, and summoning him to resign the kingdom immediately. Harold replied, that the oath, with which he was reproached, had been extorted, by the well grounded fear of violence, and for that reason could never be regarded as obligatory: that he never had any commission either from the late king or the states of England, who alone could dispose of the crown, to make any tender of the succession to the duke of Normandy; and if he, a private person, had assumed so much authority, and had even voluntarily sworn to support the duke's pretensions, the oath was unlawful, and it was his duty to take the first opportunity of breaking it: that he had obtained the crown by the unanimous suffrages of the people; and should show himself totally unworthy of their favour, did he not strenuously maintain those liberties with which they had entrusted him; and that the duke, if he made any attempt by force of arms, should experience the power of an united nation, conducted by a prince, who, sensible of the obligations imposed on him by his royal dignity, was determined, that the same moment should put a period to his life and to his government.

This answer was according to William's expectations; and therefore he had already made preparations for invading England. He was encouraged and assisted in this enterprise by Howel count of Brittany, Baldwin earl of Flanders, the emperor Henry IV. and Pope Alexander II. The latter declared Harold a perjured usurper; denounced excommunication against him and his adherents; and the more to encourage William in his enterprises, sent him a consecrated banner, and a ring with one of St Peter's hairs in it. Thus he was enabled to assemble a fleet of 3000 vessels, on board of which were embarked 60,000 men, chosen from among those numerous supplies which were sent him from all quarters. Many eminent personages were enlisted un-
England.

A.D. 1066.

In order to embarrass the affairs of Harold the more effectually, William also excited Tosti, in concert with Halfager king of Norway, to infest the English coasts. These two having collected a fleet of 350 ships, sailed up the Humber, and disembarked their troops, who began to commit great depredations. They were opposed by Morcar earl or duke (a) of Northumberland, and Edwin earl of Mercia, who were defeated. Harold, on the news of this invasion, assembled a considerable army, engaged the enemy at Stamford, and after a bloody battle entirely defeated them. Tosti and Halfager were killed in the action, and all the fleet fell into the hands of the victors; but Harold generously allowed Olave the son of Halfager to depart with 20 vessels.

The king of England had scarce time to rejoice on account of the victory, when news were brought to him that the Normans were landed in Sussex. Harold's victory had considerably weakened his army. He lost many of his bravest officers and soldiers in the action; and he disgusted the rest, by refusing to distribute the Danish spoils among them. He hastened, however, by quick marches, to repel this new invader; but though he was reinforced at London and other places with fresh troops, he found himself weakened by the desertion of his old soldiers, who, from fatigue and discontent, secretly withdrew from their colours. Guth, the brother of Harold, a man of great conduct as well as bravery, became apprehensive of the event; and entreated the king to avoid a general engagement for some time, or at least not to hazard his person. But though this advice was in itself evidently proper, and enforced by all the arguments which Guth could suggest, Harold continued deaf to every thing that could be said. Accordingly, on the 14th of October 1066, the two armies engaged near Hastings, a town of Sussex. After a most obstinate and bloody battle, the English were entirely defeated, Harold and his two brothers killed, and William left master of the kingdom of England.

Nothing could exceed the terror of the English upon the news of the defeat and death of Harold. As soon as William passed the Thames at Wallingford, Stigand, the primate, made submissions to him in the name of the clergy; and before he became within sight of London, all the chief nobility, and even Edgar Atheling himself, who, being the rightful heir to the throne, had just before been declared king, came and submitted to the conqueror. William very readily accepted of the crown upon the terms that were offered him; which were, that he should govern, according to the established customs of the country. He could indeed have made what terms he pleased; but, though really a conqueror, he chose rather to be thought an elected king. For this reason he was crowned at Westminster by the archbishop of York, and took the oath administered to the former kings of England; namely, that he would protect and defend the church, observe the laws of the realm, and govern the kingdom with impartiality.

The English historians complain of the most grie-

vous oppression by William and his Normans. Whose grie-
doer to have a pretence for oppressing them afterwards, is not easy to say; but it is certain that the beginning of his reign cannot justly be blamed. The first disgust against his government was excited among the clergy. William could not avoid the rewarding of those numerous adventurers who had accompanied him in his expedition. He first divided the lands of the English barons who had opposed him, among his Norman barons; but as these were found insufficient, he quartered the rest on the rich abbeys, of which there were many in the kingdom, until some other opportunity of providing for them offered itself.

Though this last step was highly resented by the clergy, it gave very little offence to the laity. The whole nation, however, was soon after disgusted, by seeing all the real power of the kingdom placed in the hands of the Normans. He disarmed the city of London, and other places which appeared most warlike and populous, and quartered Norman soldiers wherever he could dread an insurrection. This was indeed acting as a conqueror, and not as an elected king; but the event showed the necessity of such precautions. The king having thus secured, as he imagined, England from any danger of a revolt, determined to pay a visit to his Norman dominions. He appointed his brother Odo, bishop of Bayeux, and William Fitz-Osborne, regents in his absence; and to secure himself yet farther, he resolved to carry along with him such of the English nobility as he put the least confidence in.

Having taken all these methods to ensure the tranquility of his new kingdom, William set sail for Normandy in March 1067; but his absence produced the most fatal consequences. Discontents and murmurings were multiplied everywhere; secret conspiracies were entered into against the government; hostilities were commenced in many places; and every thing seemed to threaten a speedy revolution. William of Poictiers, a Norman historian, throws the blame entirely on the English. He calls them a sullen and mutinous race, while he celebrates with the highest encomiums the justice and lenity of Odo's and Fitz-Osborne's administration. On the other hand, the English historians tell us, that these governors took all opportunities of oppressing the people, either with a view to provoke them to rebellion, or in case they tamely submitted to their impositions, to grow rich by plundering them. Be this as it will, however, a secret conspiracy was formed among the English for a general massacre of the Normans, like what had formerly been made of the Danes. This was prosecuted with so much animosity, that the vassals of the earl Coxo put him to death because he refused to head them in the enterprise. The conspirators had already taken the resolution, and fixed the day for their intended massacre, which was to be on Ash-Wednesday, during the time of divine ser-

(a) Anciently these two titles were synonymous.
ENGLAND.

Having got intelligence of their bloody purpose, he hastened over to England. Such of the conspirators as had been more open in their rebellion, consulted their safety by flight; and this served to confirm the proofs of an accusation against those who remained. From this time the king not only lost all confidence in his English subjects, but regarded them as invertebrate and irreconcilable enemies. He had already raised such a number of fortresses in England, that the merchants dreaded the tumultuous or transient efforts of a discontented multitude. He determined therefore to treat them as a conquered nation. The first instance of this treatment was his revival of the tax of Danegeld, which had been imposed by the Danish conquerors, and was very odious to the people. This produced great discontent, and even insurrections. The inhabitants of Exeter and Cornwall revolted; but were soon reduced, and obliged to implore the mercy of the conqueror. A more dangerous rebellion happened in the north; but this was also soon quashed, and the English became sensible that their destruction was intended. Their easy submission after the battle of Hastings had inspired the Normans with contempt; their commotions afterwards had rendered them objects of hatred; and they were now deprived of every expedient which could make them either regarded or beloved by their sovereigns. Many fled into foreign countries; and among the rest Edgar Atheling himself, who made his escape to Scotland, and carried thither his two sisters Margaret and Christian. They were well received by Malcolm, who soon after married Margaret the elder sister, and also received great numbers of other exiles with the utmost kindness.

The English, though unable to make any resistance openly, did not fail to gratify their resentment against the Normans in a private manner. Seldom a day passed, but the bodies of assassinated Normans were found in the woods or highways, without any possibility of bringing the perpetrators to justice. Thus, at length, the conquerors themselves began again to wish for tranquility and security; and several of them, though entrusted with great commands, desired to be dismissed the service. In order to prevent these desertions, which William highly resented, he was obliged to allure others to stay by the largeness of his bounties. The consequences were, fresh exactions from the English, and new insurrections on their part against their cruel masters. The Norman power, however, was too well founded to be now removed, and every attempt of the English to regain their liberty served only to rivet their chains the more firmly. The county of Northumberland, which had been most active in these insurrections, now suffered most severely. The whole of it was laid waste, the houses were burned, the instruments of agriculture destroyed, and the inhabitants forced to seek new places of abode. On this occasion it is said, that above 100,000 persons perished either by the sword or famine; and the country is supposed, even to this day, to retain the marks of its ancient depopulation. The estates of all the English gentry were next confiscated, and bestowed on the Normans. By this means all the ancient and honourable families were reduced to beggary; and the English found themselves totally excluded from every road that led either to honour or preferment.

By proceeding in this manner, William at last broke the spirit of the English nation, and received no further trouble from them. In 1076, however, he found that the latter part of his life was likely to be unhappy through dissensions in his own family. He had four sons, Robert, Richard, William, and Henry, besides several daughters. Robert, his eldest son, surnamed Curthose, from the shortness of his legs, was a prince who inherited all the bravery and ambition of his family. He had formerly been promised by his father the government of the province of Maine in France, and was also declared successor to the dukedom of Normandy. He demanded from his father the fulfillment of these promises; but William gave him a flat denial, observing, that "it was not his custom to throw off his clothes till he went to bed." Robert declared his resentment; and openly expressed his jealousy of his two brothers William and Henry, (for Richard was killed, in hunting, by a stag). An open rupture was soon commenced. The two young princes one day took it into their heads to throw water on their elder brother as he passed through the court after leaving their apartment. Robert construed this frollick into a studied indignity; and having these jealousies still further inflamed by one of his favourites, he drew his sword, and ran up stairs with an intent to take revenge. The whole castle was quickly filled with tumult, and it was not without some difficulty that the king himself was able to appease it. But he could not allay the animosity which from that moment prevailed in his family. Robert, attended by several of his confederates, withdrew to Rouen that very night, hoping to surprise the castle; but his design was defeated by the governor. The popular character of the prince, however, engaged all the young nobility of Normandy, as well as of Anjou and Brittany, to espouse his quarrel; even his mother is supposed to have supported him in his rebellion by secret remittances. The unnatural contest continued for several years; and William was at last obliged to have recourse to England for support against his own son. Accordingly, he drew an army of Englishmen together; he led them over to Normandy, where he soon compelled Robert and his adherents to quitt the field, and was quickly reinstated in all his dominions. Robert then took shelter in the castle of Gerberoy, which the king of France had provided for him, where he was shortly after besieged by his father. As the garrison was strong, and conscious of their treason, they made a gallant defence; and many skirmishes and duels were fought under its walls. In one of these the king and his son happened to meet; but being both concealed by their helmets, they attacked each other with mutual fury. The young prince wounded his father in the arm, and threw him from his horse. The next blow would probably have put an end to his life, had he not called for assistance. Robert instantly recollected his father's voice, leaped from his horse, and raised him from the ground. He prostrated himself in his presence, asked pardon for his offences, and promised for the future a strict adherence to his duty. The king was not so easily appeased; and perhaps his resentment was heightened
ENGLAND.

England, by the disgrace of being overcome. He therefore gave
his malevolence to his son; and returned to his own
A.D. 1087.
camp on Robert's horse, which he had assisted him to
mount. After some recollection, however, he was recon-
ciliated to Robert, and carried him with him into
England.

William returned in 1087; and being now freed
from his enemies both at home and abroad, began to
have more leisure to attend to his own domestic affairs.
For this purpose the Doomsday-Book was composed
by his order, of which an account is given under that
article. He reserved a very ample revenue for the
crowns; and in the general distribution of land among
his followers, kept possession of no fewer than 1,400
manors in different parts of the country. No king of
England was ever so opulent; none was able to sup-
port the splendour and magnificence of a court to such a
degree; none had so many places of trust and profit to
bestow; and consequently none ever had such implicit
obedience paid to his commands. He delighted greatly
in hunting; and to indulge himself in this with the
greater freedom, he depopulated the county of Hamp-
shire for 30 miles, turning out the inhabitants, destroy-
ing all the villages, and making the wretched outcasts
no compensation for such an injury. In the time of the
Saxon kings, all noblemen without distinction had a
right to hunt in the royal forests; but William appro-
 priated all these to himself, and published very severe
laws to prohibit his subjects from encroaching on this
part of his prerogative. The killing of a boar, a deer,
or even a hare, was punished with the loss of the de-
lincquent's eyes; at the time when the killing of a man
might be atoned for by paying a moderate fine or com-
position.

As the king's wealth and power were so great, it
may reasonably be supposed that the riches of his mi-
nisters were in proportion. Odo, bishop of Bayeux,
William's brother, was become so rich, that he resol-
ved to purchase the papacy. For this purpose he took
the opportunity of the king's absence, he equipped a
vessel in the isle of Wight, on board of which he sent
immense treasures, and prepared for his embarkation.
He was detained, however, by contrary winds; and,
in the mean time, William being informed of his de-
signs, resolved to prevent the exportation of so much
wealth from his dominions. Returning therefore from
Normandy, where he was at that time, he came to
England the very instant his brother was stepping on
board. He immediately ordered him to be made pri-
soner: but his attendants, respecting the bishop's ecclis-
iastical character, scrupled to execute his com-
mands; so that the king was obliged to seize him with
his own hand. Odo appealed to the Pope: but the
king replied, that he did not seize him as bishop of
Bayeux, but as earl of Kent; and, in that capacity, he
expected, and would have, an account of his admin-
istration. He was therefore sent prisoner to Nor-
mandy; and, notwithstanding all the remonstrances
and threats of Pope Gregory, was detained in custody
during the remainder of William's reign.

Soon after this, William felt a severe blow in the
death of Matilda his queen; and, almost at the same
time, received information of a general insurrection in
Maine, the nobility of which had always been averse to
his government. Upon his arrival on the continent, he
found that the insurgents had been secretly assisted and
excited by the king of France, who took all opportu-
nities of lessening the Norman power, by creating dis-
sensions among the nobles. His displeasure on this
account was very much increased, by notice he re-
ceived of some railleries thrown out against him by
the French monarch. It seems that William, who
was become corpulent, had been detained in bed some
time by sickness; and Philip was heard to say, that
he only lay in of a big belly. This so provoked the
English monarch, that he sent him word, he would
sooner be up, and would, at his churching, present
such a number of tapers as would set the kingdom of France
in a flame.

To perform this promise, he levied a powerful army;
and, entering the Isle of France, destroyed everything
with fire and sword. He took the town of Mantes,
and reduced it to ashes. But a period was soon put to the
conquests and to the life of this great warrior by an ac-
 incident. His horse happening to put his fore feet and of the
on some hot ashes, plunged so violently, that the rider
was thrown forward, and bruised his belly on the pom-
 mel of the saddle. Being now in a bad habit of body,
as well as somewhat advanced in years, he began to be
apprehensive of the consequences, and ordered himself
to be carried in a litter to the monastery of St Ger-
vaise. Finding his illness increase, and being sensible
of the approach of death, he discovered at last the va-
nity of all human grandeur; and was struck with re-
morse for those many cruelties and violations of which
he had been guilty. He endeavoured to make com-

pensation by presents to churches and monasteries,
and gave orders for the liberation of several English nob-
men. He was even prevailed upon, though not with-
out reluctance, to release his brother Odo, against
whom he was very much incensed. He left Nor-
mandy and Maine to his eldest son Robert. He wrote
to Lanfranc the primate of England, desiring him to
crown William King of England. To Henry he be-
quathed nothing but the possessions of his mother Ma-
tilda; but foretold, that one day he would surpass both
his brothers in power and opulence. He expired on the
9th September 1087, in the 63d year of his age,
in the 21st of his reign over England, and 54th of that
over Normandy.

William, surnamed Rufus, from his red hair, was in William
Normandy at the time of his father's illness. He was
sooner received the letter for Lanfranc, than, leaving
his father in the agonies of death, he set out for En-
gland; where he arrived before intelligence of the de-
cease of the Conqueror had reached that kingdom.
Being sensible that his brother Robert, as being the
eldest son, had a preferable title to himself, he used the
utmost dispatch in getting himself firmly established
on the throne. The English were so effectually subdued,
that they made no opposition; but the Norman barons
were attached to Robert. This prince was brave,
open, sincere, and generous; and even his predominant
dish of indolence was not disagreeable to those haughty
barons, who affected an almost total independence of
their sovereign. The king, on the other hand, was
violent, haughty, and tyrannical. A powerful con-
sspiracy was therefore carried on against William; and
Odo, bishop of Bayeux, undertook to conduct it. Man-
y of the most powerful nobility were concerned; and


as the conspirators expected to be in a short time supported by powerful succours from Normandy, they retired to their castles, and put themselves in an offensive posture. William, sensible of his danger, engaged the English on his side, by promising some mitigation of their hardships, and liberty to hunt in the royal forests. Robert, in the mean time, through his natural indolence, neglected to give his allies proper assistance. The conspirators were obliged to submit. Some of them were pardoned; but most of them confiscated, and their estates bestowed on the barons who had continued faithful to the king. William, freed from this danger, thought no more of his promises to the English. He proved a greater tyrant than his father; and, after the death of Lanfranc, who had been his preceptor, and kept him within some bounds, he gave full scope to his violent and rapacious disposition. Not content with oppressing the laity, he invaded the privileges of the church, which, in those days, were held most sacred. He seized the temporalties of all the vacant bishoprics and abbey, and openly put to sale those sees and abbeys which he thought proper to dispose of.

These proceedings occasioned great murmurs among the ecclesiastics, which were quickly spread through the nation, but the terror of William's authority preserved the public tranquillity. In 1090, the king thought himself strong enough to attempt the conquest of Normandy, which at that time was in the greatest confusion through the indolent and negligent administration of Robert. Several of the barons had revolted, and these revolts were encouraged by the king of France. Robert also imagined he had reason to fear the intrigues of his own brother Henry, whom for 5000 marks he had put in possession of Coutances, near a third part of the duchy of Normandy. He therefore threw him into prison; but finding himself threatened with an invasion from the king of England, he gave Henry his liberty, and even made use of his assistance in suppressing the insurrections of his rebellious subjects. William, however, was no sooner landed in Normandy, than the nobility on both sides interposed, and a treaty of peace was concluded. In this treaty Henry finding his interests entirely neglected, retired to St. Michael's Mount, a strong fortress on the coast of Normandy, and infested the neighbourhood with his incursions. He was besieged by his two brothers, and obliged to capitulate in a short time; after which, being deprived of all his dominions, he wandered about for some time with very few attendants, and often in great poverty.

The peace with Robert was of no long duration. In the interval some hostilities with Scotland succeeded, and these terminated in the death of Malcolm king of that country; after which new broils ensued with Normandy. The rapacious temper of William prompted him to encroach upon his brother's territories, and the same incapacity prompted him to use a very extraordinary expedient in order to accomplish his designs. Having gone over to Normandy to support his partisans, he ordered an army of 20,000 men to be raised in England, and conducted to the sea-coast as if they were to be immediately embarked: but when they came there, instead of embarking, they were forced to pay the king ten shillings a man; after which they were dismissed to their several countries. With this money William engaged the king of France to depart from the protection of Robert; and also bribed many of the Norman barons to revolt. He was called from Normandy, however, by an irruption of the Welsh; and having repulsed them, he was prevented from attempting other enterprises by a conspiracy of his barons.

In 1096, however, the superstition of Robert put the king of England in possession of those dominions which he had not been able to conquer by force of arms. The crusades were now commenced, and Robert was desirous of undertaking an expedition into the Holy Land. As money for this purpose was wanting, he mortgaged his dominions to his brother for 10,000 marks. The king raised the money by violent extortions on his subjects, forcing even the convents to melt their plate, in order to furnish the quota demanded of them. He was then put in possession of Normandy and Maine; and Robert with a magnificent train set out for the Holy Land.

After the death of Lanfranc, the king had retained in his own hands the revenues of Canterbury, as he had done those of many other bishoprics; but falling into a dangerous illness, he was seized with remorse; and the clergy represented to him that he was in danger of eternal perdition if he did not make atonement for those impieties and sacrileges of which he had been guilty. He therefore instantly resolved to supply the vacancy of Canterbury; he sent for Anselm, a Piedmontese by birth, abbot of Bec in Normandy, who was much celebrated for his piety and devotion. The abbot refused the dignity with great earnestness; fell on his knees, wept, and intreated the king to change his purpose; and when he found him obstinate in forcing the pastoral staff upon him, he kept his fast so hard clench'd, that it required the utmost violence of the bystanders to open it, and forced him to receive that ensign of his spiritual dignity. William soon after recovered his health, and with it his violence and rapacity. As he now spared the church no more than before, a quarrel with Anselm soon ensued; and this was the more dangerous to the king, on account of the great character for piety which the primate had acquired by his zeal against abuses of all kinds, particularly those of dress and ornament.

At this time there was a mode which prevailed not only in England, but throughout Europe, both among men and women, of giving an enormous length to their shoes, drawing the toe to a sharp point, and affixing to it the figure of a bird's bill, or some such ornament which was turned upwards, and which was often sustained by gold or silver chains tied to the knee. The ecclesiastics took exception at this ornament, which they said was an attempt to belie the Scripture, where it is affirmed, that no man can add a cubit to his stature; and they not only decried against it with vehemence, but exclaimed that he should be excommunicated who professed to worship in shoes from which the fashion was absolutely condemned. Such, however, are the contradictions in human nature, that all the influence of the clergy, which at that time was sufficient to send vast multitudes of people into Asia to butcher one another, was not able to prevail against those long pointed shoes. The fashion, contrary to what had happened to almost all others, maintained its ground for several centuries; and even Anselm found his endeavours
ENGLAND.

A.D. 1100.

He was more successful in decrying the long hair and curled locks then worn by the courtiers. He refused the ashes on Ash-Wednesday to such as were so accoutered; and his authority and eloquence had such influence, that the young men universally abandoned that ornament, and appeared in the cropt hair recommended to them by the sermons of the priate. For this reformation Anselm is highly celebrated by his historian Eadmer, who was also his companion and secretary.

When William’s profligacy returned with his health, he was engaged in almost perpetual contests with this austere prelate. These were pretty well settled, when the king, who had undertaken an expedition into Wales, required Anselm to furnish him with a certain number of soldiers. The primate regarded this as an invasion of the rights of the church; and therefore, though he durst not refuse compliance, sent the men so miserably accoutered, that the king was exceedingly displeased, and threatened him with a prosecution. Anselm demanded restitution of all his revenues which the king had seized, and appealed to the pope. The quarrel, however, ran so high, that the primate found it dangerous to remain in England. He desired and obtained the king’s permission to retire beyond sea. His temporalties were confiscated immediately on his departure; but Pope Urban received him as a martyr in the cause of religion, and even threatened the king with sentence of excommunication. William, however, proceeded in his projects of ambition and violence, without regarding the threats of the pope; who, he knew, was at that time too much engaged with the crusades to mind any other business. Though his acquisition of Maine and Normandy had brought him into perpetual contests with the haughty and turbulent barons who inhabited those countries, and raised endless tumults and insurrections; yet William seemed still intent on extending his dominions either by purchase or conquest. William earl of Poictiers and duke of Guienne had resolved upon an expedition to the Holy Land; and, for this purpose, had put himself at the head of a vast multitude, consisting, according to some historians, of 60,000 horse, and a much greater number of foot. Like Robert of Normandy, he offered to mortgage his dominions for money sufficient to conduct this multitude into Asia. The king accepted his offer; and had prepared a fleet and army to take possession of these dominions, when an unfortunate accident put an end to his projects and his life. He was engaged in hunting, the sole amusement, and indeed the principal occupation, of princes in those rude times. Walter Tyrell, a French gentleman remarkable for his skill in archery, attended him in this recreation; and if the New Forest was the scene on which William had dined after a chase; and Tyrell, impatient to show his dexterity, let fly an arrow at a stag which suddenly started before him. The arrow glanced from a tree, and struck the king to the heart. He instantly fell down dead; and Tyrell, terrorized at the accident, eloped spurs to his horse, hastened to the sea-shore, and embarked for France, where he joined the crusade that was setting out from that country.

This happened on the 2d of August 1100, after the king had reigned 23 years, and lived about 40. His body was found in the woods by the country-people, and buried without ceremony at Winchester.

After the death of William, the crown of right devolved to Robert his eldest brother; for William had no legitimate children. But what Robert had formerly lost by his indolence, he was again deprived of by his absence at the holy war. Prince Henry was in the forest with William Rufus at the time the latter was killed. He soon heard the important news, and hastened to Winchester, and secured the royal treasure. William de Brute, keeper of the treasure, arrived almost the same instant, and opposed his pretensions; telling him, that the treasure belonged to his elder brother, who was now his sovereign, and for whom he was determined to keep it. But Henry, drawing his sword, threatened him with instant death if he dared to disobey him; and others of the late king’s retinue, who came every moment to Winchester, joining the prince’s party, he was obliged to desist. Henry lost no time in fully accomplishing his purpose. In less than three days he got himself crowned king of England by Maurice bishop of London. Actual possession supplied every deficiency of title; and no one dared to appear in defence of the absent prince.

The beginning of King Henry’s reign promised to be favourable to the English liberty; owing chiefly to his fear of his brother. To conciliate the affections of his subjects, he passed a charter calculated to remove many of the grievous oppressions which had been complained of during the reign of his father and brother. He promised, that at the death of any abbot or bishop, he never would seize the revenues of the see or abbeys during the vacancy, but would leave the whole to be respired by the successor; and that he would never let to farm any ecclesiastical benefice, or dispose of it for money. To the laity he promised, that, upon the death of any earl, baron, or military tenant, his heir should be admitted to the possession of his estate, on paying a just and lawful relief; without being exposed to those enormous exactions which had been formerly required. He remitted the wardship of minors; and allowed guardians to be appointed, who should be answerable for the truth. He promised not to dispose of any heiress in marriage but by advice of all the barons; and if any baron intended to give his daughter, sister, niece, or kinswoman in marriage, it should only be necessary for him to consult the king, who promised to take no money for his consent, nor even to refuse permission, unless the person to whom it was proposed to marry her should happen to be his enemy. He granted his barons and military tenants the power of bequeathing by will their money or personal effects to whom they pleased; and he promised that their heirs should succeed to them. He renounced the right of imposing moneyage, and of levying taxes at pleasure, on the farms which the barons kept in their own hands. He made some general professions of moderating fines; he offered a pardon for all offences; and remitted all debts due to the crown. He also required, that the vassals of the barons should enjoy the same privileges which he granted to his own barons; and he promised a general confirmation and observance of the laws of King Edward. To give greater authenticity to these concessions, a
King Henry, farther to increase his popularity, degraded and committed to prison Ralph Flambard bishop of Durham, who had been the chief instrument of oppression under his brother. He sent for Anselm who was then at Lyons, inviting him to return and take possession of his dignities. Anselm returned; but when Henry proposed to him to do the same homage to him which he had done to his brother, the king met with an absolute refusal. During his exile, Anselm had assisted at the council of Bari; where, besides fixing the controversy between the Greek and Latin churches concerning the procession of the Holy Ghost, the right of election to church-preferences was declared to belong to the clergy alone, and spiritual censures were denounced against all ecclesiastics who did homage to laymen for their sees and benefices, and on all laymen who exacted it. The rite of homage by the feudal customs was, that the vassal should throw himself on his knees, put his joined hands between those of his superior, and should in that posture swear fealty to him. But the council declared it execrable, that pure hands, which could create God, and offer him up for the salvation of mankind, should be put, after this humiliating manner, between profane hands, which, besides being inured to rapine and bloodshed, were employed day and night in impure purposes and obscene contacts. To this decree therefore Anselm appealed; and declared, that so far from doing homage for spiritual dignity, he would not even communicate with such ecclesiastics who paid that submission, or who accepted of inventions from laymen. Henry durst not insist; and therefore desired that the controversy might be suspended, and that messengers might be sent to Rome to accommodate matters with the Pope, and to obtain his confirmation of the laws and customs of England.

Henry now took another step which seemed capable of confirming his claims to the crown without any danger of a rival. The English remembered with regret their Saxon monarchs, when they compared the liberty they enjoyed under them with the tyranny of the Normans. Some descendants of that favourite line still remained; and among the rest, Matilda, the niece of Edgar Atheling. Upon her the king fixed his eyes as a proper consort, by whose means the breach between the Saxons and Normans might be cemented. A difficulty, however, occurred, because she had been educated in a nunnery. The affair was examined by Anselm in a council of prelates and nobles summoned at Lambeth. Matilda there proved, that she had put on the veil, not with a design of entering into a religious life, but merely in imitation of a custom familiar to the English ladies, who protected their chastity from the brutal violence of the Normans by taking shelter under that habit, which, amid the horrid licentiousness of the times, was yet generally revered. The council, sensible that even a princess had otherwise no security for her honour, admitted this reason as valid. They pronounced that Matilda was still free to marry; and her nuptials with Henry were celebrated by Anselm with great solemnity and pomp.

While Henry was thus rendering himself popular at home, his brother Robert, who had loitered away a twelvemonth in Italy, where he married Jibylla daughter of the count of Conversano, arrived in England, in order to put in his late and ineffectual claim to the crown. His fame, however, on account of the exploits he had performed in Palestine, was so great that even yet he was joined by many noblemen of the first rank, and the whole nation seemed prepossessed in his favour. But Henry, having paid his court to Anselm, by his means retained the army in his interest and marched with them to Portsmouth, where Robert had landed his forces a few days before. The army lay for some time in sight of each other; when an act commodation was effected through the mediation of Anselm and other great men. By this treaty it was agreed, that Robert should resign his pretensions to England, and receive in lieu of them an annual pension of 3000 marks; and if either of the princes die without issue, the other should succeed to his dominions; that the adherents of each should be pardoned and restored to all their possessions either in Normandy or England; and that neither Robert nor Henry should henceforth encourage, receive, or protect the enemies of each other.

The two princes separated with mutual marks of friendship; but next year, Henry, under various pretences, confiscated the estates of almost all the noble men, who had favoured his brother's pretensions. Bert, enraged at the fate of his friends, ventured to come to England in order to remonstrate with his brother in person. But he met with such a bad reception, that, apprehending his liberty to be in danger, he was glad to make his escape by resigning his pension.

This infringement of the treaty was followed the ensuing year by an invasion of Normandy, at the desire of Robert's own subjects, whom he was totally incapable of governing. The event of this war was the defeat and captivity of Robert, who was henceforth deprived not only of all his dominions, but of his personal liberty. He lived 28 years a prisoner, and died in the castle of Cardiff in Glamorganshire. It is said by some, that he was deprived of his sight by a red-hot copper basin applied to his eyes, and that King Henry appeased his conscience by founding the monastery of Reading.

The conquest of Normandy was completed in 1106 and next year the controversy between the king and pri- mate, concerning the investitures of clergy men and their doing homage to princes, was resumed. The king was very sensible that it was not his interest to quarrel with such a powerful body as the clergy were at the time; and on the other hand, he fully understood the necessity of guarding the prerogatives of the crown from their encroachments. While, therefore, he avoided an open rupture with Anselm, he obstinately refused to give up the privileges which had been enjoyed by his predecessors. On the first arrival of Anselm the king had avoided the dispute in the manner already mentioned. A messenger was dispatched to Rome, in order to compromise matters with the Pope. The messenger returned with an absolute refusal to the king's demands. One of the reasons given by the pope on this occasion was expressed in the following words: "It is monstrous that a son should pretend to beget his father, or a man to create his God; priests are called
for their past conduct. He also granted to Anselm a
plenary power of remediying every disorder, which he
said might arise from the barbarousness of the country.
About the same time the marriage of priests was pro-
hibited; and even laymen were not allowed to marry
within the seventh degree of affinity. By this con-
trivance the pope augmented the profits which he
reaped from granting dispensations, and likewise those
from divorces. For as the art of writing was then rare,
and parish-registers were not regularly kept, it was not
easy to ascertain the degrees of affinity even among
people of rank; and any man who had money to pay for
it, might obtain a divorce, on pretence that his wife
was more nearly related to him than was permitted by
the canons. A decree was also published, prohibiting
the clergy to wear long hair; and the king, though he
would not resign his prerogatives to the church, very
willingly cut his hair in the form which was required
of him, obliging all the courtiers at the same time to
follow his example.

From the time of this compromise, which happened
in 1107, to the year 1120, nothing remarkable hap-
pened except some slight commotions in Normandy:
but this year, Prince William, the king's only son, was
unfortunately drowned off the coast of Normandy; William
William

and Henry was so much affected, that he is said never to have

afterwards to have smiled or looked cheerful. It is very doubtful, however, whether
the death of this prince was not an advantage to the
British nation, since he was often heard to express the
utmost hatred of the natives; insomuch that he had
threatened, that when he came to the throne, he
would make them draw the plough, and would turn
them into beasts of burden. These possessions he
inherited from his father; who, though he was wont,
when it might serve his purposes, to value himself on
his birth as a native of England, shewed, in the course
of his government, an extreme prejudice against
that people. All hopes of preferment to ecclesiastical as
well as civil dignities were denied to the English during
this whole reign; and any foreigner, however igno-
rant or worthless, was sure to have the preference in
every competition. The charter formerly mentioned,
which the king granted at the beginning of his reign,
was no more thought of; and the whole fell so much
into neglect and oblivion, that in the following cen-
tury, when the barons, who had heard an obscure tra-
dition of it, desired to make it the model of the great
charter which they exacted from King John, they could
only find one copy of it in the whole kingdom; while
the grievances proposed to be redressed by it, continued
still in their full extent.

As Henry had now no legitimate children except
Matilda, whom in 1110 he had betrothed, though only
eight years of age, to the emperor of Germany,
he was induced to marry a second time in hopes of
having sons. He made his addresses accordingly to
Adelais, the daughter of Godfrey, duke of Lorraine, and
niece to Pope Calixtus; a young princess of an amiable
person. But Adelais brought him no children; and
in 1135, the king died in Normandy, from being too
Death of

pleased of lampreys; having lived 67 years, and King

Henry

By the will of King Henry, his daughter Matilda
became heiress of all his dominions. She had been
K
married,
ENGLAND.

married, after her first husband's death, to Geoffrey Plantagenet, eldest son of the count of Anjou, by whom she had a son named Henry; but as Geoffrey had given umbrage to the king of England in several instances, no notice was taken of him in the will. The nobility had already sworn fealty to her; and the foremost to show this mark of submission to the king's will had been Stephen, son of the count of Blois (who had married Adele, the daughter of William the Conqueror). He had been married to Matilda, daughter and heiress of Eustace count of Boulogne; who brought him, besides that feudal sovereignty of France, a vast property in England, which in the distribution of lands had been conferred by the Conqueror on the family of Boulogne. By this marriage Stephen acquired a new connection with the royal family of England: for Mary, his wife's mother, was sister to David the present king of Scotland, and to Matilda the first wife of Henry and mother of the empress. The king also, imagining that by the aggrandizement of Stephen he strengthened the interest of his own family, had enriched him with many possessions; but instead of this, it appeared by the event that he had only put it more and more in his power to usurp the throne.

No sooner was Henry dead, than Stephen hastened from Normandy into England. The citizens of Dover and Canterbury, apprised of his purpose, shut their gates against him; but when he arrived at London, some of the lower class of people, instigated by his emissaries, immediately proclaimed him king. The archbishop of Canterbury refused to give him the royalunction; but this difficulty was got over by Stephen's brother, the bishop of Winchester. Hugh Bigod, steward of the household, made oath before the primates, that the late king, on his death-bed, had discovered a dissatisfaction with his daughter Matilda, and had expressed his intention of leaving the count of Boulogne heir to all his dominions; and the bishop either believing, or pretending to believe, this testimony, gave Stephen the royal unction. Very few of the nobility attended his coronation; but none opposed his usurpation, however unjust or flagrant.

Stephen, in order to establish himself on the throne as firmly as possible, passed a charter, in which he made liberal promises to all ranks of men. To the clergy he promised, that he would speedily fill all the vacant benefices, and never would levy any of the rents during the vacancy. To the nobility he gave liberty to hunt in their own forests; and to the people he promised to remit the tax of danegeld, and to restore the laws of Edward the Confessor. He seized the king's treasure at Winchester, amounting to 100,000l. with part of which money he hired mercenary soldiers from the continent; and with another part procured a bull from the pope, confirming his title to the English throne.

Matilda, in the mean time, endeavoured to recover her just rights, of which Stephen had deprived her; but for some time she met with no success either in England or Normandy. Her husband Geoffrey himself was obliged to conclude a peace with Stephen, on condition of the king's paying him during that time an annual pension of 500l.

Robert earl of Gloucester was the first who shook the power of Stephen. He was natural son to the late king; a man of great honour and ability, and was very much attached to the interests of Matilda. When Stephen usurped the throne, he offered to do him homage, and take the oath of fealty; but with an ex- press condition, that the king should maintain all his stipulations, and never invade any of Robert's rights or dignities. With this condition Stephen was obliged to comply, on account of the great power of that nobleman, though he knew that it was meant only to afford him a favourable opportunity of revolting when occasion served. The clergy imitated Robert's example; and annexed to their oath of allegiance the following condition, namely; that they were only bound as long as the king defended the ecclesiastical liberties, and supported the discipline of the church. The barons, in return for their submission, exacted Disturbed terms of still more pernicious tendency. Many of them the required to have the right of fortifying their castles, and putting themselves in a posture of defence; and with this exorbitant demand the king was forced to comply. All England was immediately filled with these fortresses; which the noblemen garrisoned either with their vassals, or with licentious soldiers, who flocked to them from all quarters. The whole kingdom now became a scene of rapine and devastation. Wars were carried on by the nobles in every quarter; the barons even assumed the right of coined money, and of exercising, without appeal, every act of jurisdiction; and the inferior gentry, as well as the people, finding no defence from the laws, during this total dissolution of sovereign authority, were obliged, for their immediate safety, to pay court to some neighbouring chief, and to purchase his protection, both by submitting to his exactions, and by assisting him in his rapine upon others.

In 1137, the earl of Gloucester having projected an insurrection, retired beyond sea, sent the king a defiance, and solemnly renounced his allegiance. The next year David king of Scotland appeared with an army in defence of his niece's title; and penetrating into Yorkshire, committed the greatest devastations. He was defeated, however, with great slaughter, at Northallerton, by some of the northern barons, who had raised a powerful army; and this success so much overawed the malecontents in England, that Stephen's power might have received some stability, had he not unfortunately engaged himself in a contest with the clergy. He had already seen the mischief arising from the liberty he had granted of fortifying so many castles in different parts of the kingdom. He therefore determined to abridge this liberty as much as possible; and for that purpose he began with the castles erected by the clergy, who seemed to have less right to these military securities than the barons. Taking advantage therefore of a fray which had arisen at court between the relatives of the bishop of Salisbury and the earl of Brittany, he seized the bishops both of Salisbury and Lincoln, threw them into prison, and obliged them to deliver up the castles which they had lately erected. This produced such a violent commotion, that the opportunity seemed favourable to the pretensions of Matilda. On the 22d of September 1139, she Matilda landed in England with Robert earl of Gloucester, at lands in tended only by 140 knights; but her partisans daily increased, and she was soon in a condition to face
ENGLAND.

Stephen with equal forces in the field. Numberless encounters happened, the detail of which could afford very little entertainment to the reader. War was spread through every quarter; and the turbulent barons, having, in a great measure, shaken off all restraint of government, and now obtained the sanction of fighting in the cause of their country, redoubled their oppressions, tyrannies, and devastations. The castles of the nobility became receptacles of licensed robbers; who, sallying forth day and night, spoiled the open country, plundered the villages, and even cities. They tortured the captives to make them reveal their treasures; sold their persons to slavery, and set fire to the houses, after they had pillaged them of every thing valuable. In consequence of this destruction, the land was left untitled; the instruments of husbandry were abandoned; and a grievous famine reduced the nation to the most deplorable state that can be imagined.

After a multitude of indecisive conflicts, a battle ensued which seemed likely to ensure the public peace for some time. Stephen had marched his forces to relieve the city of Lincoln; the earl of Gloucester led a body of troops to assist those of Matilda’s party, who were besieging that place. The two armies engaged on the 2d of February within sight of the city, and a desperate battle ensued. At last Stephen’s army was defeated. He himself was for some time left without attendants; and fought on foot in the midst of his enemies, assaulted by multitudes, and resisting all their efforts with astonishing intrepidity. Being hemmed in on every side, he forced a way for some time with his battle-axe; but that breaking, he drew his sword, and with it furiously assailed his antagonists for some time longer. But at length the sword also flying in pieces, he was obliged to surrender himself a prisoner. He was conducted to Gloucester; and though at first treated with respect, he was in a short time, upon some suspicions, thrown into prison.

About a month after, Matilda was crowned at Winchester with great solemnity; but soon showed herself totally incapable of governing such a turbulent nation. She determined to repress the power of the nobles, who had now left only the shadow of authority to their sovereign. But being destitute of policy or prudence sufficient to accomplish so difficult an undertaking, a conspiracy was soon formed against her, and the bishop of Winchester detached a party of his friends and vassals to block up the city of London where the queen resided. At the same time measures were taken to instigate the Londoners to a revolt, and to seize the queen’s person. Matilda, having timely notice of this conspiracy, fled to Winchester. Here she was soon after besieged by the bishop; but the town being distress by famine, she with difficulty made her escape; while her brother the earl of Gloucester, endeavouring to follow, was taken prisoner, and exchanged for Stephen.

Matilda was now obliged to take shelter in Oxford, while Stephen reascended the throne. The civil war broke out with redoubled fury. Many battles were fought, and both parties were involved in many distresses. Matilda escaped from Oxford at a time when the fields were covered with snow, by being dressed all in white, with four knights her attendants dressed in the same colour. Another time Stephen was surprised by the earl of Gloucester at Wilton, and made his escape with the utmost difficulty. At last Matilda was obliged to quit the kingdom; and the death of the earl of Gloucester soon after seemed to give a fatal blow to her interests. In 1153, however, Prince Henry, Matilda’s son by her second husband Geoffrey, came over to England, in order once more to dispute Stephen’s pretensions to the crown. After some success on his first landing, he was opposed by Stephen with a powerful army, and matters seemed likely to come to the decision of a general engagement. But while the two armies continued within a quarter of a mile of each other, a treaty was set on foot by the interposition of William earl of Arundel, for terminating the dispute in an amicable manner. The death of Eustace, Stephen’s son, whom he had designed for the throne, which happened during the course of the treaty, facilitated its conclusion. It was agreed, that Stephen should reign during his life, and that justice should be administered in his name; that Henry, on Stephen’s death, should succeed to the kingdom; and that William, Stephen’s son, should inherit Boulogne and his patrimonial estate. This treaty filled all Europe with joy; and after the barons had sworn to it, Henry left England, and Stephen returned to the peaceful enjoyment of his throne. His reign, however, was but of short continuance; his death happening on the 25th of October 1154.

Henry was on the continent besieging a castle of one of the mutinous barons, when news was brought him of Stephen’s death. But, as he was sensible of the goodness of his title, he did not abandon his enterprise till the place was reduced. He then set out on his journey, and was received in England with the utmost joy. The first acts of his reign seemed to promise a happy and prosperous administration. He instantly dismissed the mercenary soldiers who had committed the greatest disorders throughout the nation. He ordered all the castles which had been erected since the death of Henry I. to be demolished, except a few which he retained in his own hands for the protection of the kingdom. The adulterated coin which had been struck during the reign of Stephen was cried down, and new money struck of the right value and standard. He resumed many of those benefactions which had been made to churches and monasteries in the former reigns. He gave charters to several towns, by which the citizens claimed their freedom and privileges independent of any superior but himself. These charters were the groundwork of the English liberty; for thus a new order, namely, the more opulent of the people, began to claim a share in the administration, as well as the nobility and clergy. Thus the feudal government was at first impaired; and liberty began to be more equally diffused throughout the nation.

Henry II. on his accession to the English throne, found himself possessed of very extensive dominions on the continent. In the right of his father, he possessed Anjou, Touraine, and Maine; in that of his mother, Normandy; in that of his wife, Guienne, Poitou, Xaintonge, Auvergne, Perigord, Angoumois, and the Limousin. Soon after, he annexed Brittany to his other states, by marrying his son, who was yet a child, to the heiress of Brittany, who was a child of...
ENGLAND.

England also, and was already in possession of the superiority over that province. These territories composed above a third of the French monarchy, and were by far the most opulent part of it; so that Henry, though vassal to the king of France, was greatly superior to him in power; and when England was added to all these, the French king had great reason to apprehend some disaster to himself and family. The king of England, however, resided at too great a distance to be able to employ this formidable power with success against the French monarch. He soon became a kind of stranger in his continental dominions; and his subjects there considered their allegiance as more naturally due to their superior lord, who lived in their neighbourhood, and who was acknowledged to be the supreme head of their nation. Their immediate lord was often at too great a distance to protect them; and a commotion in any part of Henry's extensive dominions gave great advantages against him. The wise and vigorous administration of Henry, however, counterbalanced in a great measure these disadvantages; and he maintained a surprising tranquillity throughout his extensive dominions during the greatest part of his reign.

Henry found no great difficulty in circumventing the power of the barons; but when he attempted to do the same thing with the clergy, he met with the most violent opposition. That body had carried their independence on the civil power so far, that now they seemed to aim at nothing else than a liberty to commit all manner of crimes with impunity. During the reign of Stephen, they had extorted an immunity from all but ecclesiastical penalties; and that grant they were resolved to maintain for the future. It may easily be supposed, that a law which thus screened their wickedness, contributed to increase it; and we accordingly find upon record, not less than 100 murders committed by men in holy orders, in the short period since the king's accession, not one of which was punished even with degradations, while the bishops themselves seemed to glory in this horrid indulgence. The king did not make any attempts against them during the life of Theobald archbishop of Canterbury, who was a man of a mild character, and besides had great merit, because, during the former reign, he had refused to put the crown on the head of Eustace, Stephen's son. He died in 1161; and the king, after his death, advanced to the see of Canterbury Thomas à Becket, his chancellor, on whose compliance he thought he might entirely depend.

The new archbishop was the first man of English pedigree, who, since the Norman conquest, had risen to any considerable station. Before his instalment in the see of Canterbury, Becket had been exceedingly complaisant, good-humoured, and agreeable to his master; and had also been accustomed to live very freely. But no sooner was he invested with this high dignity, than he totally altered his conduct, and put on all those airs of affected and orientations humility which could recommend him to the superstitions and ignorant multitude in that age. The first step taken by this hypocrite after his advancement, was to resign the office of chancellor. This he did without consulting the king; the reason he gave was, that henceforth he must detach himself from secular affairs, and be solely employed in the duties of his sacred function; but in reality that he might break off all connection with Henry. As he knew that the king intended to abridge the ecclesiastical power, he thought the best method would be to become himself the aggressor. He therefore summoned the earl of Clare to surrender the barony of Tunbridge; which, ever since the Conquest, had remained in the family of that nobleman; but which, as it had formerly belonged to the see of Canterbury, the primates pretended that his predecessors were prohibited by the canons from alienating.

William de Eynsford, a military tenant of the crown, was patron of a living which belonged to a manor that held of the archbishop of Canterbury; and Becket, without regard to William's right, presented, on a new and illegal pretence, one Lawrence to that living, who was violently expelled by Eynsford. Upon this Eynsford was excommunicated. He complained to the king, that he, who held in capite of the crown, should, contrary to the practice established by the Conqueror and maintained ever since by his successors, be subjected to that terrible sentence, without the previous consent of the sovereign. Henry, by a messenger, commanded Becket to absolve Eynsford. The haughty primates answered, that it belonged not to the king to inform him whom he should absolve, and whom communicate; but, after all, he was obliged to comply with the king's orders, though with the worst grace imaginable.

As Henry perceived that the crown was now in danger, through the superstition of the people, of falling totally under the power of the clergy, he resolved to exert himself to the utmost against their scandalous usurpations. Among their other inventions to obtain money, they had now inculcated the necessity of penance as an atonement for sin; and having again introduced the practice of paying them large sums as an equivalent for these penances, the sins of the people had thus become a revenue to the priests; and the king, computed, that, by this invention alone, they levied more money upon his subjects than what flowed by all the funds and taxes into the royal exchequer. To ease the people of so heavy and arbitrary an imposition, the king required, that a civil officer of his appointment should be present in all ecclesiastical courts, and should for the future give his consent to every composition made for spiritual offences. About this time also the king had an opportunity of proceeding against the clergy on another footing. A clerk in Worcestershire, having defrauded a gentleman's daughter, murdered her father. The king required that the clerk should be delivered up to the magistrate. Becket pleaded the privilege of the church; confined the criminal in the bishop's prison, lest he should be seized by the king's officers; and maintained that no greater punishment could be inflicted on him than degradation. The king then required, that, immediately after he was degraded, he should be tried by the civil powers; but the primates asserted, that it was ignominious to try a man twice upon the same accusation, and for the same crime. Upon this, Henry summoned an assembly of all the prelates in England; and put to them this decisive question, Whether or not they were willing to submit to the ancient laws and customs of the kingdom? The bishops unanimously replied, that they were willing, saving their own order. The king was provoked
ENGLAND.

provoked to the last degree at this equivocal answer. He left the assembly with evident marks of displeasure; and required the primate instantly to surrender the castles of Ely and Berkhaim. The other prelates were terrified; but Becket continued inflexible: however, he was at last prevailed upon, by the interposition of Philip the pope's legate and almoner, to retract the saving clause, and promise without any reserve to observe the ancient customs.

The king was not now to be satisfied with general promises from the clergy: he was determined that the ancient laws and customs should be defined, as well as the privileges of the clergy. He therefore summoned another great council of the clergy and nobility at Clarendon, to whom he submitted this important affair. A number of regulations was there drawn up, which were afterwards well known by the title of the Constitutions of Clarendon. By these it was enacted, that clergy-men accused of any crime should be tried in the civil courts; that laymen should not be tried in spiritual courts, except by legal and reputable witnesses; that the king should ultimately judge in ecclesiastical and spiritual appeals; that the archbishops and bishops should be regarded as barons, and obliged to contribute to the public expenses like other persons of their rank; that the goods forfeited to the king should not be protected in churches or church-yards by the clergy; and that the sons of villains should not take orders without the consent of their lord. These, with some others of less consequence, to the number of 16, were subscribed by all the bishops present, and even by Becket himself; who, however, at first, showed some reluctance.

Nothing now remained but to get the constitutions ratified by the pope; but in this the king was disappointed. The pope rejected them with the utmost indignation; and, out of 16, admitted only six, which he thought were not important enough to deserve censure. Becket was now mortified to the highest degree. He retracted his consent to the constitutions, redoubled his austerities, and even refused to execute any part of his ecclesiastical function till he had obtained an absolution from his holiness. Henry, considering these humiliations as insults offered to himself, desired the pope to send him a legate. He did so; but annexed a clause to his commission, by which he was prohibited from acting against the archbishop of Canterbury. The king sent back the commission to the pope; and being now exasperated beyond all patience, commenced furious prosecutions against Becket. He first sued him for some lands belonging to his primacy; and Becket being detained by sickness from coming into court, his non-attendance was construed into disrespect. The primate afterwards defended his cause in person; but all his goods and chattels were confiscated, and the bishop of Winchester was pronounced accessory to the sentence. Another suit was commenced against him for 3000 marks, which he had levied on the honour of Ely and Berkhaim, and the primate agreed to give securities for the payment of the sum. The next day a third suit was commenced against him for 1000 marks, which the king had lent him upon some former occasion; and immediately following these, a still greater demand was made; namely, that Becket should give an account of the money he had received and expended during the time he was chancellor. The money was computed at no less than 40,000 marks; and the primate, unable either to give an account, or find securities, took the following extraordinary method of evading the king's designs. He arrayed himself in his episcopal vestments; and with the cross in his hand, went forward to the palace. Having entered the royal apartments, he sat down, holding up the cross as his banner and protection. The king, who sat in an inner apartment, ordered by proclamation all the prelates and nobility to attend him; to whom he loudly complained of Becket's insolence. The whole council joined in condemning this instance of his unaccountable pride; and determined to expostulate with him about his inconsistency concerning the constitutions of Clarendon. But all their messages, threats, and arguments, were in vain. Becket put himself, in the most solemn manner, under the protection of the supreme pontiff, and appealed to him against any penalty which his inquisitive judges might think proper to inflict. Then leaving the palace, he asked the king's immediate permission to quit the country and Northampton; but being refused, he secretly withdrew in disguise, and at last found means to cross over to the continent.

Becket was received with the greatest marks of esteem, first by the king of France (who hated Henry on account of his great power), and then by the pope, whose cause he had so strenuously defended in England. Henry at the same time sent ambassadors to the pope, who were treated with coolness and contempt, while Becket was honoured with the greatest marks of distinction. These favours bestowed upon an exile and a perjured traitor (for such had been Becket's sentence of condemnation in England), irritated the king to such a degree, that he resolved to throw off at once all dependence upon the pope. He accordingly issued out orders to his justiciaries; inhibiting, under severe penalties, all appeals to the pope or the archbishop; and forbidding any of them to receive mandates from them, or to apply to their authority. He declared it treasonable to bring over from either of them any interdict upon the kingdom. This he made punishable in secular clergymen by the loss of their livings, and by castration; in laymen, by the amputation of their feet; and in laymen, by death. On the other hand, the pope and the archbishop did not fail to issue forth their fulminations in such a manner as to shake the very foundation of the king's authority. Becket excommunicated by name all the king's chief ministers who had been concerned in sequestrating the revenues of his see, and all who obeyed or favoured the constitutions of Clarendon. He even threatened to excommunicate the king if he did not speedily repent; and had not the pope himself been threatened every day with the machinations of an antipope, whose pretensions he was afraid the king of England might support, the sentence of excommunication would certainly have been denounced.

At first, Henry paid little regard to these fulminations; but afterwards, when he found that his authority over his subjects began to decline on that account, and that his rivals on the continent were endeavouring to disturb the tranquillity of his dominions, he began sincerely to desire a reconciliatory. This the pope and Becket
Becket also became desirous of, because they saw that their utmost endeavours were insufficient to draw Henry's subjects into a revolt against him. The treaty of accommodation, however, was often broken off, through the extreme jealousy of each of the parties; but at length, by the mediation of the pope's legate, all differences were adjusted, and Becket was reinstated in the see of Canterbury.

On the recovery of his dignity, the primate behaved with all his usual arrogance. Instead of retiring quietly to his diocese when he landed in England, he made a progress through Kent with all the splendour and magnificence of a sovereign pontiff. As he approached Southwark, the clergy, the laity, and all ranks of people came forth to meet him, and celebrated his triumphant entry with hymns of joy. Being thus confident of the support of the people, he resolved to make his enemies feel the severest effects of his vengeance. He suspended the archbishop of York, who had crowned Henry's eldest son in his absence. He excommunicated the bishops of London and Salisbury, with some of the principal nobility and prelates who had assisted at the coronation. One man he communicated for having spoken against him, and another for having cut off the tail of one of his horses. The excommunicated and degraded prelates immediately made their complaints to the king; and he having dropped some passionate expressions, intimating a desire to have Becket's life taken away, the supposed will of the king was instantly accomplished; nor could the king's express orders to the contrary arrive time enough to hinder the execution of this fatal purpose. See Becket.

The king was thrown into the utmost consternation on hearing of Becket's murder. He knew that the primate's death would accomplish what his most violent opposition during his life could never have done, and therefore he gave himself up to sorrow: for three days he even refused all nourishment; till at last his courtiers were obliged to break in upon his solitude, and induce him to acquiesce in an event which could not possibly be recalled. The pope was with some difficulty made sensible of the king's innocence; but refused to grant him a pardon, except on condition that he should make every future submission and perform every injunction the holy see thought proper to demand. When things were thus adjusted, the assassins who had murdered Becket were allowed to retire in safety to the enjoyment of their former dignities; and the king, with a view to divert the minds of the people to a different object, undertook an expedition into Ireland, and totally reduced that island. See Ireland.

The king was scarcely freed from the war with Ireland, and the dangerous controversy in which he had engaged with the church of Rome, when he found himself involved in the most unnatural contests with his children, to whom he had always been the most tender and affectionate father. He had ordered Henry his eldest son to be anointed king; and had determined him for his successor in the kingdom of England, the duchy of Normandy, and the counties of Anjou, Maine, and Touraine; territories which lay contiguous, and which might thus easily lend their assistance to one another. Richard his second son was invested in the duchy of Guîenne and county of Poitou; Geoffrey, his third son, inherited, in right of his wife, the duchy of Brittany; and the new con.

The licentious barons in the mean time wished for a change of government; hoping to have liberty, under young and inexperienced princes, to commit those ravines and violations which they could not do with safety when governed by such a prudent and vigilant king as Henry. In the midst of this universal deflection, however, the English monarch still retained his usual intrepidity, and prepared with as much vigour as possible for the contest. As he could depend on the fidelity of very few of his nobility, he was obliged to enlist in his service a number of desperate ruffians called Bredyneshuns, and sometimes Botters or Cotteneruns, though for what reason is not mentioned in history. These banditti were very numerous during the time of the feudal government, when many private wars were carried on between the nobles; and 20,000 of these, with a few forces furnished by his faithful barons, composed the whole of Henry's army on this occasion.

With this force the king of England totally overthrew the schemes of his enemies on the continent; but being very desirous of putting an end to the war, he this very year (1173) agreed to a conference with the king of France. At this interview, Henry offered his children the most advantageous terms. He insisted only on retaining the sovereign authority in all his dominions. To Henry he offered half the revenues of the crown of England, with some places of surety in that kingdom; or if he chose rather to reside in Normandy, half the revenues of that duchy, with all those of Anjou. He made a like offer to Richard in Guîenne; he promised to resign all Brittany to Geoffrey; and if these concessions were not deemed sufficient, he agreed to add to them whatever the pope's legates, who were present, should require of him. The conference, however, was broken off by the violence of the earl of Leicester; who not only reproached Henry in the most indecent manner, but even put his hand to his sword, as if he intended to attempt some violence against him.

In England.
England. In the mean time, the most of the English nobility united in opposition against their sovereign; and an interruption at this time by the king of Scotland assisted their rebellious schemes. The earl of Leicester soon after invaded Suffolk at the head of a body of Flemings; but they were repulsed with great slaughter, and the earl himself was taken prisoner. Soon after, William king of Scotland, who had been repulsed, and agreed to a cessation of arms, broke the truce, and invaded England with an army of 82,000 men, committing the most terrible devastations. Henry in the mean time, to reconcile himself thoroughly to the church, performed the penances at the tomb of Thomas à Becket which he had formerly promised to do. As soon as he came within sight of the church of Canterbury, he alighted from his horse, walked barefoot towards the town, and prostrated himself before the shrine of the saint. He remained a whole day in prayer and fasting, watched the holy relics all night, made a grant of 50l. a year to the convent for a constant supply of tapers to illuminate the shrine; and not satisfied with these submissions, he assembled a chapter of monks, disrobed himself before them, put a scourge into each of their hands, and presented his bare shoulders to their strokes. Next day he received absolution; and, departing for London, the agreeable news of the defeat and captivity of William king of Scotland, which happened on the very day of his absolution.

This victory proved decisive in Henry’s favour. The English barons who had revolted, or were preparing for a revolt, instantly delivered up their castles to the victor, and the kingdom was in a few weeks restored to perfect tranquillity. Prince Henry, who was ready to embark with a great army to join the English rebels, abandoned all thoughts of the enterprise. Soon after a treaty was concluded with the king of France; in which Henry granted his children much less advantageous terms than he had offered them before. The principal were, some pensions for their support, castles for their residence, and an indemnity to all their adherents. The greatest sufferer by this war was William king of Scotland. He was compelled to sign a treaty, by which he obliged himself to do homage to Henry for the kingdom of Scotland. It was agreed, that his barons and bishops should do the same; and that the fortresses of Edinburgh, Stirling, Berwick, Roxburgh, and Jedburgh, should be delivered into the hands of the conqueror till the articles were performed. This treaty was executed most punctually and rigorously on the 10th of August 1175. The king, barons, and prelates of Scotland, did homage to Henry in the cathedral of York; the greatest humiliation to which the Scottish nation had ever been subjected.

Henry was now freed from all troubles, either at home or abroad, for five years; during which time he made several salutary laws for the good of his kingdom. But, in 1180, the ambitious spirit of his children involved him in fresh calamities. Richard, who had been invested by his father in the sovereignty of Guienne, refused to do homage to his elder brother, as King Henry had required him to do. Young Henry and Geoffrey, uniting their arms, invaded their brother’s dominions; and while the king was endeavouring to compose their differences, he found himself conspired against by them all. The conspiracy, however, was defeated by the death of Prince Henry in 1183. He had retired to Martel, a castle near Turenne, where he was seized with a fever; and perceiving the approach of death, he was at last struck with remorse for his dutiful behaviour towards his father. He sent a messenger to the king, who was not far distant; expressed his contrition for his faults; and intreated the favour of a visit, that he might at least die with the satisfaction of having received his forgiveness. The king, who had so often experienced his son’s ingratitude and violence, apprehended that his sickness was entirely a feint, and dared not trust himself in the prince’s hands. But soon after, receiving certain intelligence of his death, and proofs of his sincere repentance, the good old king was affected with the deepest sorrow. He thrice fainted away; he accused his own hard-heartedness in refusing the dying request of his son; and he lamented that he had deprived the prince of the last opportunity of making atonement for his offences.

Prince Henry, who died in the 28th year of his age, left no posterity. His brother Richard succeeded to his dominions, and soon discovered as turbulent a spirit as that which had actuated his brother; and Henry was compelled to give up Guienne, which he had designed for his fourth son John; and even made preparations for carrying on war against his father, and brother Geoffrey. Henry sent for Eleanor his queen, the heiress of Guienne; to whom Richard, either daring an insurrection in her favour, or out of a sense of duty, willingly yielded up the territory, and retired peacefully to his father’s court. This breach, however, was no sooner made up, than Geoffrey demanded Anjou to be added to his dominions in Brittany. This the king refused; upon which he fled to the court of France, and prepared to levy an army against his father. Henry, however, was freed from the danger which threatened him from that quarter, by his son’s death, who was killed in a tournament at Paris. The loss of this prince gave few, except the king himself, any uneasiness; for he was universally hated, and went among the people by the name of the Child of Perdition. The widow of Geoffrey, soon after his decease, was delivered of a son, who received the name of Arthur, and was invested with the duchy of Brittany, under the guardianship of his grandfather, who, as duke of Normandy, was also superior lord of that territory. Philip, as lord paramount, disputed for some time his title to this wardship; but was obliged to yield to the inclinations of the Bretons, who preferred the government of Henry. Some other causes inflamed the dissension between these two monarchs, and Philip once more seduced Richard from his duty. He insisted, that his marriage with Adelais, Philip’s sister, should be immediately completed, and threatened to enforce his pretensions with a formidable army. This occasioned another conference between Gisors and Trie, the usual place of meeting, under a vast elm that is said to have shaded more than an acre. In the midst of this conference the archbishop of Tyre appeared before the assembly in the most miserable habit, and begged assistance against the infidels, who, under Saladin, had almost totally expelled the Christians from Asia. His intelligence...
England.


gence appeared so very dismal, that the kings of France and England laid aside their animosity. Both of them immediately took the cross; but Richard, who had long wished to have all the glory of such an expedition to himself, could not bear to have even his father for a partner in his victories. He therefore entered into a confederacy with the king of France; so that Henry found himself at last obliged to give up all thoughts of the crusade, in order to defend himself against this unnatural combination. The event of the war proved very unfortunate for Henry, who lost several towns, and narrowly escaped falling into the hands of the enemy himself. At last a treaty was concluded at the intercession of the duke of Burgundy, the count of Flanders, and the archbishop of Rheims; but upon terms very humiliating to the king of England. It was agreed that Richard should marry the princess Adelais, and be crowned king of England during the lifetime of his father; that Henry should pay 20,000 merks to the king of France, as a compensation for the charges of the war; that his own brothers should engage to make him observe this treaty, and in case of violating it, to join Philip and Richard against him; and that all his vassals who had espoused the cause of Richard should receive an indemnity for their offence. These terms, mortifying as they were, Henry bore with patience; but when, upon receiving a list of the barons that were to be pardoned, he found his own son John, who was his favourite, among them, he could no longer support his grief. He broke out into the most lamentable expressions of despair; cursed the day in which he received his miserable being; and bestowed on his ungrateful children a maladministration which he could never afterwards be prevailed upon to retract. Soon after, he fell into a lingering fever occasioned by his grief; and of this he died on the 6th of July 1189, in the 58th year of his age and 33rd of his reign. His natural son Geoffrey, who alone had behaved dutifully towards him, attended his corpse to the nunnery of Fontevrault, where it lay in state in the abbey-church. Next day Richard, who came to visit the dead body of his father, was struck with horror at the sight. At his approach, the blood was seen to gush out at the mouth and nostrils of the corpse; and this accident was, by the superstition of the times, interpreted as the most dreadful rebuke. Richard could not endure the sight. He exclaimed that he was his father's murderer; and expressed a strong, though too late, sense of his unuttiful conduct.

Richard succeeded to the throne without opposition immediately after his father's death; and, on his accession, set his mother Eleanor (who had been again confined) at liberty. A romantic desire for strange adventures, and an immoderate zeal for the external rites of religion, were the ruling passions of the times. By the first of these Richard was inflamed to the highest degree, and therefore behaved as if the whole design of his government had been to attempt the recovery of the Holy Land from the Infidels. The superstition of the people showed itself in a most violent and tragical manner on the very day of the king's coronation. The Jews were the objects of universal hatred, so that Richard had issued out orders forbidding any of them from appearing at his coronation. But some of them bringing him large presents from their nation, presumed, notwithstanding these orders, to approach the hall in which the king dined. Being discovered, they were exposed to the insults and injuriees of the bystanders; in consequence of which they fled, and were pursued by the people. A report was spread, that the king had given orders to massacre all the Jews. This supposed command was executed in the most cruel manner. Mothers were thrown at the doors of the city of London; and this example was followed in most of the cities of England. Five hundred Jews had retired into York castle for safety; but finding themselves unable to defend the place, they murdered their wives and children; threw the dead bodies over the wall against their enemies who attempted to scale it; and then, setting fire to the houses, perished in the flames. The gentry in the neighbourhood, who were all indebted to the Jews, ran to the cathedral where their bonds were kept, and made a solemn bonfire of them before the altar.

Richard immediately began to take measures for his Richard's expedition into Palestine. His father had left him preparatory instructions for his 100,000 marks; and this sum he augmented by all expedients he could think of, however pernicious to the public, or dangerous to the royal authority. He set all the revenue up to sale the revenues and manors of the crown, and several offices of the greatest trust and power. Liberties, charters, castles, were given to the best bidders. His friends warned him of the danger attending this venality; but he told them he would sell the city of London itself, if he could find a purchaser. Numerous exactations were also practiced upon all ranks and stations; menaces, promises, and expostulations, were used to fright the timid, and allure the avaricious. A zealous preacher of those times was emboldened to reprove the conduct of the king; and advised him to part with his three daughters, which were pride, avarice, and sensuality. To this Richard readily replied, "You counsel right, my friend; and I have already provided husbands for them all. I will dispose of my pride to the templars; my avarice to the monks; and as for my sensuality, the clergy shall share that among them." At length the king having got together a sufficient supply for his undertaking, and even sold his superiority over Scotland for a moderate sum, set out for the Holy Land; whither he was impelled by repeated messages from the king of France, who was ready to embark on the same enterprise.

An account of Richard's exploits in this expedition is given under the articles Egypt, Sicily, Cyprus, &c.—Having at last concluded a truce with Saladin, he set out on his return for England. He was, however, at a loss how to proceed. He durst not return by the way he came, as this would put him in the power of the king of France, between whom and the king of England an irreconcilable enmity had taken place. No way therefore was left but by going more to the north; for which reason he took shipping for Italy, but was wrecked near Aegleia. From thence he travelled towards Ragusa, and resolved to make his way through Germany in the habit of a pilgrim. But his expenses and liberalities having betrayed him, notwithstanding this disguise, he was arrested by Leopold, the duke of Austria, who commanded him to be loaded with shackles. This prince had served under Richard
England at the siege of Acre (the ancient Ptolemis), where having received some disgust, he took this base method of revenging himself. Henry VI. emperor of Germany, was then equally an enemy to Richard, on account of his having married Berengaria the daughter of Tancred king of Sicily. He therefore required the royal captive to be delivered up to him, and stipulated a large sum of money to the duke as a reward for his service.

The kingdom of England in the mean time was in great confusion. Richard had left it under the direction of Archbishop of Durham, and Longchamp bishop of Ely. The tempers of these prelates being very different, an animosity between them soon took place. Longchamp at last arrested his colleague, and obliged him to resign his power in order to obtain his liberty. The king, by many letters, commanded Longchamp to replace his coadjutor, but to no purpose. When the situation of the king became uncertain, Longchamp tyrannized to such a degree, that John the king's brother thought proper to oppose him. He then left the kingdom; and upon this the archbishop of Rouen was made head of the room. The king of France being informed of these dissensions, strove to increase them as much as possible; and had even almost prevailed upon John to throw off his allegiance, by promising to put him in possession of all Richard's continental dominions.

When the English first received the news of Richard's captivity, a general indignation was excited through the whole nation. The greatest, and almost the only traitor in the kingdom, was the king's own brother John. On the very first invitation from the court of France, he went abroad and held a consultation with Philip; the object of which was the perpetual ruin and captivity of his unhappy brother. He promised to deliver into Philip's hands a great part of Normandy; and, in return, he received the investiture of all Richard's transmarine dominions: it is even said, that he did homage to the French king for the crown of England.

In consequence of this treaty, Philip invaded Normandy, and made considerable progress in the conquest of it. He was, however, at last repulsed by the earl of Leicester, who was now returned from the Holy Land; and a truce was concluded, on condition of paying the French king 20,000 merks, and putting four castles into his hands by way of security for the payment. John, who had come over to England, met with still less success in his enterprises. He was only able to make himself master of the castles of Windsor and Wallingford; but when he came to London, and demanded the kingdom as heir to his brother, of whose death he pretended to have received certain intelligence, be was rejected by all the barons, and measures were taken to oppose and subdue him. The defence of the kingdom was so well provided for, that John, after some fruitless efforts, was obliged to conclude a truce with his opponents; and, before the expiration of it, he thought proper to retire to France, where he openly acknowledged his alliance with Philip.

All the efforts of Richard's enemies proved ineffectual to detain him in captivity. He was brought before the diet of the empire at Worms, where the emperor Henry brought against him a charge of many crimes and misdemeanours; but to this the king replied with so much spirit and eloquence, that the German princes exclaimed loudly against the conduct of the emperor; the pope threatened him with excommunication; and Henry, who had hearkened to the proposals of the king of France and Prince John, found that it would be impossible for him to execute his and their base purposes, and detain the king of England any longer in captivity. He therefore concluded a treaty with him for his ransom; and agreed to restore him to his liberty for 150,000 marks, about 100,000l. of our money, of which 100,000 marks were to be paid immediately, and 67 hostages delivered for the remainder.

The money for the king's ransom was most cheerfully raised by the English. The churches and monasteries melted down their plate to the amount of 30,000 merks; the bishops, abbots, and monks, paid a fourth part of their yearly rent; the parochial clergy contributed a tenth part of their tithes; and the requisite sum being thus collected, Queen Eleanor and Walter archbishop of Rouen set out with it for Germany, paid the money to the emperor and duke of Austria at Mentz, delivered them hostages for the remainder, and freed Richard from his captivity. His escape was very critical. Henry had been detected in the assassination of the bishop of Liege, and in an attempt of the like nature on the duke of Louvain; and finding himself extremely obnoxious to the German princes on account of these odious practices, he had determined to seek support from an alliance with the French king, and to detain Richard in his captivity, notwithstanding the sum he had already received for his ransom. He therefore gave orders that Richard should be pursued and arrested; but the king making all imaginable haste, had already embarked at the mouth of the Scheldt, and was out of sight of land when the emperor's messengers reached Antwerp. The king of France no sooner heard of Richard's deliverance, than he wrote to John his confederate in these terms: "Take care of yourself: the devil is broke loose."

The king of England returned from captivity on Return to Returns to the 20th of March 1194, and was received with the utmost joy by his subjects. He had been but one day landed, when his treacherous brother John came to make his submission. At the intercession of Queen Eleanor he was received into favour. "I forgive him (said the king), and hope I shall as easily forget his offences as he will my pardon." Richard was impatient to revenge himself on the king of France, and therefore instantly made war upon him. But, though both kings were inflamed with the most violent resentment against each other, they found it impossible to engage their powerful barons heartily in their cause. The war, therefore, produced no remarkable event; and, in 1195, was concluded by a truce for five years. On some slight occasion it was ready to break out anew, when the pope's legate interposed, and a treaty was about to be concluded. King Richard in the mean time was wounded by an arrow at the siege of Chalus, a castle of Limoges. The wound was not in his death itself dangerous; but being unskilfully treated, a mortification ensued, and the king expired on the 6th of April 1199, in the 10th year of his reign and 42d of
ENGLAND.

The new king was weak, tyrannical, cruel, and treacherous. In short, he seemed to be endowed with almost every bad quality that can fall to the share of man. His conduct, therefore, soon rendered him universally odious. Imagining himself now secure on the side of France, he indulged his passion for Isabella, the daughter and heiress of the count of Angoumois, with whom he was much enamoured. His queen, the heiress of the family of Gloucester, was still alive; and Isabella was married to the count de la Marche, though, by reason of her youth, the marriage had not been consummated. John persuaded the count de Angoumois to tarry off his daughter from her husband; at the same time that he procured, under some pretence or other, a divorce from the queen. Thus he incurred the displeasure of the pope, and also of the count de la Marche, and a powerful confederacy was formed against him.

As John had neither courage nor policy sufficient to keep his barons in awe, he took a method for that purpose equally base and cruel. This was by hiring a set of Russians, whom he called his champions, to fight duels with them, in cases where they required to clear themselves from any charge by fighting a duel, according to the custom of those times. Thus he proposed to get rid of his refractory barons; but they, despairing of succour who were so far below their rank, refused to fight with them, and a dangerous combination was formed among the barons against him.

The murder of Prince Arthur rendered John still more grossly detected. The young prince with his mother had fled to the court of France, where they were received with the greatest kindness, and found their interest more vigorously supported than before. Their enterprises were attended with considerable success, when Arthur himself had the misfortune to be taken prisoner. All the other captives were sent to England; but the prince was shut up in the castle of Falaise, and from that time was never heard of. It was universally believed that John had murdered him with his own hand; and this inflamed the general resentment against him to such a degree, that he soon after lost all his French provinces. In 1205, the duchy of Normandy itself was also conquered by Philip, and John was forced to fly with disgrace to England.

The king resolved to wreak his vengeance upon the barons, who, he pretended, had deserted his standard in Normandy. For this reason, he levied large sums on their estates; in order, as he said, to undertake an expedition to the continent. This expedition, however, he several times capriciously deferred; and when having ventured out to sea, returned again without making the smallest attempt. At last, he landed at Bacton, and burnt the city of Angers; but hearing that the enemy were preparing to oppose him, he returned without attempting any thing else.

This inordinate and cowardly behaviour of John made him contemptible in the eyes of his subjects, but the Norman princes had so far extended the prerogatives of the English crown, that the barons, however discontented, durst not yet attempt to change the form of government. John, by entering into a controversy with the church, completed his ruin. The clergy, who for some time had acted as a community totally independent of the civil power, had their elections of each other generally confirmed by the pope, to whom alone they owed subjection. The election of archbishops, however, had been a subject of continual dispute between the suffragan bishops and the Augustinian monks. In the mean time the archbishop of Canterbury died; and the Augustinian monks, in a very private manner, selected Reginald, his superior, in his place. The bishops exclaimed against this election, as a manifest innovation of their privileges; and a furious theological contest was likely to ensue. John very imprudently took a side in this controversy, and espoused the cause of the suffragan bishops; in consequence of which, John de Grey, bishop of Norwich, was chosen. The cause was appealed to Rome; and Pope Innocent III seizing with avidity an opportunity of extending his power, commanded the monks to choose Cardinal Stephen Langton, an Englishman, as the court of Rome. The power of nominating an archbishop of Canterbury (a person of almost equal authority with the king), was an acquisition that would effectually give the court of Rome an unlimited authority over England. John, therefore, was resolved not to submit to this imposition; but he had not judgment sufficient to conduct him. He violently expelled the monks from their convent, and seized upon their revenues. The pope, perceiving, from this absurd conduct, that John was unequal to the task he had undertaken, after some intrigues, threatened to put the whole kingdom under an interdict. The prelates threw themselves on their knees before the king, and in the most earnest manner requested him to avoid the resentment of the holy tribunal, by receiving the priates, and restoring the monks to their convent. John, however, broke out into the most violent invectives. He swore by God's teeth (his usual oath), that if the kingdom was put under an interdict, he would banish the whole body of the clergy, and confiscate all their possessions. The pope at last, finding he might do it with safety, issued forth this terrible sentence, so much dreaded by the whole nation. A stop was immediately put to divine service, and the administration of all the sacraments except baptism. The church-doors were shut, and the images of the saints laid on the ground. The dead were refused Christian burial; and were thrown into ditches and on the highways, without any funeral solemnity. Marriage was celebrated in the churches, and the people prohibited the use of meat as
ENGLAND.

England, in times of public penance. They were debarred from all pleasures; even from shaving their beards, saluting each other, or paying any regard to their apparel. The clergy deplored the unhappy state of the nation in the most lamentable manner; while John, in revenge, imprisoned all their concubines, and treated the adherents of Langton with the utmost rigour.

The furious and imprudent efforts of John proved totally ineffectual. He had scarce a friend left in the whole nation; and therefore, in 1209, the pope denounced a sentence of excommunication against him. This was soon followed by another still more terrible; namely, the absolving all the subjects of the king of England from their allegiance, and declaring every one to be excommunicated who had any commerce with him at his table, council, or even in private conversation. The king, rendered quite furious by these repeated indignities, wreaked his vengeance on his unhappy subjects, whose affections he ought rather to have attempted to conciliate. The pope, therefore, proceeded to execute the full measure of his wrath on this devoted prince, by giving away his kingdom to Philip of France. He published a crusade all over Europe against King John; exhorting the nobility, the knights and men of every condition, to take up arms against him, and enlist under the French banner. Philip was not less active on his part. He summoned all the vassals of the crown to attend him at Rouen; and having collected a fleet of 1700 vessels, was ready, in 1213, to invade England.

The pope had now overstretched his power; and had the English nation been governed by a prince of any degree of prudence or resolution, the clergy would in all probability have been totally broken. The people, however superstitious and ready to obey in matters of religion, could not tamely submit to be given away by the pope as slaves from one master to another; and therefore this consideration, added to the natural antipathy subsisting between the French and English, put John, notwithstanding all his offences, at the head of an army of 60,000 men. But the pope was too great a politician to suffer matters to be carried to extremities. He promised himself many more advantages from the submission of John than from an alliance with Philip; and therefore came over in person, or, at any rate, sent over his legate, to England, under pretence of conferring with the barons, but in reality to hold a conference with John. He there represented to this forlorn prince, the numbers of the enemy, the hatred of his own subjects, and the secret confederacy there was against him in England. He intimated, that there was but one way to secure him from the impending danger; namely, to put himself under the protection of the pope, who was a merciful father, and still willing to receive a repenting sinner. The subject and irresolute spirit of John submitted to this last piece of arrogance, and he took an oath to obey whatever the pope should command. In consequence of this oath, he took another, the most extraordinary mentioned in the records of history; and which, as it was taken while he commanded an army of 60,000 men, discovers a meanness of spirit almost incredible. The terms imposed by it were expressed in the following words. "I John, by the grace of God, king of England and lord of Ireland, in order to expiate my sins, from my own free will, and the advice of my barons, give to the church of Rome, to Pope Innocent and his successors, the kingdom of England, and all other prerogatives of my crown. I will hereafter hold them as the pope's vassal. I will be faithful to God, to the church of Rome, to the pope my master, and his successors legitimately elected. I promise to pay him a tribute of 1000 merks; to wit, 300 for the kingdom of England, and 300 for the kingdom of Ireland."

This oath was taken by the king before all the people, kneeling, and with his hands held up between those of the legate, to add to his former insolence, trampled under his feet the tribute which John had consented to pay. The king of France was enraged at this behaviour of the pope; and resolved to execute his project of conquering England, in spite of him and all his censures. His fleet, however, was attacked in their harbours by the English, who took 300 vessels, and destroyed about 100 more; while Philip, finding it impossible to prevent the rest from falling into the hands of the enemy, despaired of himself, and thus was obliged to give up all hopes of success.

John being thus freed from all danger, continued to follow the same cruel and tyrannical measures which attempt to reduce the barons to the condition of serfs. He ordered the scandalous subjection to the clergy now gave the barons an opportunity of exerting themselves, in order to reduce the enormous prerogatives of the crown. Their demands were at length heard by the archbishop of Canterbury, who, on all occasions, had a sincere regard for the interests of the kingdom. At a synod of his prelates and clergy, convened in St Paul's, on pretence of examining into the losses of some bishops who had been exiled by John, he privately conferred with a number of barons, to whom he expatiated on the vices and injustice of their sovereign. He showed them a copy of Henry the first's charter; (being the only one in the kingdom, and which had been buried in the rubbish of an obscure monastery). Langton exhorted the barons to insist on a renewal of it; and they solemnly swore to perform. The same agreement was afterwards renewed at a more numerous meeting of barons summoned by Langton at St Edmondbury. Here it was resolved, that at Christmas they should prefer their common petition in a body, and in the mean time they separated with a design to put themselves in a posture of defence, enlist men, and fortify their castles. In the beginning of January 1215, they repaired to London, accosted in their military garb and equipage, and presented their petition to the king, alleging that he had promised to grant a confirmation of the laws of Edward the Confessor, at the time he was absolved from his excommunication. John resented their presumption; and required a promise under their hands and seals, that they would never demand, or attempt to extort, such privileges for the future. This they refused with such unanimity and resolution, that the king desired time to consider of their demands. He promised, that, at the festival of Easter, he would give a positive answer to their petitions; and offered them the archbishop of Canterbury, the bishop of Ely,
to excommunicate a single baron. The king, being England now quite defenceless, was obliged at last to comply with the demands of his subjects. A conference was accordingly appointed, and all things were adjusted for this most important treaty.

The king's commissioners met the barons at a place called Runimead, between Staines and Windsor; and him to sign, which is yet held in reverence as the spot where the standard of freedom was first erected in England. Here the king signed the charter called Magna Charta, which continues in force to this day, and is still regarded as the great bulwark of British liberty. See Magna Charta.

This charter, however, at the time that it was made, secured liberty to the clergy, barons, and gentlemen of much more than to the bulk of the people, who did not for a long time obtain any privileges of importance. Freedom of elections was secured to the clergy; and it was determined, that fines on them for any offence should be laid in proportion to their estates, and not the value of their persons. The privileges secured to the barons were, either a statement in the rigour of the feudal laws, or relief from arbitrary and ambiguous decisions before the courts. It was also decreed, that barons should recover the lands of their vassals, even though forfeited by felony, after having been in the possession of the crown for a year and a day; and no tax was to be imposed without consent of the great council of the nation, excepting in case of the captivity of the king, the knighthood of his eldest son, or marrying his eldest daughter. No land belonging to any baron was to be seized for a crown debt, unless the possessor had not personal property enough to pay it; neither was any vassal to be allowed to sell so much of his land as to incapacitate him from performing the necessary service to his lord. It was also determined, that when the great council of the nation was called, the prelates, earls, and barons should be summoned by a particular writ, and the lesser barons chosen of common consent, and other personages from the sheriff. In favour of the people it was stipulated, that they should have from the barons all the immunities and privileges granted by the king to the former. Merchants were to be allowed to carry on their business without any arbitrary tolls or impositions, and to go out of the kingdom and return at pleasure. The goods of every freeman were to be disposed of according to his will; or if he died intestate, the nearest heir should succeed him. No carts, horses, or wood, were to be taken by the crown officers without the consent of the owner. The king's courts were to be stationary, and no delay to be made in doing justice to every one; no freeman should be taken or imprisoned, dispossessed of his free tenement, outlawed or banished, unless by the legal judgment of his peers, &c. It was likewise stipulated, that London should remain in the hands of the barons, and the Tower be consigned to the primate, till the 15th of August following; or till the articles of the charter should be fulfilled. To give the more security for this, the king allowed them to choose 25 of their own number, to whose authority no limits were set either in extent or duration. If any complaint were made of a violation of the charter, either by the king or his officers, any four of the barons might admonish the king to redress the grievance; and if satisfaction were not obtained,

In the mean time the king was left at a place called Otitham in Sorrey, attended only by seven knights. He mainly endeavoured to avert the storm by the mediation of his bishops and ministers. He appealed to Langton against the barons, not suspecting that he was engaged in the confederacy; and desired him to humiliate the church censures against those who had made war upon his lawful prince. Langton declared that he would pass no censure where he found no delinquent; but said, that much might be done if the king would dismiss some foreign auxiliaries which he had lately brought over. Upon this John disbanded a great body of Germans and Flemings whom he had hitherto retained in his service, and Langton refused
and to bestow their dignities and estates upon his French subjects, on whose fidelity he could more safely rely. This caused a considerable desertion among Louis's party: so that John once more found himself in a condition to make an effort for his crown. He resolved to penetrate into the heart of the kingdom, and, for this purpose, he departed from Lynn, and took the road towards Lincolnshire at the head of a great body of troops. His road lay along the shore, which was overflowed at high water; but the king, not being apprised of this, or being ignorant of the tides of the place, lost all his carriages, treasure, and baggage by their influx. He himself escaped with the utmost difficulty, and arrived at the abbey of Swinford; where his grief for the loss he had sustained, and the distracted state of his affaires, threw him into a fever, which soon appeared to be attended with fatal symptoms. He died at Newark in the year 1216, the death of gth of his age, and 18th of his reign. He left two legitime sons: Henry, who succeeded him on the throne, and was about nine years of age; and Richard, who was about seven. He left also three daughters: Jane, married to Alexander king of Scotland; Eleanor, married to the earl of Pembroke; and Isabel, married to the emperor Frederic II.

When John died, the earl of Pembroke was marshal of England. By this office he was at the head of the army, and of consequence, in times of such turbulence, at the head of the state. He was a nobleman of great honour and fidelity, and had continued faithful to John in his greatest reverses of fortune. He now determined to support the authority of the infant Prince Henry; and therefore carried him immediately to Gloucester, where the ceremony of coronation was performed, in the presence of Gaul the legate and some noblemen, by the bishops of Winchester and Bath.

The young prince was obliged to swear fealty to the Henry III. pope, and renew the homage which his father had done for the kingdom; after which, the earl of Pembroke was chosen protector.

Till the king arrived at the years of maturity, the transactions of his reign can only be considered as the new consequences of the disposition of his tutors. Pembroke caused him grant a new charter of liberties, consisting of the concessions extorted from John, with some alterations; and the next year it was renewed, with the addition of some other articles. Thus these famous charters were brought very nearly to the shape in which they have ever since stood; and they were, during many generations, esteemed the most sacred rampart to national liberty and independence. As they secured the rights of all orders of men, they were successively defended by all, and became in a manner the basis of the English monarchy, and a kind of original contract, which both limited the authority of the king, and ensured the conditional allegiance of his subjects. Though often violated, they were still claimed and recalled by the nobility and people; and as no precedents were supposed valid that infringed them, they rather acquired, than lost, authority, from the frequent attempts made against them, in several ages, by regal and arbitrary power.

These charters were made use of by Pembroke as arguments to draw off the malecontent barons from their allegiance to Louis. He represented to them, that... whatever,
England, whatever jealousy they might have entertained against the late king, a young prince, the lineal heir of their ancient monarchs, had now succeeded to the throne, ascending either to the resentments or principles of his predecessor: The desire of the county, which they had employed, of calling in a foreign potentate, had, happily for them, as well as for the nation, failed of entire success; and it was still in their power, by a quick return to their duty, to restore the independence of the kingdom, and to secure that liberty for which they so zealously contended: That, as all past offences of the barons were now buried in oblivion, they ought, on their part, to forget their complaints against their late sovereign; who, if he had been any less blaming in his conduct, had left to his son the salutary warning to avoid his path, which had led to such fatal extremities: And that, having now obtained a charter for their liberties, it was their interest to show, by their conduct, that the acquisition was not incompatible with their allegiance; and that the rights of the king and people, so far from being hostile and opposite, might mutually support and sustain each other. 

These considerations, enforced by Pembroke’s known character of constancy and fidelity, had a very great influence on the barons. Most of them began to negociate with him, and many actually returned to their duty. At the same time Louis continued to disgust those of his own party by the preference which he visibly gave to the French. Though he went over to France, therefore, and brought fresh succours from thence, he found that his party was greatly weaker than before, by the desertion of his English confederates: And that the death of King John had, contrary to his expectations, occasioned the total ruin of his affairs. In a short time Pembroke was so much strengthened by deserters from Louis’s party, that he ventured to invest Mount Stoe; though upon the approach of the count de Perche with the French army, he desisted from that enterprise. The French general immediately marched to Lincoln; and, being admitted into the town, laid siege to the castle, and soon reduced it to extremity. Pembroke summoned his forces from every quarter, in order to relieve this important place; and he appeared so much superior to the French, that they shut themselves up within the city, resolving to take shelter there. But the garrison of the castle, having received a strong reinforcement, made a vigorous sally upon the besiegers, while the English army assaulted them from without. The French army was totally routed; the count de Perche with only two persons more were killed; but many of the chief commanders, and about 400 knights, were made prisoners. On the news of this fatal event, Louis raised the siege of Dover, and retired to London; where he received intelligence of a new disaster, which put an end to all his hopes. A French fleet, which carried a strong reinforcement, had appeared on the coast of Kent: where they were attacked and repulsed with considerable loss by Philip d’Albini. He is said to have gained the victory by the following stratagem. Having got the wind of the French, he came down upon them with violence; and throwing on their faces a great quantity of quicklime, which he purposely carried on board, they were so blinded that they were disabled from defending themselves. This misfortune so discouraged the barons who yet adhered to Louis, that they came from every quarter to make their submission to Pembroke; and Louis himself, finding his affairs totally desperate, was glad to make his escape from a country where every thing was become hostile to him. He therefore concluded a peace with the protector; promised to evacuate the kingdom; and only stipulated, in return, an indemnity to his adherents, and a restitution of their honours and fortunes, together with the free and equal enjoyment of those liberties which had been granted to the rest of the nation.

When the king grew up, he was found to be very unfit for the government of such a turbulent people as the English at that time were. Though his temper was mild and humane, he was also very weak, fickle, and irresolute. He disgusted the people by the careness he bestowed on foreigners; and this disgust rose once to such a height, that the barons refused to assemble in the general council of the nation, or parliament, at his desire. When commanded to do so, they sent a message to Henry, desiring him to dismiss his foreigners; otherwise they would drive both him and them out of the kingdom, and put the crown on the head of one who was more worthy to wear it. The king, on the contrary, induced him to heap riches upon his foreign favourites in a manner which he could by no means afford; this often brought him into very great straits; and to relieve himself, he was obliged to have recourse to many arbitrary measures, which he could not otherwise have chosen. Nothing, however, of very great moment happened till the year 1255, when the pope found means to embark Henry in a scheme for the conquest of Naples, or Sicily on this side the Eare, as it was called; an enterprise, which not only brought much dishonour to the king, but involved him for some years in very great expense and trouble. The court of Rome some time before had reduced the kingdom of Sicily to the same state of feudal vassalage which he pretended to exercise over England; but Mainfroy, an usurer, under pretence of governing the kingdom for the lawful heir, had seized the crown, and was resolved to reject the pope’s authority. As the pope found that his own force was not sufficient to gain his point, he had recourse to Richard the king of England’s brother, who had been created earl of Cornwall, and had such talents for amassing money, that he was reckoned the richest prince in Christendom. To him the pope offered the kingdom of Sicily, upon the single condition of his conquering it from the usurper. Richard was too wise to accept this offer; upon which the pope applied to Henry, and offered him the crown of Sicily for his second son Edmund. Henry, dazzled by this proposal, without reflecting on the consequences, or without consulting his brother or the parliament, gave the pope unlimited credit to expend whatever sums he thought necessary for completing the conquest of Sicily. In consequence of this unlimited grant, his holiness determined to exert his apostolical authority to the utmost, in extorting money from the English. A crusade was published, requiring every one who had taken the cross against the infidels, or even vowed to advance money for that purpose, to support the war against Mainfroy, whom he accused of being a more terrible enemy
ENGLAND.

A grant was made to the king of the goods of intestate clergy, as well as of the revenues of vacant benefices and those of non-residents. These taxation, however grievous, were submitted to with little murmuring, but another suggestion by the bishop of Hereford excited the most violent clamours. This prelate, who at that time resided in the court of Rome, drew hails on all the abbots and bishops of the diocese, the amount of which was 120,540 marks, which he granted to Italian merchants in consideration of the money they had expended to advance the support of the Sicilian war. As it was apprehended that the English clergy would not easily submit to such an extraordinary demand, a commission was given to Rustond, the pope's legate, to use his authority. An assembly of the prelates and abbots was accordingly summoned; who, on hearing the proposal sanctified with the names both of the pope and king, were struck with the utmost surprise and indignation. A violent altercation took place; during which the legate told them, that all ecclesiastical benefices were the property of the pope, and that he might dispose of them as he pleased. The affair ended, however, in the submission of the clergy; but the barons still continued refractory, and for some time answered the king's demands of supplies with expletives; urging the king's partiality to foreigners, and the various injuries the nation had sustained from the seat of crown. The great notion of the nation, which had late obtained the name of parliaments, was thereupon dissolved, and another called, but with as little success as before. The king, however, had involved himself in so much debt, that a large supply was become absolutely necessary; and as that could by no means be obtained from parliament, he was now reduced to the humiliating expedient of going about among several of his subjects as he thought most attached to him, and begging assistance from them at their own houses. At length his barons, perceiving the exigencies to which he was reduced, seemed willing to afford him aid; and, upon his promising to grant them a plenary redress of grievances, a very liberal supply was obtained, for which he renewed their charter with more usual solemnity. All the prelates and abbots were assembled with burning tapers in their hands; the magna charta was read in their presence; and they denounced sentence of excommunication upon whom should infringe upon its decisions. They then put out their tapers on the ground, and exclaimed, "May every soul that procures false to this agreement be stoned and corrupted in hell." The king subjoined, "So help me God, I will inviolably keep all these things, as I am a man, as I am a Christian, as I am a knight, and as I am a king crowned and anointed."

No sooner had the king received the supplies of which he stood so much in need, than he forgot all his engagements, put his confidence entirely in foreign counsellors, and evaded or broke through in numerous instances the charters he had given. This conduct rendered him so obnoxious to the barons, that Simon Mosehurst earl of Leicester, a man of a very violent and ambitious temper, determined to attempt no innovation in the government. He formed a powerful conspiracy against the king, and the designs of the conspirators were effectually put in execution in the year 1234. Henry had summoned a parliament in expectation of receiving supplies for his Sicilian project; when the barons appeared in the hall, clad in complete armour, with their swords by their sides. The king, struck with this unusual appearance, asked them what was their purpose, and whether they pretended to make him their prisoner? Roger Bigod, earl marshal, answered in name of the rest, that they wished to be their prisoner; that they even intended to grant him large supplies, in order to fix his son on the throne of Sicily; that they only expected some return for this expense and service; and that as the king had frequently made submissions to the parliament, he acknowledged his past errors, and had still allowed himself to be carried into the same path, which gave them such reason of complaint, he must now yield to more strict regulations, and confer authority on those who were able and willing to redress the public grievances. Henry instantly assured them of his intentions to grant them all possible satisfaction; and for that purpose summoned another parliament at Oxford, to digest the new plan of government, and to elect proper persons who were to be entrusted with the chief authority. This assembly, afterwards called the most parliament, went very expeditiously to work on the business of reforming. Twenty-four barons were appointed, with supreme authority, to reform the abuses of the state; and Leicester was placed at their head. The first step was to order four knights to be chosen out of each county, who should examine into the state of their respective constituents, and should attend at the ensuing parliament to give information of their complaints. They ordained that three sessions of parliament should be regularly held every year; and that a new high sheriff should be elected annually; that no wards nor castles should be entrusted to foreigners, no new forests made, nor the revenues of any counties let to farm.

These constitutions were so just, that some of them remain to this day. But the parliament having once obtained the sovereign power, took care not to part with it again. They set only protracted the time of their sitting under various pretences; but at last had the effrontery to impose an oath upon every individual of the nation, declaring an implicit obedience to all the statutes executed or to be yet executed by the barons who were thus appointed as rulers. They not only abridged the authority of the king, but the efficacy of parliament also; giving up to 12 persons the whole parliamentary power between each session.—Their usurpations were first opposed by the knights of the shires, whom they themselves had appointed. These had for some time began to be regularly assembled in a separate house, to consider of the national grievances; the first of which was the conduct of the 24 rulers. They represented, that though the king had performed all that was required of him, the barons had hitherto done nothing on their part that showed an equal regard for the people; that their own interest and power seemed the only aim of all their decrees; and they even sailed upon the king's eldest son Prince Edward.
ENGLAND.

England. Edward to interpose his authority, and save the sinking nation.

A.D. 1515.

The prince was at this time about 22 years of age, and by his active and resolute conduct had inspired the nation with great hopes. He told those who made the application to him, that he had sworn to the late constitutions; and, on that account, though they were contrary to his own private opinions, he was resolved not to infringe them. At the same time, however, he sent a message to the barons, requiring them to bring their undertaking to an end, or otherwise to expect the most vigorous resistance to their usurpations. On this the barons were obliged to publish a new code of laws, which, though it contained scarce any thing material, yet, it was supposed, would for a while dazzle the eyes of the people, until they could take measures to establish their authority upon surer foundations. In this manner, under various pretences, they continued their power for three years; while the whole nation loudly condemned their treachery, and the pope himself at last absolved the king and his subjects from the oath they had taken to obey their injunctions. Soon after this, a parliament was called, and the king reinstated in his former authority. The barons were obliged to submit for a time; but the Earl of Leicester having joined the Welsh, who at a time made an irruption into England, the kingdom was reduced to the most deplorable situation. The pusillanimity of the king prevented any proper or judicious method from being pursued for extirpating the people from their distresses; and at last a treaty was concluded with the barons on the most disadvantageous terms that can be imagined. They were restored to the sovereignty of the kingdom, took possession of all the royal castles and fortresses, and even named the officers of the king's household. They summoned a parliament to meet at Oxford, in order more fully to settle the plan of government; and by this assembly it was enacted that the authority of the 24 barons should continue not only during the life of King Henry, but also during that of Prince Edward.

Who is deposed and taken prisoner, with the king and his brother.

These scandalous conditions would have been easily complied with by King Henry; but they were utterly rejected by Prince Edward, and a civil war immediately ensued. The prince was at first successful; but, though his impetuosity, occasioned the loss of a great battle, in which his father and uncle were taken prisoners, and he himself was obliged soon after to surrender to the Earl of Leicester. The king was now reduced to the most deplorable situation. His partisans were totally disarmed, while those of the Earl of Leicester still kept themselves in an offensive posture. Leicester seized the estates of no fewer than 18 barons; engrossed to himself the ransom of all the prisoners; monopolized the sale of wood to foreign markets; and at last ordained that all power should be exercised by nine persons, who were to be chosen by three others, or the majority of them; and these three were the Earl of Leicester himself, the Earl of Gloucester, and the Bishop of Chichester.

First House of Commons.

The miserable situation to which the kingdom was now reduced, proved at last the means of settling the government on a more proper foundation. Leicester, in order to secure himself, was obliged to have recourse to an aid, till now entirely unknown in England, namely, that of the body of the people. He called a parliament, where, besides the barons of his own party, and several ecclesiastics who were not proper tenants of the crown, he ordered returns to be made of two knights from every shire; and also deputies from the boroughs, which had been hitherto considered as too inconsiderable to be allowed any share in the legislation. This parliament was called on the 26th of January 1526; and here we find the first outline of an English House of Commons; an institution which has ever since been considered as the bulwark of British liberty.

The new parliament was far from being so compliant to Leicester as he had desired or expected. Many of the barons who had hitherto steadfastly adhered to his party were disgusted with his boundless ambition; and the people, who found that a change of masters was not a change from misery to happiness, began to wish for the re-establishment of royal authority. Leicester at last, to make a merit of what he could not prevent, released Prince Edward from his confinement, and had him introduced at Westminster-ball, where his freedom was confirmed by the unanimous voice of the barons. But though Leicester had all the popularity of restoring the prince, he was yet politic enough to keep him guarded by his emissaries, who watched all his actions. At last, however, he found means to make his escape by the following manner. The Duke of Gloucester, being disgusted with Leicester, retired from court, and went to his estates on the borders of Wales. His antagonist pursued him thither; and to give the greater authority to his arms, carried the king and prince of Wales along with him. This furnished young Edward with the opportunity he had so long desired. Being furnished by the Earl of Gloucester with a horse of extraordinary swiftness, he took leave of his attendants, who were in fact his guards, but were not able to come up with him. They pursued him, however, for some time; but the appearance of a body of troops belonging to Gloucester soon put an end to their pursuit.

The prince no sooner recovered his liberty, than the royalists joined him from all quarters, and an army was soon procured which Leicester could not withstand. This nobleman now found himself in a remote quarter of the kingdom; surrounded by his enemies; and debarred from all communication with his friends by the river Severn, whose bridges Edward had broken down. In this extremity, he wrote to his son to hasten to his assistance from London, with a considerable body which he had under his command. With this view his son advanced to Kenilworth; but here he was surprised, and his army entirely dispersed by Prince Edward. The young prince, immediately after this victory, advanced against Leicester himself; who, ignorant of the fate of his son's army, had passed the Severn in boats. He was by no means able to cope with the royalists; his men being inferior both in numbers and resolution to their antagonists. His army was defeated with great slaughter. Leicester himself was slain, though he called out for quarter, together with his eldest son Henry, and about 100 knights and other gentlemen. The old king had been purposely placed by the rebels in the front of the battle, where he was wounded, and in great danger of being killed; but, crying out, "I am Henry of Winchester your king," he was saved and put in a place of security by his son, who...
England, who had flown to his assistance. The body of Leicester being found among the dead, was barbarously mangled by one Roger Mortimer; and then sent to his widow, as a testimony of the royal party’s barbarity and success.

This victory, gained at Evesham, proved decisive in favour of the royal party. Almost all the castles, garrisoned by the barons, hastened to make their submissions, and opened their gates to the king. The Isle of Axholme alone, and that of Ely, trusting to the strength of their situation, ventured to make resistance; but were at last reduced, as well as the castle of Dover, by the valour and activity of Prince Edward. Adam de Gourdon, a courageous baron, maintained himself some time in the forests of Hampshire, committing depredations in the neighbourhood; and obliged the prince to lead a body of troops into that country against him. Edward attacked the camp of the rebels; and being transported by the ardour of action, leaped over the trench with a few followers, and encountered Gourdon himself in a single combat. The victory was long disputed between these two valiant combatants; but ended at last in the prince’s favour, who wounded his antagonist, threw him from his horse, and took him prisoner. He not only granted him his life, but introduced that very night to the queen at Guildford, procured his pardon, and was ever after faithfully served by him.

In 1275, Prince Edward, having settled the affairs of the kingdom, undertook an expedition to the Holy Land, where he signalled himself by many acts of valour. The king’s health declined visibly after the departure of his son; and at last, worn out with cares and the infirmities of age, he expired at 88 Edmonsbury on the 16th of November 1272, in the 64th year of his age and the 56th of his reign.

Death of Henry III.

Prince Edward had reached Sicily in his return from the Holy Land, when he received an account of his father’s death; at which he expressed much concern. As he knew that England was at that time in a state of perfect tranquillity, he was in no haste to return, but spent near a year in France before he made his appearance in England. He was received by his subjects with the utmost joy, and crowned at Westminster by Robert archbishop of Canterbury on the 19th of August 1274. He immediately applied himself to the correcting of those disorders which the civil commotions, and weak administration of his father, had introduced. A system of strict justice, bordering on severity, was introduced and kept up through the whole of this reign. The Jews were the only part of his subjects whom Edward oppressed. Many arbitrary taxes were levied upon them; 280 of them were hanged at once for adulterating the coin; the goods of the rest were confiscated, and all of them banished the kingdom.

Edward I.

In 1276, the king undertook an expedition against Lewellyn prince of Wales, who had refused to do homage for his crown. The conquest of that country was not fully accomplished till the year 1283; after which the principality of Wales was annexed to the crown of England, and thenceforth gave a title to the king’s eldest son. In 1286, the settlement of Wales appeared so complete, that the king went abroad in order to make peace between Alfonso king of Arragon and Philip le Bel king of France, who had a difference about the kingdom of Sicily. He succeeded in his negotiations; but, staying abroad three years, he found that many disorders had been introduced in his absence. Many instances of robbery and violence had broken out in all parts of England; but the corruption of the judges, by which the fountains of justice were poisoned, was of still more dangerous consequence. Edward, in order to remedy this prevailing abuse, summoned a parliament, and brought the judges to a trial; where all of them except two, who were clergymen, were convicted of this flagrant iniquity, were fined, and deposed from their office. The amount of the fines levied upon them is of itself a sufficient proof of their guilt, being above 100,000 marks; an immense sum in those days, sufficient to defray the expenses of a war between two great nations. The king afterwards made all the new judges swear that they would take no bribes; but the deposing and fining the old ones was the more effectual remedy.

In 1291, King Edward began to meditate the conquest of Scotland, which employed him during the rest of his life; but which, though that kingdom was by him reduced to the greatest distress, he was never able to accomplish. At the same time, he was engaged in expensive contests with France; and these multiplied wars and preparations for war, by obliging him to have frequent recourse to parliamentary supplies, became the remote causes of great and important changes in the government. The parliament was new modelled into the form which has continued ever since.

As a great part of the property of the kingdom, by the introduction of commerce and improvements in agriculture, was transferred from the barons to the lower class of people, so their consent was thought necessary for raising the supplies. For this reason, the king issued writs to the sheriffs, enjoining them to send to parliament, along with two knights of the shire, two deputies from each borough within their county; and these provided with sufficient powers from their constituents to grant such demands as they should think reasonable for the safety of the state. The charges of these deputies were to be borne by the boroughs which sent them; and so far were they from considering this deputation as an honour, that nothing could be more displeasing to any borough than to be thus obliged to send a deputy, or to any individual than to be thus chosen. The authority of these commons, however, increased through time. Their union gave them weight; and it became customary among them, in return for the supplies which they granted, to prefer petitions to the crown for the redress of those grievances under which the nation was supposed to labour. The more the king’s necessities increased, the more he found it necessary to give them an early redress; till, from requesting, the commons proceeded to requiring; and having all the property of the nation, they by degrees began also to be possessed of the power.

Edward I. died of a dysentery at Carlisle on the 3rd and 7th of July 1307, as he was leading a great army into succeeded Scotland, against the inhabitants of which he had vowed the most dreadful vengeance. He was succeeded by his son Edward II., whom he had charged with his dying breath to prosecute the war against Scotland, and never to desist till he had finally subdued the kingdom.

* See Wales.

england.

A.D. 1514.

The reign of Edward II. affords no particulars of great moment. Being a prince of a weak understanding, though endowed with no remarkable bad qualities, his reign was one continued series of quarrels with his turbulent subjects. His favourites were the most general causes of discontent. The first of these was one Piers Gaveston, the son of a Gascon knight of some distinction, who had honourably served the late king, and who, in reward for his services, had obtained an establishment for his son in the family of the prince of Wales.—To be the favourites of any king whatever, is no doubt in itself a sufficient offence to the rest of the courtiers. Numberless faults were therefore found with Gaveston by the English barons. When the king went to expose the prince Isabella, to whom he had been long contracted, Gaveston was left guardian of the realm, with more ample powers than had usually been conferred in such a case. But when the queen, who was of an imperious and intriguing spirit, arrived, Gaveston had the misfortune to fall under her displeasure also; on account of the ascendency he had acquired over the king. A conspiracy was therefore soon formed against the favourite; at the head of which were the queen, and the earl of Lancaster, cousin-german to the king, and the most opulent and powerful nobleman in England. The king, unable to resist such a combination, was at last obliged to banish Gaveston; but recalled him some time after. This was sufficient to spread an alarm over the whole kingdom: a civil war ensued; and the nobility having got Gaveston into their hands, soon freed themselves of any further apprehensions from him, by putting him to death.

After this decisive defeat at Baunockburn, King Edward chose a new favourite named Hugh le Despenser. He was a young man of a noble English family, some merit, and very engaging accomplishments. His father was a person of a much more respectable character than the son; but the being admitted to a share of King Edward's favour was a sufficient crime. The king imprudently dispossessed some lords of their estates, in order to bestow them upon this favourite; and this was a sufficient pretence for openly attacking both the father and son. The earl of Lancaster and Hertford flew to arms. Sentence was procured from parliament of perpetual exile against the two Spencers, with a forfeiture of all their estates. At last the king took the field at the head of 30,000 men, and pressed the earl of Lancaster so closely, that he had not time to collect his forces together; and, flying from one place to another, he was at last stopped in his way towards Scotland, and made prisoner. He was immediately condemned by a court-martial; and executed on an eminence near Pomeroy, with circumstances of the greatest indignity.

Spencer now triumphed for some time over his enemies; most of the forfeitures were seized for his use, and he is said to have been guilty of many acts of rapine and injustice. But he was soon opposed by a more formidable enemy, Queen Isabella. She went to France, and refused to return to England till Spencer was removed from the royal presence, and banished the kingdom. Thus she made herself popular in England, where she was received with delight; and she had the pleasure of enjoying the company of a young nobleman named Martyn, upon whom she had lately placed her affections. The queen's court, therefore, became a sanctuary for all the malcontents who were banished their own country, or who chose to come over. When she thought matters were ripe for her purpose, she sailed from Dorset harbour, accompanied by 3000 armed men. She landed without opposition on the coast of Suffolk, on the 24th of September 1326; and she appeared, than there seemed to be a general re- volt in her favour. The unfortunate king found the spirit of disloyalty spread over the whole kingdom. He had placed some dependance on the garrison of Bristol, which was under the command of the elder Spencer; but they continued against their governor; and that unfortunate favourite was deposed, and condemned by the tumultuous barons to the most ignominious death. He was hanged on a gibbet in his armour; his body was cut in pieces and thrown to the dogs; and his head was sent to Winchester, where it was set on a pole, and exposed to the insults of the populace. Young Spencer did not long survive his father. He was taken, with some others who had followed the fortunes of the wretched king, in an obscure convent in Wales. The queen had not patience to wait the formality of a trial; but ordered him to be immediately led forth before the insulting populace, and seemed to take a savage pleasure in beholding his distress. He was executed on a gibbet 50 feet high; his head was sent to London, where it was received by the citizens with brutal triumph, and fixed on the bridge.

In the mean time the king, who hoped to find refuge in Wales, was quickly discovered, and delivered up to his adversaries; who treated him in the most inhuman manner. He was conducted to the Tower under the insults and reproaches of the people, and confined in the Tower. A charge was soon exhibited against him; in which no other crimes but his incapacity to govern, his indolence, his love of pleasure, and his being swayed by evil counsellors, were objected against him. His deposition, however, was quickly voted by parliament; he was assigned a pension for his support; his son Edward, a youth of 14, was chosen to succeed him, and the queen was appointed regent during the minority. The deposed monarch did not long survive the loss of his crown. He was at first consigned to the custody of the earl of Lancaster; but this nobleman showed some marks of respect and pity, he was taken out of his hands, and delivered over to the lords Berkeley, Mautravers, and Gurnay, who were entrusted alternately, each for a month, with the charge of guarding him. While he was in Berkeley's custody, he was still used with some degree of humanity; but when the turn of Mautravers and Gurnay came, every species of indignity was practised upon him, as if they had designed to accelerate his death by the bitterness of his sufferings. It is reported, that one day when
Edward was to be shaved, they ordered cold and dirty water to be brought from a ditch for that purpose; and when he desired it to be changed, and was still denied his request, he burst into tears, and exclaimed, That in spite of their insolence he should be shaved with clean and warm water. As his persecutors, however, saw that his death might not arrive, even under every cruelty they could practice, and were daily afraid of a revolution in his favour, they determined to rid themselves of their fears by destroying him at once. Mortimer, therefore, secretly gave orders to the two keepers, who were at his devotion, instantly to dispatch the king; and these ruffians contrived to make the manner of his death as cruel and barbarous as possible. Taking advantage of Berkeley's sickness, in whose custody he then was, and who was thereby incapacitated from attending his charge, they came to Berkeley-castle, and put themselves in possession of the king's person. They threw him on a bed, and held him down with a table which they had placed over him. They then ran a hose-pipe up his body, through which they conveyed a red-hot iron; and thus burnt his bowels without disfiguring his body. By this infernal contrivance they expected to have their crime concealed: but the horrid shrieks of the king, which were heard at a distance from the castle, gave a suspicion of the murder; and the whole was soon after divulged by the confession of one of the accomplices. Gournay and Mauvartes were held in detention by all mankind; and when the ensuing revolution deprived their protectors of power, they found it necessary to fly the kingdom. Gournay was afterwards seized at Marseilles, delivered over to the seneschal of Guienne, and put on board a ship with a view of carrying him over to England; but he was beheaded at sea, by secret orders, as was supposed, of some nobles and prelates of England, anxious to prevent any discovery which he might make of his accomplices. Mauvartes concealed himself for some years in Germany; but having found means of rendering some services to Edward III, he ventured to approach his person, threw himself on his knees before him, and received a pardon.

By the death of Edward II, the government fell entirely into the hands of the queen and her paramour Mortimer. The parliament, which raised young Edward to the throne, had indeed appointed 12 persons as his privy-council, to direct the operations of government. Mortimer excluded himself, under a show of moderation; but at the same time secretly influenced all the measures that came under their deliberation. As this influence began very soon to be perceived, and the queen's criminal attachment to Mortimer was universally known, these governors soon became very obnoxious to the people. The first stroke given to Mortimer's power was during an irruption of the Scots, when the favourite prevented the young king from attacking the enemy. Though it is very probable that the English army would have been destroyed by making an attack on an army situated in such an advantageous post as the Scots at that time occupied, Mortimer incurred great blame on that account. He was accused of having allowed the Scots to make their escape; and the general disgust on this account was increased by his concluding a peace with that kingdom, wherein the English renounced all title to the sovereignty of Scotland for the sum of 30,000 marks. Soon after Mortimer seized and executed the earl of Kent, brother to the late king; who, supposing Edward II, to be still alive, had formed a design of reinstating him in his kingdom. The execution was so sudden, that the young king had not time even to interpose in his behalf; and Mortimer soon after seized this nobleman's estate for his own use, as he did all the immense fortunes of the Spencers.

Edward, finding the power of Mortimer a continual restraint upon himself, resolved to shake off the authority that was likewise grown odious to the whole nation. The queen and Mortimer had for some time chosen the castle of Nottingham for their residence. It was strictly guarded, the gates were locked every night, and the keys carried to the queen. It was therefore agreed between the king and some of the barons, who secretly entered into his designs, to seize upon them in this fortress. Sir William Eland the governor was induced to admit them through a subterraneous passage, which had been formerly contrived for an outlet, but was now choked up with rubbish, and known only to one or two. Through this passage the noblemen in the king's interest entered the castle in the night-time; and Mortimer, without having it in his power to make any resistance, was seized in a place adjoining to that of the queen. The parliament, which was then sitting, condemned him, without either permitting him to make his defence, or examining a single witness against him. He was hanged on a gibbet at a place called Elmers, about a mile from London. A similar extravagance sentence was passed against some of his adherents, particularly Gournay and Mauvartes, who found an opportunity of escaping as above mentioned. The queen, who was perhaps the most culpable of the whole, was screened by the dignity of her station. She was, however, deposed from all share of power; and confined for life to the castle of Rising, with a pension of 3000 pounds a-year. From this confinement she was never set free, though the king paid her an annual visit of ceremony. She lived 25 years after her deposition.

Edward III. proved the greatest warrior that ever sat on the English throne. He first attempted to raise Edward Baliol to the sovereignty of Scotland; but this he found impossible fully to accomplish. Edward next formed a project of invading and conquering France, to the sovereignty of which he pretended a French birthright. His first expectations were attended with so little success, that on his return to England he found the nation very much discontented, and himself harassed by his numerous creditors, without any sufficient resource for paying them. Being determined, however, not to bear any blame himself if he could throw it anywhere else, he took the first opportunity of wreaking his vengeance upon his subjects. Finding his arbi- therefore the tower of London negligently guarded on his return, he imprisoned the constable and all his officers, treating them with the greatest severity. He then fell upon the sheriffs and collectors of the revenue, whom he dismissed from their employments, and appointed an inquiry into their conduct to be made by persons who, knowing the king's humour, were sure to find every one guilty who came before them. The keeper of the privy-seal, the chief-justice, the mayor of London, the
the bishops of Chichester and Litchfield, with the chancellor and treasurer, were deposed and imprisoned. In this case, a resentment and cruelty, however, he found himself opposed by the archbishop of Canterbury, whom he had appointed to collect the taxes laid on for the support of the French war. That prelate happening to be absent at the time of the king's arrival, did not immediately feel the effects of his resentment. Being informed, however, of the humour in which his sovereign was, he issued a sentence of excommunication against all who, on any pretence whatever, should exercise violence against the persons or estates of clergy or persons, or who infringed those privileges secured by the great charter, or who accused a prelate of treason, or any other crime, in order to bring him under the king's displeasure. A regular combination was formed against the king by the clergy, with the priors at their head; who, to excite the indignation of the people as much as possible, reported to the king intended to recall the general pardon and the remission to old debts which had been granted, and to impose fresh and arbitrary taxes without consent of parliament. The archbishop also, in a letter to the king, informed him, that there were two powers by which the world was governed, viz. the holy pontifical apostolic dignity and the regal authority; of which the clerical power was evidently the supreme, as the priests were to answer even for the conduct of kings at the last judgment; and were besides the spiritual fathers of all the faithful, kings and princes not excepted; having, besides, a heavenly charter, enabling them to direct their wills and actions, and to censure their transgressions. On this the king resolved to mortify him, by sending no summons to him when the parliament was called: but the prelate, undaunted by this mark of resentment, appeared before the gates of the parliament-house with his crosier in his hand, demanding admittance as the first peer of the realm. This application was rejected for two days, but at last complied with; and the parliament now no longer chose to abridge the king's authority considerably. They began with observing, that as the great charter had been violated in many points, particularly by the illegal imprisonment of many freemen and the seizure of their goods, it was necessary to confirm it anew, and to oblige all the chief officers of the law and others to swear to the observance of it. It was also required, that whenever any of the great officers became vacant, the king should fill them up by the advice of his council and the consent of such barons as should at the time be found to reside in the neighbourhood of the court. They enacted also, that on the third day of every session the king should resume all such offices into his own hand, excepting those of the justices of the two benches and the barons of exchequer; that the ministers should for the time be reduced to private persons; that they should in that condition answer before parliament to any accusations preferred against them; and that, if they were found in any respect guilty, they should be finally deprived of their offices, and others appointed in their stead. In return for such ample concessions, the king was offered a grant of 20,000 sacks of wool; and such was his urgent necessity, that he was compelled to accept it even upon these terms. Still, however, he deter-

mined to adhere to his engagements no longer than till this necessity was removed. Though the agreement, therefore, was ratified in full parliament, he secretly entered a protest; that, as soon as his convenience permitted, he would from his own authority revoke what had been extorted from him. This protest was afterwards confirmed by a public edict; in which he intimated, that all that statute had been made contrary to law; that it was prejudicial to the prerogatives of the crown, which he had only dissembled when he seemed to ratify it; and that in his own breast he had never assented to it: and declared, that from henceforth it had no force or authority. This exertion of arbitrary power, which it might have been imagined would have his power, occasioned a prodigious clamour, was not taken notice of by any of the subsequent parliaments; so that in the course of two years Edward had entirely regained his authority, and obtained a repeal of the obnoxious statute just mentioned. Having thus settled matters of general importance, the king resumed his expedition against France, where he gained great advantages. In his absence the Scots invaded England; but were entirely defeated at Durham, and his king himself taken prisoner. The English king in the mean time continued his victories on the continent; in which he was greatly assisted by Edward enshrined the Black Prince, the greatest hero recorded in the English annals. But for the wars of Edward III. and the exploits of this famous prince, see the articles SCOTLAND AND FRANCE. The Black Prince died on the 8th of June 1376, and the king survived only about a year. He expired on the 21st of June 1377, and was succeeded by his second son Richard.

As the new king was only eleven years old when Richard II. ascended the throne, the government was vested in the hands of his three uncles, the duke of Lancaster, York, and Gloucester. The different dispositions of these noblemen, it was thought, would cause them check the designs of each other. Lancaster was neither popular nor enterprising; York was indolent and weak; and Gloucester turbulent, popular and as famous as his contents first arose among the common people. They had now acquired a share of liberty sufficient to inspire them with a desire for more, and this desire was greatly increased by the discourses of John Ball a seditious preacher. He went about the country, and incited on his audience, that mankind were all derived from one common stock; and that all of them had equal right to liberty and the goods of nature, of which they had been deprived by the ambition of a few insolent rulers.

These doctrines were greedily swallowed by the populace, who were further inflamed by a new imposition, of three groats a-head upon every person in the kingdom above 15 years of age. This had been granted as a supply by parliament, and was no doubt necessary, on account of the many expensive wars in which the kingdom was engaged, but its apparent injustice, in laying no more burden upon the rich than the poor, excited the utmost resentment of the people. The manner, too, of collecting this tax, soon furnished them with an occasion of revolt. It began in Essex, where a report was industriously spread that the peasants were to be destroyed, their houses burned, and their farms plundered. A blacksmith, well known by the name of
England.

A.D. 1377.

England.

of Wat Tyler, was the first that excited them to arms.

The tax-gatherers coming to this man's house while he was at work, demanded payment for his daughter.

This he refused, alleging that she was under the age mentioned in the act.

One of those fellows offered to produce as very indecent proof to the contrary, and at the same time laid hold of the maid. This the father resenting, immediately knocked out the ruffian's brains with his hammer. The bystanders applauded the action; and exclaimed that it was high-time for the people to take vengeance on their tyrants, and to vindicate their native liberty. The whole country immediately took arms, and the insurgents soon amounted to about 100,000 men. They advanced to Blackheath, where they sent a message to the king, who had taken shelter in the Tower, desiring a conference with him. The king was desirous of complying with their demands, but was intimidated by their fierce behaviour. In the mean time, they entered the city, burning and plundering the houses of such as were obnoxious for their power or riches. Their animosity was particularly levelled against the lawyers, to whom they showed no mercy. The king, at last, knowing that the Tower was no longer able to resist their assaults, sent out among them, and desired to know their demands. To this they made a very humble remonstrance; requiring a general pardon, the abolition of slavery, freedom of commerce in the market-towns, and a fixed rent instead of those services required by the tenure of vil-

The king granted all these requests; and charters were made out by which the grant was ratified. In the mean time, however, another body of these insurgents had broke into the Tower, and murdered the chancellor, the primate, and the treasurer, with some other officers of distinction. They then divided themselves into bodies, and took up their quarters in different parts of the city. At the head of one of these was Wat Tyler, who led his men into Smithfield, where he was met by the king, who invited him to a conference under pretence of hearing and redressing his grievances. Tyler ordered his compatriots to retire till he should give them a signal, and boldly ventured to begin a conference with the king in the midst of his retinue. His demands were, That all slaves should be set free; that all commoners should be open to the poor as well as to the rich; and that a general pardon should be passed for the late outrages. Whilst he made these demands, he now and then lifted up his sword in a menacing manner: which insolence so raised the indignation of William Walworth lord mayor of London, that, without considering the danger to which he exposed his majesty, he stunned Tyler with a blow of his mace, while one of the king's knights riding up, dispatched him with his sword. The multitudes, seeing their leader fall, prepared themselves to take revenge. Their bows were already bent for execution: when Richard, though not yet 16 years of age, rode up to the rebels, and with admirable presence of mind cried out: "What, my people, will you kill your king? Be not concerned for the loss of your leader. I myself will now be your general. Follow me into the field, and you shall have whatever you desire." The multitude immediately disisted, and followed the king into the fields, where he granted them the same charters that he had before granted to their compa-

nions. These charters, however, were soon after revoked, and the common people reduced to the same situation in which they had formerly been.

The courage, address, and presence of mind, which the king had discovered in quelling such a dangerous tumult, gave great hopes to the nation: but, in proportion as Richard advanced in years, these hopes were blasted; and his want of capacity, or at least of solid judgment, appeared in every enterprise he attempted. The king had unluckily lost the favour of the common people after the insurrection just mentioned. He allowed the parliament to revoke the charters of enfranchisement and pardon which had been granted to some of the ringleaders in the late disorders had been severely punished, and some even put to death without any form or process of trial. Thus the popular leaders were greatly exasperated by this cruelty, though probably the king did not follow the dictates of his own mind so much in it as the advice of his counsellors. But having thus lost the favour of one party, he quickly fell under the displeasure of the other also. Supposing himself to be in too great subjection to his uncles, particularly the duke of Gloucester, he attempted to shake off their assaults by casting them to such a degree of power as might enable them to rival them. His first favourite was Robert de Vere, Earl of Oxford, a young man of an agreeable person, but dissolute in his behaviour, who soon acquired an absolute ascendant over him. So much was he deter-

mined to show his attachment to this nobleman, that he first created him marquis of Dublin, a title never known in England before; then duke of Ireland; transferring to him the entire sovereignty of that island by patent for life. He gave him in marriage his cousin-german, the daughter of the earl of Bed-

ford; but soon after permitted him to divorce her for another lady with whom he had fallen in love. This nobleman soon became the dispencer of all the king's favours to such a degree, that a conspiracy was formed against him; at the head of which were Mowbray, earl of Nottingham, Fitz Alan earl of Arundel, Percy earl of Northumberland. Montacute earl of Salisbury, and Beauchamp earl of Warwick. Vere was impeached in parliament; and though nothing was even alleged against him, he was condemned and deprived of his office. They next proceeded to attack the royal authority itself. Under pretence that the king was yet unable to govern the kingdom, though at that time 21 years of age, they appointed a commission of 14 persons whom the sovereignty was to be transferred for a year. This measure was driven forward by the duke of Gloucester, and none but his own faction were admitted as members of the committee. The king could not without regret perceive himself thus totally deprived of authority. He first endeavoured to gain over the parliament to his interests, by influencing the sheriffs of each county, who were then the only returning officers. This measure failing, he next applied to the judges. They declared, that the commission which had deprived the king of his authority was unlawful, and that those who procured or advised it were punishable with death. Their sentence was quickly opposed by declara-

Highgate.
ENGLAND.

In 1389, Highgate, at the head of a body of men sufficient to intimidate the king and all his adherents. These insurgents, sensible of their own powers, began by demanding the names of those who had advised him to his late rash measures. A few days afterwards they appeared armed in his presence, and accused by name the archbishop of York, the duke of Ireland, the earl of Suffolk, and Sir Robert Treasillian, one of the judges who had declared in his favour, together with Sir Nicholas Bember, as public and dangerous enemies to the state. The duke of Ireland fled into Cheshire, where he attempted to raise a body of forces; but was quickly obliged to fly into Flanders, on the arrival of the duke of Gloucester with a superior army. Soon after, the king was obliged to summon a parliament, where an accusation was drawn up against five of his councillors. Of these only Nicholas Bember was present; and he was quickly found guilty, condemned, and executed, together with Sir Robert Treasillian, who had been discovered and taken during the interval. Lord Beauchamp of Holt was soon after summoned, and executed; and Sir Simon Burley, who had been the king's governor, shared the same fate, though the queen continued for three hours on her knees before the duke of Gloucester, imploring his pardon.

Such unparalleled insolence and barbarity in a subject could not go unpunished. In 1389, the king at an extraordinary council of the nobility assembled after Easter, to the astonishment of all present, desired to know his age. Being told that he was turned of twenty, he alleged that it was then time for him to govern without help; and that there was no reason why he should be deprived of those rights which the meanest of his subjects enjoyed. The lords answered in some confusion that he had certainly an undisputed right to take upon himself the government of the kingdom. "Yes (replied the king), I have long been under the government of tutors; and I will now show you my right to power by their removal." He then ordered Thomas Aruwel, whom the king had lately appointed chancellor, to give up the seals; which he next day delivered to William Wickham, bishop of Winchester. He next removed the duke of Gloucester, the earl of Warwick, and other lords of the opposition, from the council; and all the great officers of the household, as well as the judges, were changed.

The king being thus left at liberty to govern as he thought proper, for some time behaved in such a manner as to gain the affections of the people. It does not appear indeed that he ever gave much cause of complaint; but it was impossible for any prince in those days to keep himself secure on the throne but by a very severe and vigorous administration. The duke of Gloucester, perceiving that Richard was not of a warlike disposition, frequently spoke with contempt of his person and government; and deliberated concerning the lawfulness of throwing off all allegiance to him. The king being informed of his conduct by spies appointed for that purpose, at last formed a resolution of ridding himself of Gloucester and his faction at once. He therefore ordered that nobleman to be immediately arrested and sent over to Calais, where there was no danger of his being rescued by his numerous adherents. The earls of Arundel and Warwick were seized at the same time; and a new parliament, which the king knew would be perfectly obedient to his will, was summoned to Westminster. Here the consumption of 150, who had assumed on the royal authority, was assailed for ever; all those acts which had condemned his former ministers were repealed; and the general pardon which the king had formerly given when he assumed the government into his own hands, was revoked. Several of Gloucester's party were condemned, and executed, and at last that nobleman himself was called for to take his trial as well as the rest; but he had before been privately disposed of in prison.

After the destruction of the duke of Gloucester and the heads of his party, a misunderstanding arose among the noblemen who had joined in the prosecution. The duke of Hereford appeared in parliament, and accused the duke of Norfolk of having spoken seditious words against his majesty in a private conversation. Norfolk denied the charge, gave Hereford the lie, and offered to prove his innocence by single combat. The challenge was accepted; but the day appointed for the encounter the king would not suffer them to engage, but commanded both of them to leave the kingdom. The duke of Norfolk was banished for life, but Duke of the duke of Hereford only for ten years. The former Hereford retired to Venice, where in a short time he died of a broken heart. Hereford behaved in a resigned and submissive manner; which so pleased the king, that he consented to shorten the time of his banishment four years; he also granted him letters patent, ensuring him of the enjoyment of any inheritance which should fall to him during his absence; but upon the death of his father the duke of Lancaster, which happened shortly after, Richard revoked those letters, and kept the estate to himself.

This last injury inflamed the resentment of Hereford to such a degree, that he formed a design of deposing the king. He was a great favourite both with the army and people; he was immensely rich; and was supported by black arts, and by the great families of the nation. The king at the same time, it is said, gave himself up to an idle, effeminate life; and his ministers following his example, the national honour was lost. The number of malecontents daily increased, and only waited for the absence of the king, in order to put their schemes in execution; and this opportunity soon offered.

The earl of March, presumptive heir to the crown, having been appointed the king's lieutenant in Ireland, was slain in a skirmish with the natives of that country; which so incensed Richard, that, mindful of his precarious situation at home, he went over to Ireland with a considerable army, in order to revenge his death in person. The duke of Lancaster (for that was the title which Hereford assumed on the death of his father) hearing of the king's absence, instantly embarked at Nantes; and with a retinue only of 60 persons in three small vessels, landed at Revesport in Yorkshire. The earl of Northumberland, who had long been a malecontent, together with Henry Percy his son, from his ardent valour was summoned to join him with their forces; and the people flocked to him in such numbers, that in a few days his army amounted to 60,000 men.
Richard, in the mean time, continued in perfect security in Ireland for some time. Contrary winds for
three weeks together prevented his receiving any news of the rebellion which was begun in his native
lands. He landed therefore at Milford Haven without suspicion, attended by a body of 30,000 men; but im-
immediately found himself opposed by a power which he could not by means resist. His army gradually desert-
de him, till at last he was obliged to quit the duke, that he would submit to whatever terms he pleased to
prescribe. The duke did not think proper to enter into any treaty with the king; but carried him to
London, where he was confined close prisoner in the Tower, formally deposed by parliament, or rather
by the duke of Lancaster, and at last put to death. The manner of his death is variously related. Accordin-
g to some, eight or nine radiants were sent to the castle of Pomfret, whether the unhappy prince had been
removed, in order to despatch him. They rushed unexpectedly into his apartment; but Richard,
knewing their design, resolved to sell his life as dearly as possible. He wrested a pole-axe from one of the mur-
derers, with which he killed four of them; but was at length overpowered and killed. Others relate that he
was starved in prison; and that, after he was denied all nourishment, he prolonged his life 14 days, by feeding
on the fruits of his bed. He died in the year 1399, in the 34th year of his age, and 233 of his reign.—It
was during the reign of Richard II. that Wicliff, the noted reformer, published his doctrines in England. See
Wicliff.

Duke of Lancaster's claim to the crown.

After sentences of deposition had been pronounced on Richard by both houses of parliament, the throne
being then vacant, the duke of Lancaster stepped forth; and having assumed the crown on the throne and
on the throne, and called on the name of Christ, gave in his claim to the throne in the following words, in
which we shall give in the original language: "In the name of Father, Son, and Holy Ghost, I Henry
of Lancaster, challenge this name of Ynglond, and the crown, with all the members and the appurten-
ces; all that I do accomplish by right line of the blood, coming from the good King Henry therby, and
that right that God of his grace hath sent me, with help of my, and of my freedome to recover it; the
which was won to be made by default of governance, and encroach of the good lawes."
The right which the duke here claimed by descent from Henry III. proceeded on a false story that Ed-
ward earl of Lancaster, son of Henry III. was really the elder brother of Edward II.; but that, by reason of
some deformity in his person, he had been postponed in the succession, and Edward the younger brother
imposed on the nation in his stead. The present duke of Lancaster inherited from Edmund, by his mother, the
right which he now pretended to the crown; though the falsehood of the story was so generally known, that
he thought proper to mention it only in general terms.

No opposition, however, was made to the validity of this title in parliament; and thus commenced the
difference between the houses of York and Lancaster, which were not terminated but by many bloody and
formidable wars.

Henry IV.

The reign of Henry IV. was little else than a continued series of insurrections. In the very first perio-
dment be called, no fewer than 40 challenges were given
D. 1403.

A. D. 1403.

The occasion of it was, that Henry denied the earl liberty to ransom some Scots prisoners which had been
taken in a skirmish with that nation. The king was desirous of detaining them, in order to increase his de-
mands upon Scotland in making peace; but as the ransom of prisoners was in that age looked upon as
right belonging to those who had taken them, the earl thought himself grievously injured. The injury ap-
ppeared still the greater, because Northumberland considered the king as indebted to him both for his life and
crown. He therefore resolved to dethrone Henry;
and to raise to the throne young Mortimer, who was the true heir to the crown, as being the son of Roger North-
Mortimer earl of March, whom Richard II. had de-
No. 183.

The battle was fought on the 20th of July 1440; and we can scarce find in those ages any other in which the
shock was so terrible and constant. At last Percy being
killed by an unknown hand, the victory was decided
in.
ENGLAND.

E. A. D. 1405.

England in favour of the royalists. There are said to have fallen on that day near 2500 gentlemen, and 6000 private men, of whom near two-thirds were of Percy's army.

The earl of Northumberland having recovered from his sickness, and levied an army, was on his march to join his son; but being opposed by the earl of Westmorland, and hearing of the defeat at Shrewsbury, he dismissed his forces, and came with a small retinue to the king at York. He pretended that his sole intention was to mediate between the contending parties; and the king thought proper to accept of his apology, and grant him a pardon for his offence. The other rebels were treated with equal lenity; and none of them, except the earl of Worcester and Sir Richard Vernon, who were regarded as the chief authors of the insurrection, perished by the hands of the executioner. This lenity, however, was not sufficient to keep the kingdom quiet; one insurrection followed another almost during the whole of this reign; but either through Henry's vigilance, or the bad management of the conspirators, they never could unite their forces in such a manner as was necessary for bringing their projects to a successful issue.

This reign is remarkable for the first capital punishment inflicted on a clergyman of high rank. The archbishop of York having been concerned in an insurrection against the king, and happening to be taken prisoner, was beheaded without either indictment, trial, or defence; nor was any disturbance occasioned by this summary execution. But the most remarkable transaction of this reign was, the introduction of that absurd and cruel practice of burning people on account of their religion. Henry, while a subject, was thought to have been very favourable to the doctrines of Wickliff; but when he came to the throne, finding his possession of it very insecure, he thought superstitious a necessary implement of his authority, and therefore determined by all means to pay court to the clergy. There were hitherto no penal laws against heresy; not indeed through the toleration of the court of Rome, but through the stupidity of the people, who could not perceive the absurdities of the established religion.

But when the learning and genius of Wickliff had once broken the fetters of prejudice, the ecclesiastics called aloud for the punishment of his disciples; and Henry, who was very little scrupulous in his conduct, resolved to gratify them. He engaged parliament to pass a law for this purpose: it was enacted, that when any heretic, who relapsed, or refused to abjure his opinions, was delivered over to the secular arm by the bishop or his commissaries, he should be committed to the flames before the whole people. This weapon did not remain long unemployed in the hands of the clergy. William Sauré, rector of St Oisiths in London, had been condemned by the convocation of Canterbury; his sentence was ratified by the house of peers; the king issued his writ for the execution; and the unhappy man was burnt alive in the year 1401. The doctrines of Wickliff, however, seem to have already gained ground very considerably in England. In 1403, the commons, who had been required to grant supplies, proposed in plain terms to the king to seize all the temporalities of the church, and employ them as a perpetual fund to serve the exigencies of the state. They insisted that the clergy possessed a third of the lands of the kingdom; and they contributed nothing to the public burdens; and that their exorbitant riches tended only to disqualify them from performing their ministerial functions with proper zeal and attention. When this address was presented, the archbishop of Canterbury, who then attended the king, objected that the clergy, though they went not in person to the wars, sent their vessels and tenants in all cases of necessity; while at the same time, they themselves who staid at home were employed night and day in offering up their prayers for the happiness and prosperity of the state. The speaker answered with a smile, that he thought the prayers of the church but a very slender supply. The archbishop, however, prevailed in the dispute; the king discouraged the application of the commons; and the lords rejected the bill which the lower house had framed for despoiling the church of her revenues. The commons were not discouraged by this repulse. In 1410, they returned to the charge with more zeal than before. They made a calculation of all the ecclesiastical revenues, which, by their account, amounted to 485,000 marks a-year, and included 26,000 ploughs of land. They proposed to divide this property among 25 new earls, 1500 knights, 600 esquires, and 100 hospitals; besides 20,000 marks a-year, which the king might keep for his own use; and they insisted that the clerical functions would be better performed than at present, by 15,000 parish priests, at the rate of 7 marks a-piece of yearly stipend. This application was accompanied with an address for mitigating the statutes enacted against the Wickliffites or Lollards, so that the king knew very well from what source it came. He gave the commons, however, a severe reply; and further to satisfy the church that he was in earnest, ordered a Lollard to be burnt before the dissolution of parliament.

The king had been for some time subject to fits, which continued to increase, and gradually brought him to his end. He expired at Westminster in 1413, in the 46th year of his age, and the 7th of his reign. He was succeeded by his son Henry V, whose martial talents and character had at first occasioned unreasoning jealousies in the mind of his father, so that he thought proper to exclude him from all share of public business. The active spirit of Henry being thus restrained from its proper exercise, broke out in every kind of extravagance and dissipation. It is even reported, that when beated with liquor, he scrupled not to accompany his riotous associates in attacking the passengers on the streets and highways, and robbing them of their goods. No sooner, however, did he ascend the throne, than he called together his former companions, acquainted them with his intended reformation, exhorted them to imitate his example; but strictly prohibited them, till they had given proofs of their sincerity in this particular, to appear any more in his presence: After which, he dismissed them with liberal presents. His father's wise ministers, who had checked his riots, found that they had, unknown to themselves, being paying the highest court to their sovereign; and were received with all the marks of favour and confidence. The chief justice, who had formerly imprisoned the prince himself, and therefore trembled to approach the royal presence, met with praises.
England.

was exorted to persevere in the same rigorous and impartial execution of the laws. The king was not only anxious to repair his own misconduct, but also to make amends for those iniquities into which policy or necessity of affairs had betrayed his father. He expressed the deepest sorrow for the fate of the unhappy King Richard, and even performed his funereal obsequies with pomp and solemnity, and beseeched favours upon all those who had shown themselves attached to him. He took into favour the young earl of March, though his competitor for the throne; and gained so far on his gentle and unambitious nature, that he remained ever after sincerely attached to him. The family of Percy was restored to its fortune and honours; and the king seemed desirous to bury all distinctions in oblivion.

Men of merit were preferred, whatever party they had been of; all men were unanimous in their attachment to Henry; and the defects of his title were forgotten amidst the personal regard which was universally paid him.

The only party which Henry was not able to overcome was the new sect of Lollards, or reformers of religion. These were now gaining such ground in England, that the Romish clergy were greatly alarmed, and Henry was determined to execute the laws upon them. The heads of that party at present was Sir John Oldcastle, Lord Cobham; a nobleman who had distinguished himself by his valor and military talents on many occasions, and acquired the esteem both of the late and present king. His high character and zeal for the new sect pointed him out to Arundel archbishop of Canterbury as a proper object of ecclesiastical fury, and therefore he applied to Henry for permission to indict him. The king desired him first to try gentle methods, and undertook to converse with Lord Cobham himself upon religious subjects. He did so, but could not prevail, and therefore abandoned Cobham to his enemies. He was immediately condemned to the flames: but having found means to make his escape, he raised an insurrection; which was soon suppressed, without any other consequence than that of bringing a stain on the sect to which he belonged. Cobham himself made his escape, but four years afterwards was taken and executed as a traitor. Immediately after, the most severe laws were passed against the Lollards. It was enacted, that whoever was convicted of Lollardy, besides suffering capital punishment according to the laws formerly established, should also forfeit his lands and goods to the king; and that the chancellor, treasurer, justices of the two benches, sheriffs, justices of the peace, and all the chief magistrates in every town and borough, should take an oath to use their utmost endeavours for the extirpation of heresy.

Notwithstanding these terrible laws, the very parliament which enacted them, namely that of 1414, when the king demanded a supply, renewed the offer formerly pressed upon Henry IV. and intreated the king to seize all the ecclesiastical revenues, and convert them to the use of the crown. The clergy were greatly alarmed. They could offer the king nothing of equal value. They agreed, however, to confer on him all the privileges alien, which depended on capital abbey in Normandy, and which had been bequeathed to them when that province was united to England. The most effectual method, however, of warding off the blow at present was by persuading the king to undertake a war with France, in order to recover the provinces in that kingdom which had formerly belonged to England. This was agreeable to the dying injunction of Henry IV. He advised his son never to let the English remain long in peace, which was apt to breed intestine commotions; but to employ them in foreign expeditions, by which the prince might acquire honour, the nobility in sharing his dangers might attach themselves to his person, and all the restless spirits find occupation for their iniquity. The natural disposition of Henry sufficiently inclined him to follow this advice, and the civil disorders of France gave him the fairest prospect of success. Accordingly, in 1415, the king invaded France at the head of 30,000 men.

The great progress he made there is related at length under the article France. He had espoused the king's daughter, and conquered the greatest part of the kingdom. His queen was delivered of a son named Henry, whose birth was celebrated by the greatest rejoicings both at London and Paris; and the infant prince seemed to be universally regarded as heir to both monarchies. But Henry's glory, when it seemed to be approaching the summit, was blasted at once by death, and all his mighty projects vanished. He was seized with a distemper which at that time the physicians had not skill enough to cure; and he expired on the 31st of August 1422, in the 34th year of his age, and Henry V. the 10th of his reign.

Henry VI. succeeded to the throne before he was quite a year old, and his reign affords only the most dismal accounts of misfortunes and civil wars. His relations very soon began to dispute about the administration during the minority. The duke of Bedford, one of the most accomplished princes of the age, was appointed by parliament protector of England, defender of the church, and first councillor to the king. His brother, the duke of Gloucester, was fixed upon to govern in his absence, while he conducted the war in France; and in order to limit the power of both brothers, a council was named, without whose advice and approbation no measure could be carried into execution.

The kingdom of France was now in the most desperate situation. The English were masters of almost the whole of it. Henry VI. though but an infant, was solemnly invested with regal power by legates from Paris; so that Charles VII. of France succeeded only to a nominal kingdom. With all these great advantages, however, the English daily lost ground; and in the year 1450 were totally expelled from France. It may easily be imagined, that such a train of bad success would produce discontent among the rulers at home. The duke of Gloucester was envied by many on account of his high station. Among these was Henry Beaufort, bishop of Winchester, great uncle to the king, and the legitimate son of John of Gaunt brother to Richard II. The prelate, to whom the care of the king's education had been committed, was a man of great capacity and experience, but of an intriguing and dangerous disposition. He had frequent disputes with the duke of Gloucester, over whom he gained several advantages on account of his open temper. The duke of Bed-
England. Ford employed both his own authority and that of parliament to reconcile them, but in vain; their mutual animosities served for several years to embarrass government, and to give its enemies every advantage. The sentiments of the two leaders were particularly divided with respect to France. The bishop laid hold of every prospect of accommodation with that country; and the duke of Gloucester was for maintaining the honour of the English arms, and regaining whatever had been lost by defeats or delay. Both parties called in all the auxiliaries they could. The bishop resolved to strengthen himself by procuring a proper match for Henry, at that time 33 years old; and then bringing over the queen to his interests. Accordingly, the earl of Suffolk, a nobleman whom he knew to be steadfast in his attachments, was sent over to France, apparently to settle the terms of a truce which had then been begun, but in reality to procure a suitable match for the king.

The bishop and his friends had cast their eyes on Margaret of Anjou, daughter of Regnier, titular king of Sicily, Naples, and Jerusalem; but without either real power or possessions. She was considered as the most accomplished princess of the age, both in mind and person; and it was thought would, by her own abilities, be able to supply the defects of her husband, who appeared weak, timid, and superstitious. The treaty was therefore hastened on by Suffolk, and soon after ratified in England. The queen came immediately into the bishop's measures: Gloucester was deprived of all real power, and every method taken to render him odious to the public. One step taken for this purpose was to accuse his duchess of witchcraft. She was charged with conversing with one Roger Bolingbroke, a priest and reputed necromancer; and also with one Mary Bourdeman, who was said to be a witch. It was asserted that these three in conjunction had made an image of the king in wax, which was placed before a gentle fire: and as the wax dissolved, the king's supposed face appeared; and meant no good. In short, his life was to be at an end. This accusation was readily believed in that superstitious age. The prisoners were pronounced guilty, the duchess condemned to do penance and suffer perpetual imprisonment; Bolingbroke the priest was hanged, and the woman burnt in Smithfield.

The bishop, called also the Cardinal, of Winchester, was resolved to carry his resentment against Gloucester to the utmost. He procured a parliament to be summoned, not at London, which was too well affected to the duke, but at St Edmundsbury, where his adherents were sufficiently numerous to overawe every opponent. As soon as Gloucester appeared, he was accused of treason and thrown into prison; and on the day on which he was to make his defence, he was found dead in his bed, though without any signs of violence upon his body.

The death of the duke of Gloucester was universally ascribed to the cardinals of Winchester, who themselves died six weeks after, testifying the utmost remorse for the bloody scene he had acted. What share the queen had in this transaction, is uncertain; but most people believed that without her knowledge the duke's enemies durst not have ventured to take away his life. The king himself shared in the general ill-will, and he never had the art to remove the suspicion. His ineptitude also began every day to appear more clearly, and a pretender to the throne soon made his appearance. A.D. 1450.

In the year 1450, Richard duke of York began to think of preferring his claims to the crown. All the Yorks' titles of the house of Mortimer were extinct; but Anne, the sister of the last earl of March, having espoused the earl of Cambridge, who had been beheaded for treason in the reign of Henry V., had transmitted her latent, but not yet forgotten, claim, to her son Richard. This prince, descended by his mother from Philip, only daughter of the duke of Clarence, second son of Edward III., stood plainly in order of succession, before the king; who, deriving his descent from the duke of Lancaster, third son of that monarch. The duke was a man of valour and abilities, as well as of some ambition; and he thought the weakness and unpopularity of the present reign afforded a favourable opportunity to assert his title. The ensign of Richard was a white rose, that of Henry a red one; and this gave names to the two factions, who were now about to drench the kingdom in blood.

After the cardinal of Winchester's death, the duke of Suffolk, who also had been concerned in the assassination of Gloucester, governed everything with uncontrollable sway. His conduct soon excited the jealousy of the other nobility, and every odious or unsuccessful measure was attributed to him. The duke, however, imagining that his crimes were of such a nature as could not be proved, boldly called upon his enemies to show an instance of his guilt. The house of commons immediately opened against him a charge of corruption, tyranny, and treason. He was accused of being the cause of the loss of France; of persuading the French king, with an armed force, to invade England; and of betraying the secrets of state. The popular resentment against him was so strong, that Henry, in order to secure him as much as possible, sentenced him to five years banishment. This was, however, only a form of punishment, as an escape from justice. The captain of a ship was therefore employed to intercept him in his passage to France. He was seized near Dover, his head struck off, and thrown on the side of a long-boat, and his body thrown into the sea.

The complaints against Henry's government were insurmountable, even by an insurrection headed by one John Cade, a native of Ireland. He had been obliged to fly to John Cade, over into France for his crimes; but, on his return, seeing the people prepared for violent measures, he assumed the name of Mortimer; and, at the head of 20,000 Kentish men, advanced towards Blackheath. The king sent a message to demand the cause of their rising in arms. Cade in the name of the community answered, That their only aim was to punish evil ministers, and produce a redress of grievances for the people. On this a body of 25,000 troops was levied; and Henry marched with them in person against Cade, who retired on his approach, as if he had been afraid of coming to an engagement. He lay at ambassage, however, in a wood; not doubting but he should be pursued by the king's whole army; but Henry was content with sending a detachment after the fugitives, and returned to London himself; upon which Cade issued from his ambuscade, and cut the detachment in pieces.
ENGLAND.

Engl̓and. Soon after, the citizens of London opened their gates to the victor; and Cade, for some time, maintained great order and regularity among his followers. He always led them out into the fields in the night-time, and published several edicts against plunder and violence of any kind. He was not, however, long able to keep his people in subjection. He beheaded the traitor, Lord Say, who, on his trial and after his troops committing some irregularities, the citizens resolved to shut their gates against him. Cade endeavoured to force his way, a battle ensued, which lasted all day, and was ended only by the approach of night. The archbishop of Canterbury, and the chancellor, who had taken refuge in the Tower, being informed of the situation of affairs, drew up, during the night, an act of amnesty, which was privately dispersed among the rebels. This had such an effect, that in the morning Cade found himself abandoned by his followers; and retreating to Rochester, was obliged to fly alone into the woods. A price being set on his head by proclamation, he was discovered and slain by one Alexander Eden, who, in recompense for this service, was made governor of Dover castle.

The court now began to entertain suspicions that the insurrection of John Cade had not happened merely in consequence of his own machinations and ambition, but that he had been instigated thereto by the Duke of York, who, as we have already seen, pretended a right to the crown. As he was about this time expected to return from Ireland, and a report took place that he was now to assert his supposed right by force of arms, orders were issued in the king's name to deny him entrance into England. This was prevented by his appearance with no more than his ordinary attendants; but though he thus escaped the danger for the present, he instantly saw the necessity of proceeding in support of his claim. His partisans were instructed to distinguish between his right by succession and by the laws of the kingdom. The adherents of Lancaster maintained, that though the advancement of Henry IV. might be looked upon as irregular, yet it was founded upon general consent; or, even allowing it to have been at first invalid, it had now been for a long time established, and acquired solidity of consequence; nor could the right of succession at any rate be pleaded for the purpose of overthrowing the general peace and tranquillity of the kingdom. The principles of liberty as well as the maxims of true policy had been injured by the house of York; while the public were bound to those of Lancaster, so less by political than moral duty, in consequence of the oaths of fealty that had been so often sworn to them; the Duke of York himself having repeatedly sworn allegiance to them, and thus indirectly renounced those claims which he now brought forward to disturb the public tranquillity. On the part of the Duke of York, it was replied, that the good of the people required the maintenance of order in the succession of princes; that, by adhering constantly to this rule, a number of inconveniences would be prevented which must otherwise ensue; and though that order had been broken through in the case of Henry IV. it was never too late to remedy any pernicious precedent. It would indeed be a great encouragement to usurpers, if the immediate possession of power, or their continuance in it for a few years, could convert them into legal princes; and the people must be in a very miserable situation, if all restraints on violence and ambition were taken off, and full liberty given to every innovator to make what attempts he pleased. They did not indeed deny that time might confer solidity on a government originally entirely committed to usurpation; but a very long course of years was not only required for this purpose, but a total extinction of those who had any just title. The deposition of Richard II. and advancement of Henry IV. were not legal acts, but the effects of mere levity in the people, in which the house of York had acquired from necessity, and not from any belief of the justice of their cause; nor could this be ever interpreted into any renunciation of their pretensions; neither could the restoration of the true order of succession be considered as an encouragement to rebellion and turbulence, but the correction of a former abuse by which rebellion had been encouraged. Besides, the original title of Henry IV. was founded entirely on present convenience and even this was now entirely shifted to the house of York. The present prince was evidently incapable of governing the kingdom by reason of his imbecility; so that every thing was governed either by corrupt ministers or an impertinent Queen, who engaged the nation in foreign connections entirely contrary to its interests; while, on the other hand, the true heir of the crown was a prince of approved judgment and experience, and a native of England, who, by his restoration, would undoubtedly correct all those abuses of which there was now such just reason to complain.

In this dispute it was evident that the house of York had the better in point of argument: nevertheless, as a prince of the house of Lancaster was in immediate possession of the throne, and could by no means be charged with any crime, the cause of the former was less generally interesting; especially as it must always have been uncertain, a priori, whether the Duke of York would have governed any better than King Henry. After his return from Ireland, however, the former used all his power and influence to foment the discontent which had for some time prevailed in the kingdom; and the conduct of the next parliament manifested the success of his intrigues. A violent attack was made upon such noblemen as were known to be in favour of the king. The house of Somerset presented a petition against the Duke of Somerset, the Duchess of Suffolk, the Bishop of Chester, Lord Dudley, and several others of inferior rank; praying not only that the king would remove them from his council, but that he would prohibit them from coming within twelve miles of the court. Henry, not daring to refuse this petition altogether, consented to banish all those of inferior rank, whom the commons had specified, but only for a year; and this too on condition that he had no use for their assistance in quelling any rebellion. But he rejected a bill for attainting the late Duke of Suffolk, and proposed some other measures which seemed to militate against the court, though it had passed both the house of lords and the house of commons.

Encouraged by this disagreement between Henry and
and his parliament, the duke of York raised an army of 10,000 men, with whom he marched towards London, demanding a reform in matters of government, and the removal of the duke of Somerset. This first enterprise, however, proved unsuccessful; the gates of the city were shut against him, and he was pursued by the king at the head of a superior army. In the end, he retired into Kent; and as there was a number of his friends in the army of King Henry, a conference took place, in which Richard still insisted upon the removal of the duke of Somerset, and his submitting to be tried in parliament. This request, in appearance complied with, Somerset arrested; the duke of York was then persuaded to wait upon the king in his royal pavilion; but, on repeating his charge against the duke, he was surprised to see the latter come out from behind the curtain, and offer to maintain his innocence. Richard perceiving that he had not sufficient interest to ruin his adversary, pretended to be satisfied, and retired to his seat at Wigmore in Wales; and during the time he resided there, a better opportunity was given him of accomplishing his designs than he could have hoped for. The king fell into a kind of lethargic disorder, which increased his natural imbecility to such a degree, that he could no longer retain a shadow of royalty. Richard now had interest enough to get himself appointed protector, with power to hold parliaments at pleasure; with which high office he was no sooner invested, than he turned out all the Lancastrian party from their offices, and sent the duke of Somerset to the Tower; but on the recovery of the king, which happened in no long time after, he himself was dismissed from his employment, the duke of Somerset released, and the administration once more put into his hands. On this the duke of York levied an army, merely, as he pretended, to enforce the reformation of government and the removal of the duke of Somerset. Thus Henry, though sore against his will, was obliged to face him in the field. A battle ensued at St Albans; in which the royalists were defeated, and the duke of Somerset, the chief partisan of their cause, killed in the action. The king himself was wounded, and took shelter in a cottage near the field of battle, where he was taken prisoner, but was afterwards treated with great respect and kindness by the duke of York.

Henry, though he was now only a prisoner treated with the forms of royalty, was nevertheless pleased with his situation; but his queen, a woman of a bold and masculine spirit, could not bear to have only the appearance of authority, while others enjoyed all the real power. She therefore excited the king once more to assert his right by force of arms; and after several manoeuvres, the duke of York was obliged to retire from court. A negotiation for peace was at first set on foot, but the mutual distrusts of both parties soon broke it off. The armies met at Bloreheath on the borders of Staffordshire, on the 23d of September 1459; and the Yorkists at first gained some advantages. But when a more general engagement was about to ensue, a body of veterans who served under the duke of York deserted to the king; and this so intimidated the duke’s party, that they separated the next day without striking a blow. The duke of York fled to Ireland; and the earl of Warwick, one of his ablest and best supporters, escaped to Calais, with the government of which he had been entrusted during the late protectorship.

The York party, though thus in appearance suppressed, only waited a favourable opportunity of retrieving their affairs. Nor was this opportunity long wanting. Warwick having met with some successes at sea, landed at Kent; and being there joined by other barons, marched up to London amidst the acclamations of the people. The city immediately opened its gates to him, and he soon found himself in a condition to face the royal army. An engagement ensued at Northampton on the 10th of July 1460, in which the royalists were entirely defeated, and the king again taken prisoner. The duke of York then openly laid claim to the crown; and on this occasion the first instance of a spirit of national liberty is said to have appeared in the house of lords. The cause of Henry and the duke of York was solemnly debated; and the latter, though a conqueror, did not absolutely gain his cause. It was determined that Henry should possess the throne during his life; and that the duke of York should be appointed his successor, to the utter exclusion of the prince of Wales, who was then a child.

Though the royal party now seemed destined to every resource, the queen still retained her intrepidity. She fled into Wales, where she endeavoured to raise another army. The northern barons, provoked at the southern ones for settling the government and succession to the crown without their consent, soon furnished her with an army of 20,000 men. Another battle was fought near Wakefield Green, on the 24th of December 1460. The Yorkists were defeated, and the duke himself was killed in the action. His head was Duke of afterwards cut off by the queen’s orders, and fixed on York kil- one of the gates of York, with a paper-crown, in de- eration of his pretended title. His son the earl of Rut- land, a youth of 17, was taken prisoner, and killed in cold blood by Lord Clifford, in revenge for his father’s death, who had fallen in the battle of St Albans. After this victory, Margaret marched towards Lon- don, in order to set the king at liberty; but the earl of Warwick, who now put himself at the head of the Yorkists, led about the captive king, in order to give a sanction to his proceedings. He engaged the queen’s forces at St Albans; but through the treachery of Lord Lovelace, who deserted during the heat of the engagement with a considerable body of forces, Warwick was defeated, and the king fell once more into the hands of his own party.

The submission of the city of London seemed now to be the only thing wanting to complete the queen’s success; but Warwick had secured it in his interests, and the citizens refused to open their gates to the queen. In the mean time, young Edward, eldest son of the late duke of York, put himself at the head of his father’s party. He was now in the bloom of youth, remarkable for the beauty of his person and his bravery, and was a great favourite of the people. He de- feated Jasper Tudor earl of Pembroke, at Mortimer’s cross in Herefordshire. The earl himself was taken prisoner, and immediately beheaded by Edward’s or-
England.

Edward, in the mean time, thinking himself securely fixed on the throne, gave a loose to his favourite passions; one of which was an immoderate love of women. To divert him from this, the earl of Warwick, to whom he was indebted for his crown, advised him to marry. Edward consented, and sent him speedily to Scotland, with letters, the issue of which was to negotiate a match with the princess of Savoy. The negotiation proved successful; but, in the mean time the king had privately espoused Elizabeth Woodville, daughter to Sir Philip Woodville, who had married the duchess of Bedford after the death of her first husband. Edward had employed his arts of seduction against this lady in vain before he married her; but unfortunately the match was concluded just at the time that the earl of Warwick had proved successful in the negotiation with the princess of Savoy. The minister therefore returned full of indignation against his sovereign; and Edward, forgetting how great cause he had to be offended, determined to remove him entirely from his councils. Warwick was likewise disgusted by the favour shown to the queen's party; which, though certainly a piece of very commendable policy in Edward, was entirely disagreeable to the ambitious disposition of that nobleman. A plan of revenge was therefore thought of; and most powerful combinations were formed against Edward: to accomplish which, Warwick not only employed his own influence, which was very extensive, but likewise that of the duke of Clarence, Edward's brother, to whom the earl had allied himself by giving him his daughter in marriage; after which he persuaded him to embrace his cause. Some circumstances of the present time also favoured the scheme. The inhabitants about St Leonard's in Yorkshire complained, that the duties levied for that institution, and which had been originally appointed for pious purposes, were secreted by the managers, who refused to contribute their part. As the clergy were concerned in this affair, they attempted to silence their antagonists by ecclesiastical fulminations against them; upon which the latter took up arms, fell upon the officers of the hospital, and having massacred them, proceeded towards York, to the number of 15,000. In the first skirmish, they had the misfortune to lose their leader, who was instantly executed. The rebels, however, still continued in their march and in short time appeared in such numbers as to become formidable to government. Henry earl of Pembroke was sent against them with a body of 5000 men; and having taken Sir Henry Nevil, one of the leaders of the insurgents, prisoner, instantly put him to death; but this was soon revenged by a similar execution on himself, who happened to be defeated and taken prisoner a short time after. This defeat had been occasioned by a disagreement between the earls of Pembroke and Devonshire; in consequence of which the latter had gone off with his troops, leaving Pembroke to shift for himself the best way he could. The king, enraged at this, caused Devonshire to be executed in a like summary manner: but this was of no service to his cause; a new body of insurgents appeared under Sir Robert Welles, son to a nobleman of that name. The latter, in order to secure him from all suspicions of disloyalty, fled to a monastery; but he was soon arrested from thence and put to death by the insidious promises of King Edward, whose treachery was equal to his cruelty. His son

Edward in the mean time advanced to London; and being joined by the remainder of Warwick's army, he soon obliged Margaret to retire, entered the city amidst the acclamations of the people, and was crowned king on the 5th of March 1461.

Notwithstanding all her misfortunes, however, Margaret still continued undaunted. She retired to the north, where she was soon joined by such numbers, that her army amounted to 60,000 men. She was opposed by young Edward and Warwick at the head of 40,000; and both armies met near Tooting, in the county of York, on the 9th of March 1461. A bloody battle ensued, in which the queen's army was totally defeated; and as Edward, prompted by his natural cruelty, had ordered no quarter to be given, 40,000 of the Lancastrians were slain in the field or in the pursuit. Edward is said to have gained this victory by means of a violent storm of snow, which blew full in the face of the queen's army, and so blinded them that they could scarcely make any use of their arms. After this disaster the queen fled to Scotland with her husband and son; and notwithstanding all the misfortunes she had already met with, resolved once more to enter England at the head of 5000 men granted her by the king of France. But even here she was attended by her usual bad fortune. Her little fleet was dispersed by a tempest, and she herself escaped with the utmost difficulty by entering the mouth of the Tweed. Soon after, a defeat, which her few forces sustained at Hexham, seemed to render her cause entirely desperate; and the cruelties practised upon all her adherents rendered it very dangerous to befriend her.

By these repeated misfortunes the house of Lancaster was so effectually ruined, that Margaret was obliged to separate from her husband, and both of them to shift for themselves the best way they could. The king was still protected by some of his friends, who conveyed him to Lancashire, where he remained in safety for a twelvemonth; but being at last discovered, he was thrown into the Tower and kept close prisoner. The queen fled with her son to a forest, where she was set upon by robbers, who stripped her of her rings and jewels, treating her otherwise with the utmost indignity. A quarrel which happened among them about the division of the spoil afforded her an opportunity of escaping from their hands into another part of the forest, where she wandered for some time without knowing what to do. At last, when quite spent with hunger and fatigue, she saw a robber coming up to her with a drawn sword in his hand. Finding it altogether impossible to escape, she suddenly took the resolution of putting herself under his protection. Advancing towards him, therefore, and presenting the young prince, "Here (says she), my friend, I commit to your care the safety of your king's son." This address so much surprised the robber, that, instead of offering her any injury, he professed himself entirely devoted to her service. After living for some time concealed in the forest, she was at last conducted to the sea-side, where she found a ship which conveyed her to Flanders. On her arrival there, she went to her father's house, who, though very poor, gave her such entertainment as he could afford; and in this retreat she staid some years in expectation of finding an opportunity of retrieving her affairs.
England.

ENGLAND.

A.D. 1452.

Warwick and Clarence join the insurgents.

Notwithstanding such an appearance of a general insulation, the king had so little suspicion of the loyalty of Warwick and Clarence, that he employed them in raising troops to quell the insurgents. Instead of executing their commission with fidelity, however, they joined the malcontents with all the forces they could raise; but being quite disinconcerted by the defeat and death of Sir Robert Welle, they retired to Lancashire, in hopes of being joined by Lord Stanley, who had married the earl of Warwick's sister. Being disappointed in this, they were obliged to disband their army, and fly into Devonshire, whence they set sail for Calais. Upon their arrival on the continent, matters seemed not to be much mended: the deputy-governor, whom Warwick had left, refused him admittance; nor would he even allow the archbishop of Clarence to land, though he had been delivered of a son on board only a very few days before, and was at this time extremely ill. Being well acquainted, however, with the unstable nature of the affairs in England at that time, he afterwards made an apology to Warwick for this behaviour. The latter pretended to be easily reconciled; but immediately left the place, having seized some Flemish vessels which he found lying in the neighbourhood.

As a very close alliance subsisted between Warwick and the duke of Burgundy, the king of France became uneasy; and therefore, as soon as the earl landed in his dominions, received him with the greatest marks of esteem. The reconciliation between him and the unfortunate Queen Margaret now seemed to be natural, though, considering all circumstances, this must have formerly appeared in a manner impossible. The earl's father had been put to death by the orders of Margaret; and Warwick, in return, had twice taken prisoner King Henry, banished the queen, and put to death almost all their faithful adherents. By the mediation of the French monarch, however, all differences were accommodated. A fleet was prepared to reconduct them to England; and seizing a proper opportunity, they landed at Dartmouth with a small body of troops, while Edward was in the north suppressing an insurrection which had lately appeared there. Warwick was attended with astonishing success on his arrival in England, and in less than six days saw himself at the head of 60,000 men. Edward was now obliged in his turn to fly the kingdom. Having narrowly escaped an attempt made upon his person by the marquis of Montagne, he embarked on board a small fleet which lay off Lynn in Norfolk. While at sea, he was chased by some ships belonging to the Hans Towns, that were then at war both with France and England; but at length, having escaped all dangers, Edward landed safely in Holland, where he met with but an indifferent reception from the duke of Burgundy, with whom he had lately entered into an alliance.

Warwick is the mean time advanced to London, and once more released and placed on the throne the miserable King Henry VI. A parliament was called, which very solemnly confirmed Henry's title to the throne, and Warwick himself was dignified by the people with the title of the king-maker. All the taillanders of the Lancastrians were reversed; and every one was restored who had lost either honours or fortune by his former adherence to Henry's cause. All A.D. 1452. The adherents of Edward fled to the continent, or took shelter in monasteries, where they were protected by the ecclesiastical privileges. But Edward's party was not yet destroyed. After an absence of nine months, being seconded by a small body of troops granted him by the duke of Burgundy, he made a descent at Ravenspur in Yorkshire. At first he met with little success; but his army increasing on his march, he was soon in a condition to appear before the capital, which immediately opened its gates.

The unfortunate Henry was thus again plucked from the throne; and the hopes of Warwick were almost totally blasted by the defection of Clarence, Edward's brother. Nothing now remained but to come to an engagement as soon as possible. Warwick knew his forces to be inferior to those of Edward, but placed great dependence on his own generalship. He therefore advanced to Barnet, within ten miles of London, where he resolved to wait the coming of Edward. The latter soon came up with him, and on the 14th of April, 1472, a most desperate battle was fought. Edward, according to custom, had ordered no quarter to be given; and obtained the victory through a mistake of a body of Warwick's forces, who fell with fury on their own party instead of the enemy. The earl himself was slain, together with his brother, and 10,000 of his bravest followers.

The queen was just then returned with her son from France, where she had been soliciting supplies. She had scarce time to refresh herself from the fatigues of the voyage when she received the fatal news of the death of Warwick, and the total destruction of her party. All her resolution was not able to support her under such a terrible disaster. Her grief now for the first time, it is said, manifested itself by her tears; and she immediately took sanctuary in the abbey of Beaulieu in Hampshire. Here she still found some friends willing to assist her. Tudor earl of Pembroke, Courteny earl of Devonshire, the lords Wenlock and St. John, with some other men of rank, encouraged her yet to hope for success, and promised to support her to the last. On this assurance, she resumed her courage, and advancing through the counties of Devon, Somerset, and Gloucester, increased her army every day. At last, however, she was overtaken by Edward with his victorious army at Tewkesbury, on the banks of the Severn. The queen's army was totally defeated; the earl of Devonshire and Lord Wenlock were killed in the field; the duke of Somerset, and about 20 other persons of distinction, who had taken shelter in a church, were surrounded, dragged out and immediately beheaded; about 3000 of their party fell in battle, and the army was entirely dispersed. Queen Margaret and her son were taken prisoners, and brought to the king, who asked the prince in an insulting manner how he dared to invade his dominions? The young prince replied, that he came thither to claim his just inheritance; party upon which Edward struck him on the face with his gauntlet. The dukes of Clarence and Gloucester, Lord Hastings, and Sir Thomas Grey, took this blow as a signal for further violence, hurrying the prince into the next apartment, and there dispatched him with their
young king's coronation. Lord Stanley first began to suspect his designs; and communicated his suspicions to Lord Hastings, who had long been firmly attached to the king's family. Lord Hastings would not at first give credit to this surmise; but he very soon had a fatal proof of the truth of what had been communicated to him. On the 13th of June 1483, he was hurried out of the council-room in the Tower by Gloucester's order, and beheaded on a log of timber. The soldiers who carried him off made a bustle as though an attempt had been made to rescue him, and one of them discharged a blow at Lord Stanley's head with a polecaxe; but he happily escaped by shrinking under the table. The same day were executed the earl Rivers, and some others, who had committed no other crime than being faithful to the young king.

The protector now thought he might with safety lay claim to the throne. He had previously gained over the duke of Buckingham, a nobleman of great influence among the people. He used his utmost endeavours to inspire the people with a notion of the illegitimate birth of the late king, and consequently of his children. Dr Shaw, a popular preacher, was also hired to harangue the people to the same purpose from St Paul's cross. Having expatiated on the incontinence of the queen, and the illegality of the young king's title, he then made a panegyric on the virtues of the protector. "It is the protector (continued he) who carries in his face the image of virtue, and the marks of a true descendent. He alone can restore the lost glory and honour of the nation." It was hoped that upon this occasion some of the populace would have cried out, "Long live King Richard!" but the audience remaining silent, the duke of Buckingham undertook in his turn to persuade them. Having expatiated on the calamities of the last reign and the illegitimacy of the present race, he told the people, that he saw only one method of warding off the miseries which threatened the state, which was by electing the protector; but he seemed apprehensive that he would never be prevailed upon to accept a crown accompanied with such difficulty and danger. He next asked his auditors, whether they would have the protector for their king? but was mortified to find that a total silence ensued. The mayor, who was in the secret, willing to relieve him in this embarrassed situation, observed, that the citizens were not accustomed to be harrangued by a man of his quality, and would only give an answer to their recorder. This officer, therefore, repeated the duke's speech; but the people continuing still silent, "This is strange obstinacy (cried the duke): we only require of you, in plain terms, to declare, whether or not you will have the duke of Gloucester for your king; as the lords and commons have sufficient power without your concurrence?" At this, some of the multitude, incited by the servants of the protector, and Buckingham, raised a feeble cry of "God save King Richard!" The mob at the door repeated the cry; and throwing up their caps into the air, cried out, "A Richard! A Richard!" After this farse was enacted, Buckingham, on the 24th of June 1483, waited on Richard with offers of the crown; but the protector, with hypocritical modesty, at first declined the offer, till being told, that the people, in case of his refusal, must look out for one that would be more compliant,
Richard III.

The first step taken by the new king was to send orders to Sir Robert Brackenbury governor of the Tower, to put the young princes to death. But this he refused; and submissively answered that he knew not how to embrace his hands in innocent blood. A fit instrument for this purpose, however, was not wanting. Sir John Tyrrel readily undertook the office; and Brackenbury was ordered to resign the keys to him for one night. Tyrrel choosing three associates, Slater, Deighton, and Forest, came in the night-time to the door of the chamber where the princes were lodged; and sending in the assassins, bid them execute their commission, while he himself stood without. They found the young princes in bed, and fallen into a sound sleep. The assassins smothered them with the bolster and pillows; after which they showed their naked bodies to Tyrrel, who ordered them to be buried at the stair-foot under a heap of stones (c).

Richard having thus secured himself on the throne by the most iniquitous methods, attempted to strengthen his interest by foreign alliances, and procuring the favour of the clergy at home by great indulgences; but he found his power threatened from a quarter where he least expected an attack. The duke of Buckingham, who had been so instrumental in raising him to the throne, did not think himself properly rewarded. He made a demand of some confiscated lands in Hereford, to which his family had an ancient claim. Richard either reluctantly complied with his request, or only granted it in part; so that a coolness soon ensued between them, and in a little time Buckingham came to a resolution of dethroning the monarch whom he had just raised. For some time he remained in doubt whether he would assume the crown himself, or set up another. At length he determined on the latter; and resolved to declare for Henry, earl of Richmond, who was at that time an exile in Brittany, and was considered as the only surviving branch of the house of Lancaster. He was one of those who had the good fortune to escape the numerous massacres of the former reigns; but as he was a descendant of John of Gaunt by the female line, he was for that reason obnoxious to those in power. He had long lived in exile, and was once delivered over to the ambassadors of Edward IV. when the duke of Burgundy delivered him to England; when the duke of Burgundy delivered him, repenting of what he had done, and took him from the ambassadors just as they were carrying him on board. His right to the crown by succession was very doubtful; but the cruel behaviour of Richard inclined the people in general greatly to favour him; and, to give an additional strength to his title, a match was projected betwixt him and the princess Elizabeth, the eldest daughter of Edward IV. which, by uniting the two rival families, would put an end to those dissensions which had so long filled the kingdom with bloodshed and confusion. Richard, in the mean time, from some reasons which have not been particularly fixed by historians, began to entertain doubts of the fidelity of Buckingham, and determined to cut him off. For this purpose he sent for him to court: but Buckingham, instead of obeying the summonses, fled into Wales, where he raised a considerable army, and he took with him an army from up arms; and was at his army and wade England. Richard hastened to the assistance of what forces he could raise; but the march of Buckingham being retarded by a most uncommon inundation and put to the destruction of the Severn which lasted 10 days, his troops were so disheartened at this event, that they almost all deserted him. The duke was therefore obliged to fly in distress, and Richard instantly set a price upon his head. Buckingham was now obliged to trust his life in the hands of an old servant of his own, named Baster; but this man, tempted by the greatness of the reward, betrayed him to the sheriff of Shropshire, by whom he was seized and conducted to Richard at Salisbury, who caused him to be executed without delay. The earl of Richmond, in the mean time, had set sail from St Malo with a body of 5000 men: but after his arrival in England, receiving the disagreeable news of Buckingham’s misfortune, he was obliged to set sail again for Bretagne; while Richard, emboldened by the bad success of his enemies, determined to confirm his title to the throne by calling a parliament, which till this time he had not ventured to do. At present matters were so circumstanced, that the parliament had no other resource than to comply with his desires, and acknowledge his right to the crown. An act was passed confirming the illegitimacy of Edward’s children; and an attainder was also confirmed against the earl of Richmond; the duties of tonnage and poundage were granted to the king for life; and his only son Edward, then about twelve years of age, was created prince of Wales. In return for these concessions, Richard passed several popular laws, particularly against the extorting of money by benevolences, and some others calculated to gain the good will of the opposite party. He paid his court also to the queen dowager with such assiduity and success, that she left her sanctuary, and put herself and her daughters into his hands. The ambition and cruelty of this man indeed are said to have extinguished every sentiment of natural affection as well as humanity. He had married Anne, the second daughter of the earl of Warwick, and widow of Edward prince of Wales, whom he himself had murdered; but having born him but one son, who died about this time, he considered her as an insuperable obstacle to the accomplishment of his desires; for which reason it was thought he put an end to her life by poison: and as he knew that the projected match between the earl of Richmond and the princess Elizabeth could only make the rivalry of the former any way formidable, he resolved to obtain a dispensation.

(c) These circumstances are said to have been confessed in the succeeding reign, though the perpetrators escaped punishment. The bodies of the two princes were sought for without any success under the reign of Henry VIII.; but in the time of Charles II., the bones of two persons answering to their age were found in the spot where they were said to have been buried; which, being supposed to be the remains of these two unfortunate youths, they were buried under a marble monument in Westminster Abbey.
England.

The queen-dowager is even said to have come into this scheme, with a view to recovering her power; but the princess herself always rejected his addresses with abhorrence. The refusal of the princess occasioned no small perplexity in Richard; and before he could determine on any proper method of accomplishing his purpose, he received news of Richard's preparations for landing in England. These being soon accomplished, Henry set sail from Harfleur in Normandy, and landed without opposition, on the 17th of August 1485, at Milford haven in Wales. Richard, in the mean time, not knowing where the invasion was to take place, had posted himself at Nottingham; which being almost in the centre of the kingdom, was therefore proper for resisting any invader. Sir Rice ap Thomas and Sir Walter Herbert were commissioned by Richard to oppose his rival in Wales; but the former immediately deserted to him, and the latter made but a very feeble resistance. Richard instantly resolved to meet his antagonist, and to risk every thing on the event of a battle. Richmond, though he had not above 6000 men, and the king near double that number, did not decline the combat; being chiefly encouraged by the promises of Lord Stanley to join him with a body of 7000 men, and with whom he hovered at a little distance from the intended field of battle, seemingly indetermined to join either side.

The king having commanded his army to form themselves in order of battle, intrusted the van to the duke of Norfolk, while he himself, with the crown on his head, took the command of the main body. Lord Stanley in the mean time posted himself on one flank between the two armies, while his brother Sir William took his station directly opposite. As his intention of either joining the enemy or keeping neutral during the time of the engagement was now far from being doubtful, Richard sent him orders to join the main body; which not being complied with, the tyrant determined to put to death Stanley's son, who had been left with him as a pledge of his father's fidelity. He was persuaded, however, to defer the execution till after the engagement, that Stanley might thereby be induced to delay his purpose in joining the enemy. This, however, did not answer the expectation. Soon after the engagement was begun, Stanley deserted Richard's party, and joining Richmond, entirely decided the fortune of the day. The tyrant, perceiving his situation to be quite desperate, and seeing his rival at no great distance from him, drove up against him with fury, in hopes that either Henry's death or his own would decide the victory between them. He killed Sir William Brandon the earl's standard-bearer; he dismounted Sir John Cheyne; and was within reach of Richmond, when Sir William Stanley breaking in with his troops, Richard was surrounded and overwhelmed by numbers. His body was found in the field, covered with dead enemies, and besmeared with blood. It was thrown carelessly across a horse, carried to Leicester, amidst the shouts of insulting spectators, and interred in the Gray-Friars church at that place.

The usurper's crown being found on the field of battle, was placed on the head of the conqueror, while the whole army cried out, "Long live King Henry!" Two days after the battle, Henry gave orders to con-
England.

York and Lancaster necessarily occasioned, were not sufficient to reconcile the hearts of the English to their sovereign. His extreme severity towards the house of York still continued; and unfortunately this was much more believed by the generality of the nation than that of Lancaster. Many of the Yorkists had been treated with great cruelty, and deprived of their fortunes under pretence of treason; a general resentment had likewise been made of the grants made by the prince of the house of York. It was likewise universally believed that the queen herself met with harsh treatment, on account of her being one of that unfortunate house; and from all these circumstances it was not reasonably imagined that his enmity was inveterate and invincible. Hence, notwithstanding his politic and vigorous administration, people made no scruple of openly expressing their disapprobation of his conduct and government; and one rebellion seemed to be extinguished only to give birth to another. The king, at the commencement of his reign, confined the duke of Clarence's son, as has already been mentioned. This unfortunate youth, who had obtained the title of the earl of Warwick, was, through long confinement, entirely unacquainted with the affairs of the world. Simple as he was, however, he was now made use of to disturb the public tranquility. The queen-dowager was with great reason suspected to be at the bottom of this conspiracy; but not choosing to interfere openly in the matter herself, she employed one Simon a priest of Oxford to execute her purposes. This man cast his eyes upon one Lambert Simnel, a baker's son in the same place, a youth of only 15 years of age; but who, from his graceful appearance and accomplishments, seemed proper for personating a man of quality. A report had been spread among the people, that Richard duke of York, second son of Edward IV., had secretly made his escape from the cruelty of his uncle, and lay somewhere concealed in England. Simnel had at first instructed his pupil to assume that name, which he found to be much the object of public affection; but hearing afterwards a new report, that Warwick had escaped from the Tower, and observing that this news was attended with no less general satisfaction, he changed the plan of his imposture, and made Simnel personate that unfortunate prince. The plaint youth was therefore directed by his instructor to talk upon many occurrences, as happening to him in the court of Edward. But as the impostor was not calculated to bear close examination, he was removed to Ireland; and so well had he profited by the lessons given him, that he no sooner presented himself to the earl of Kildare the deputy, claiming his protection as the unfortunate earl of Warwick, than he began to converse with several other noblemen with regard to him. These expressed even a stronger belief in Simnel's story than the deputy himself had done; and in proportion as the story was spread abroad, the more credit it obtained. The impostor was lodged in the castle of Dublin; the inhabitants universally took an oath of allegiance to him, as the true descendant of the Plantagenets; he was crowned with a diadem taken from the statue of the blessed virgin, and proclaimed king by the title of Edward VI.; and the whole kingdom followed the example of the capital.

Such an unexpected event alarmed Henry so much, that he would have gone over to Ireland on purpose to quell the rebellion in person, had he not been afraid of the machinations of the queen-dowager in his absence. He was determined to confine her for life in a monastery; under pretence, however, that it was done on account of her having forsook her country. The queen mourned against the severity of her treatment; but the king persisted in his resolution, and she remained in confinement till the time of her death, which happened some years after.

The next measure was to show Warwick to the people. He was taken from the Tower, and led through the principal streets of London; after which he was conducted in solemn procession to St. Paul's, where great numbers were assembled to see him. But, however, they proceeded in Dublin to honour their pretended monarch; and he was crowned with great solemnity in the presence of the earl of Kildare, the chancellor, and the other officers of state. At last being furnished by the decessor of Burgundy with a body of 2000 veteran Germans under the command of Martin Swart, a brave and experienced officer, he resolved to invade England. He landed in Lancashire, from whence he marched to York, expecting that the country people would rise and join him on his march. But in this he was deceived: the people were unwilling to join a body of foreigners; and were besides kept in awe by the great reputation of Henry. Lord Lincoln, therefore, who commanded the rebel army, determined to bring the matter to a speedy issue. Accordingly he met the royal army at Stoke in the county of Nottingham. An obstinate engagement ensued, but at length King Henry obtained a complete victory. Lord Lincoln, with 4000 private men, perished in the battle; and Simnel with his tutor Simon were taken prisoners. Simnel being a priest, could not be tried by the civil power, and was only committed to close confinement. Simnel was pardoned, and made a scullion in the king's kitchen, whence he was afterwards advanced to the rank of falconer, in which employment he died.

Henry being now freed from all danger from that quarter, determined to take ample vengeance on his avers him. For this purpose he took a journey into the enemy's north; but though he found many delinquents, his natural avarice prompted him to exact heavy fines from them rather than to put them to death. His proceedings, however, were extremely arbitrary; the criminals being tried, not by the ordinary judges, but either by commissioners appointed for the occasion, or suffering punishment by sentence of a court-martial. Having thus fully established his authority as far as it could be done by suppressing and punishing domestic enemies, he next determined to recommend himself to his subjects by a report of his military disposition; hoping, that by undertaking, or pretending to undertake, some martial enterprises, he would thus gain the favour of the people naturally turbulent, and unaccustomed to live long at peace with their neighbours. He certainly had not, however, the least intention of prosecuting foreign conquests: though to please the people, he frequently gave out that he designed to invade France, and lay waste the whole country, rather than remove his continental possessions. Under these pretences, particularly that of assisting the Breslau, whom the king
England.

A.D. 1447

Obtains a subsidy on pretence of assisting the inhabitants of Bretagne.

247

An insurrection suppressed.

Henry makes a seized invasion of France.

249

Henry obtains a subsidy which he had solicited under pretence of invading France, though he would willingly have avoided any expense in preparations for that purpose in order to keep the money in his possession; but as the Bretons had applied to him for assistance, and their distresses became every day more urgent, he found himself obliged to attempt something. With this view he set sail for Calais with an army of 25,000 foot and 1600 horse, of which he gave the command to the duke of Bedford and the earl of Oxford: but notwithstanding this apparently hostile disposition, negotiations for peace had been secretly begun, and commissioners even appointed to consider of the terms, three months before King Henry set out for the continent. As the love of money was the prevailing passion of the English monarch, and the possession of Bretagne was a great object to France, an accommodation soon took place between the contending parties. The king of France engaged to pay Henry near 200,000l. as a reimbursement for the expenses of his expedition, and stipulated at the same time to pay him and his heirs an annual pension of 25,000 crowns more. Thus the authority of Henry seemed to be so firmly established, as to leave no reason to dread any rival in time to come; but still he found himself mistaken. The duchess of Burgundy, resenting the deprivation of her family, and exasperated by her frequent miscarriages in the attempts already made, resolved to make a final effort against Henry, whom she greatly hated. For this purpose she propagated a report that her nephew Richard Plantagenet, duke of York, had escaped from the Tower where his elder brother was murdered, and that he still lay somewhere concealed. Finding this report eagerly received, she soon found a young man who assumed both his name and character. The person chosen to act this part was the son of one Oosbeck, or Warbeck, a converted Jew, who had been in England during the reign of Edward IV. His name was Peter; but it had been corrupted after the Flemish manner into Peterkin, or Perkin. It was by some believed, that Edward, among his other amorous adventures, had a secret correspondence with Warbeck's wife, which might account for the great similarity of features between Perkin and that monarch. The duchess of Burgundy found this youth entirely suited to her purposes. The lessons she gave him were easily learned and strongly retained. His graceful air, his courtly address, his easy manners, and elegant conversation, were capable of imposing upon all but those who were privy to the imposture. The kingdom of Ireland was pitched upon for Perkin's first appearance, as it had been before for that of Simnel. He landed at Cork; and immediately assuming the name of Richard Plantagenet, was followed by great numbers of credulous people. He wrote letters to the earls of Desmond and Kildare, inviting them to join his party; he dispersed everywhere the strange intelligence of his escape from his uncle. Richard's cruelty; and his story meeting with general credit, he soon became an object of the public favour. All those who were disgusted with the king, prepared to join Perkin; but particularly those who formerly were Henry's favourites, and had contributed to place him on the throne. These, thinking their services had not been sufficiently repaid, now became heads of the conspiracy. Their attempts, however, were all frustrated by the vigilance of the king, and most of the conspirators of any note were publicly executed.

Perkin finding it was in vain to attempt anything in England, went to the court of James IV. of Scotland. Here he was received with great cordiality; and James carried his confidence in him so far, that he even gave him in marriage Lady Catherine Gordon, daughter to the earl of Huntley, and a near kinswoman of his own. But when he attempted to set him on the throne of England, he found himself totally disappointed; and on the conclusion of peace between the two kingdoms, Perkin was obliged to leave Scotland. From thence he went to Flanders; and meeting with but a cool reception there, he resolved to try the affections of the people of Cornwall, who had lately risen against the king on account of a new tax which had been levied upon them. On his first appearance, Perkin was joined by about 3000 of these people, with which force he laid siege to Exeter. Henry, however, having marched against him with a considerable army, Perkin's heart failed him, though his followers now amounted to 7000; and he took shelter in a monastery. His wife fell into the conqueror's hands; who placed her in a respectable situation near the queen's person, with a suitable pension, which she enjoyed till her death. Perkin being persuaded to deliver himself into the king's hands, was compelled to sign a confession of his former life and conduct; but this was so defective and contradictory, that very little regard was paid to it. His life was granted him; though he was still detained in custody, and keepers were appointed to watch his conduct. From these, however, he broke loose; and flying to the sanctuary of Shyne, put himself into the prior's hands. He was once more prevailed upon to trust himself in the king's hands, and was committed to the Tower; but having here entered into a correspondence with the earl of Warwick in order to make their escape, both of them were condemned and executed.

To Henry VII. in a great measure, is owing the present
England.

present civilized state of the English nation. He had all along two points principally in view; the one to depress the nobility and clergy, and the other to exalt and humanize the populace. In the feudal times every nobleman was possessed of a certain number of vassals over whom he had, by various methods, acquired an almost absolute power; and, therefore, upon every slight disgust, he was able to influence them to join him in his revolt or disobedience. Henry considered, that the giving of his barons a power to sell their estates, which were before unalienable, must greatly weaken their interest. This liberty therefore he gave them; and it proved highly pleasing to the commons, nor was it disagreeable to the nobles themselves. His next scheme was to prevent their giving liverties to many hundreds of their dependants, who were thus kept like the soldiers of a standing army to be ready at the command of their lord. By an act passed in this reign, none but menial servants were allowed to wear a livery; and this law was enforced under severe penalties.

With the clergy, Henry was not so successful. The number of criminals of all kinds who found protection in monasteryes and other places appointed for religious worship, seemed to indicate little less than an absolute toleration of all kinds of vice. Henry used all his interest with the pope to get these sanctuaries abolished, but to no purpose. All that he could procure was, that if thieves, murderers, or robbers, registered as sanctuary men, should sally out and commit fresh offences, and retreat again, in such cases they might be taken out of the sanctuary and delivered up to justice.

In 1500, the king's eldest son Arthur was married to the Infanta Catherine of Spain, which marriage had been projected and negotiated seven years. But the prince dying in a few months after marriage, the princess was obliged to marry his younger brother Henry, who was created prince of Wales in his room. Henry himself made all the opposition which a youth of twelve years of age is capable of: but as the king persisted in his resolution, the marriage was by the pope's dispensation shortly after solemnized. In the latter part of this king's reign, his economy, which had always been exact, degenerated into avarice, and he oppressed the people in a very arbitrary manner. He had two ministers, Empson and Dudley, perfectly qualified to second his avaricious intentions. They were both lawyers, and usually committed to prison by indictment such persons as they intended to oppress; from whence they seldom got free but by paying heavy fines, which were called mitigations and compositions: but by degrees the very forms of law were omitted; and they determined in a summary way upon the properties of the subjects, and confiscated their effects to the royal treasury. — Henry VII died of the gout in his stomach, in the year 1509, having lived 52 years, and reigned 23; and was succeeded by his son Henry VIII. In Henry VII's reign was built a large ship of war called the Great Harry, which cost 14,000l. This was, properly speaking, the first ship in the English navy. Before this period, when the king wanted a fleet, he had no other expedient than to hire ships from the merchants.

Henry VIII. ascended the throne when he was about 18 years of age, and had almost every advantage England, which a prince can have on his accession. He had a well-stored treasury and indisputable title, and was at A.D. 1514, peace with all the powers in Europe. Commerce and arts had been some time introduced into England, where they met with a favourable reception. The young prince himself was beautiful in his person, expert in all polite exercises, open and liberal in his air, and loved by all his subjects. The old king, who was himself a scholar, had instructed him in all the learning of the times, so that he was an adept in school-divinity before the age of 18.

All these advantages, however, seemed to have been lost upon the new king. Being destitute of a good heart and solid understanding, he proved a tyrant. Being always actuated, not by reason, but by the passion which happened to be uppermost in his mind, he behaved in the most absurd and contradictory manner; and however fortunate some of his measures proved at last, it is impossible that either his motives, or the means he took for the accomplishment of his purposes, can be approved of by any good man.

One of Henry's first actions in his royal capacity was to punish Empson and Dudley, who were obnoxious to the populace on account of their having been the instruments of the late king's capacity. As they could not be impeached merely on account of their having strictly executed the will of the king, they were accused of having entered into a treasonable conspiracy, and of having designed to seize by force the administration of government; and though nothing could be more improbable than such a charge, the general prejudice against them was so great, that they were both condemned and executed.

In 1511, the king entered into a league with Pope Julius II. and Ferdinand king of Spain, against Louis XII. of France. In this alliance Henry was the only disinterested person. He expected nothing besides the glory which he hoped would attend his arms, and the title of Most Christian King, which the pope assured him would soon be taken from the king of France to be conferred upon him. The pope was desirous of wresting from Louis some valuable provinces which he possessed in Italy, and Ferdinand was desirous of sharing in the spoil. Henry summoned his parliament, who very readily granted him supplies, as he gave out that his design was to conquer the kingdom of France, and annex it to the crown of England. It was in vain that one of his old prudent counsellors objected, that conquests on the continent would only drain the kingdom without enriching it; and that England, from its situation, was not fitted to enjoy extensive empire. The young king, deaf to all remonstrances, and hurried away by his military ardour, resolved immediately to begin the war. But after several attempts, which were rendered unsuccessful only by the mismanagement of those who conducted them, a peace was concluded with France on the 7th of August 1514. Henry's arms were attended with more success in Scotland; where King James IV. with the greatest part of the Scots nobility, and 10,000 of the common people, were cut off in the battle of Flodden. Henry See Scot- in the meantime, pulled up with his imaginary Successes against France, and his real ones against Scot-
England.

The old ministers who had been appointed by his father to direct him, were now disregarded; and the king's confidence was entirely placed in Thomas afterwards Cardinal Wolsey, who seconded him in all his favourite pursuits, and who, being the son of a private gentleman at Ipswich, had gradually raised himself to the first employments of the state. He doth not seem to have had many bad qualities besides his excessive pride, which disgusted all the nobility; but the great share he possessed in the favour of such an absolute prince as Henry VIII. put him quite out of the reach of his enemies.

The king having soon exhausted all the treasures left him by his father, as well as the supplies which he could by fair means obtain from his parliament, applied to Wolsey for new methods of replenishing his coffers. The minister's first scheme was to get a large sum from the people under the title of benevolence; though no title could be more improperly applied, as it was not granted without the greatest murmurings and complaints. Wolsey even met with opposition in the levying of it. In the first place, having exacted a considerable sum from the clergy, he next applied himself to the house of commons; but they only granted him half the sum he demanded. The minister at first was highly offended, and desired to be heard in the house; but they replied, that none could be permitted to sit and argue there except such as were members. Soon after, the king having occasion for new supplies, by Wolsey's advice attempted to procure them by his prerogative alone, without consulting his parliament. He issued out commissions to all the counties of England for levying four shillings in the pound from the clergy, and three shillings and fourpence from the laity. This stretch of royal power was soon opposed by the people, and a general insurrection seemed ready to ensue. Henry endeavoured to pacify them by circular letters; in which he declared, that what he demanded was only by way of benevolence. The city of London, however, still hesitated on the demand; and in some parts of the country insurrections were actually begun. These were happily suppressed by the duke of Suffolk; but the cardinal lost somewhat of the king's favour on account of the improper advice he had given him. To reinstate himself in his good graces, Wolsey made the king a present of a noble palace called York-place, at Westminster, assuring him that from the first he had intended it for the king's use. If order to have a pretence for amassing more wealth, Wolsey next undertook to found two new colleges at Oxford; and for this purpose he received every day fresh grants from the pope and the king. The former imprudently gave him leave to suppress some monasteries, and make use of their revenues for the erection of his new colleges; but this was a fatal precedent for the pontiff's interests, and it taught the king to seize on the monastic revenues whenever he stood in need of money.

For a considerable time Wolsey continued to enjoy the king's favour in an extreme degree; and as no monarch was ever more despotic than Henry VIII., no minister was ever more powerful than Wolsey. This extraordinary elevation served only to render his fall the more conspicuous, and himself the more miserable, when it took place: and what was worse, he had long foreseen, from what he knew of the king's capricious and obstinate temper, that it certainly would happen one time or other. The cause of this final overthrow was the desire King Henry began to entertain of having his queen Catharine divorced. The doctrines of disgrace, the reformation, propagated by Luther in 1517, had gained considerable ground in England, and many professors a belief in them, notwithstanding the severe persecution which had been carried on against heretics during some of the preceding reigns. The clergy had become so exceedingly corrupt, and were immersed in such monstrous ignorance, that they were universally hated even by their own party; while no regard at all was paid to their decisions, or rather they were looked upon with the utmost abhorrence, by the reformers. Even the papal authority, though still very great, had in no greater a space of time than ten years (viz. from 1517, when Luther first began to attack it, to the present year 1527), declined very sensibly. The marriage of Henry, therefore, being looked upon by concerning all parties as in itself illegal, and only sanctioned by the legality a dispensation from the pope, had been frequently objected to on different occasions. We are informed by some authors, that when Henry VII. betrothed his son, at that time only 12 years of age, he evidently showed an intention of taking afterwards a proper opportunity to annul the contract; and that he ordered Prince Henry, as soon as he should come of age, to enter a protestation against the marriage; charging him on his death-bed not to finish an alliance so unusual, and liable to such insuperable objections. Some members of the privy-council, particularly Warham the prior, afterwards declared against the completion of the marriage; and even after it was completed, some incidents which in a short time took place were sufficient to make him sensible of the general sentiments of the public on that subject. The states of Castile had opposed a marriage betwixt the emperor Charles and the English princess Mary, Henry's daughter, urging among other things the illegitimacy of her birth. The same objection afterwards occurred on opening a negotiation with France for a marriage with the duke of Orleans.

If these accounts are to be depended upon as authentic, we can scarcely perceive it possible but Henry sen for himself must have been somewhat staggered by them; though it is by no means probable that they were his only motives. The queen was six years older than the king, her personal charms were decayed, and his affection lessened in proportion. All her children had died in infancy except one daughter, the princess Mary above mentioned; and Henry was, or pretended to be, greatly struck with this, as it seemed something like the curse of being childless, pronounced in the Mosaic law against some evil. Another point of the utmost importance was the succession to the crown, which any question concerning the legitimacy of the king's marriage would involve in confusion. It was also supposed, with great reason, that should any obstacles of this kind occur, the king of Scotland would step in as the next heir, and advance his pretensions to the crown of England. But, above all, it was probable that he was influenced by the love he had for Anne Boleyn, who had lately been contracted for. Anne Boleyn, who...
ENGLAND.

A.D. 1527

been appointed maid of honour to the queen. In this station Henry had frequent opportunities of seeing her, and soon became deeply enamoured; and finding that his passion could not be gratified but by marriage, it is not to be doubted that he was thus obstinately set upon the divorce; for which purpose he sent his secretary to Rome to obtain from Clement a bull for dissolving his marriage with Catharine. That he might not seem to entertain a doubt of the pope's prerogative, he insisted only on some grounds of nullity in the bull granted by his predecessor, John, for the accomplishment of the marriage. In the preamble to this bull, it had been said, that it was granted only upon the solicitation of Henry himself; though it was known that he was then a youth under 12 years of age; it was likewise asserted, that the bull was necessary for maintaining the peace between the two crowns; though otherwise it is certain that there was no appearance of a quarrel betwixt them. These false premises seemed to afford a very good pretence for dissolving it; but, as matters then stood, the pope was involved in the utmost perplexity. Queen Catharine was aunt to the emperor, who had lately made Clement himself a prisoner, and whose resentment he still dreaded: and besides, he could not with any degree of prudence declare the bull of the former pope illicit, as this would give a mortal blow to the doctrine of papal infallibility. On the other hand, Henry was his protector and friend; the dominions of England were the chief resource from whence his finances were supplied; and the king of France, some time before, had got a bull of divorce in circumstances nearly similar. In this exigence he thought the wisest method would be to spin out the affair by negotiation; and in the mean time he sent over a commission to Wolsey, in conjunction with the archbishop of Canterbury, or any other English prelate, to examine the validity of the king's marriage and of the former dispensation; granting them also a provisional dispensation for the king's marriage with any other person.

The pope's message was laid before the council in England; but they considered, that an advice given by the pope in this secret manner might very easily be disavowed in public; and that a clandestine marriage would totally invalidate the legitimacy of any issue the king might have by such a match. In consequence of this, fresh messengers were dispatched to Rome, and evasive answers returned; the pope never imagining that Henry's passion would hold out during the tedious course of an ecclesiastical controversy. But in this he was mistaken. The king of England had been taught to dispute as well as the pope, and valued himself not a little on his knowledge in theology: and to his arguments he added these: telling him, that the English were not too well disposed to withdraw from the holy see; and that if he continued uncomplying, the whole country would readily follow the example of their monarch, who should always deny obedience to a pontiff that had treated him with such falsehood and duplicity. The king even proposed to his holiness whether, if he were not permitted to divorce his present queen, he might not have a dispensation for having two wives at once?

The pope, perceiving the king's eagerness; at last sent Cardinal Campeggio his legate to London; who with Wolsey, opened a court for trying the legitimacy of the king and queen to appear before them. The trial commenced the 31st of May 1529; and both parties presented themselves. The king answered to his name and title when called: but the queen, instead of answering to give her place, rose from her seat, and, throwing herself at the feet of the pope, made a very pathetic harangue; which her beauty, her virtue, her misfortunes, rendered still more affecting. She told her husband, "That she was a stranger in his dominions, without protection, without counsel, and without assistance; exposed to all the injustice which her enemies were pleased to impose upon her; that she had quitted her native country, without any other resource than her connections with him and his family; and that, instead of suffering thence any violence or iniquity, she had been assured of having in them a safeguard against every misfortune: That she had been his wife during 20 years; and would here appeal to himself, whether her affectionate submission to his will had not merited other treatment than to be thus, after so long a time, thrown from him with indignity: That she was conscious,—he himself was assured,—that her virgin honour was yet unimpaired when he received her into his bed; and that her connections with his brother had been carried no farther than the mere ceremony of marriage: That their parents, the kings of England and Spain, were esteemed the wisest princes of their time, and had undoubtedly acted by the best advice when they formed the agreement for that marriage, which was now represented as so criminal and unnatural: And that she acquiesced in their judgment, and would not submit her cause to be tried by a court whose dependance on her enemies was too visible ever to allow her any hopes of obtaining from them as equitable or impartial decision." Having spoken these words, the queen rose; and, making the king a low reverence, left the court; nor would she even appear in it. The legate having again summoned the queen to appear before them, on her refusal, declared her contumacious, and the trial proceeded in her absence. But when the business seemed to be nearly decided, Campeggio, on some very frivolous pretence, prorogued the court, and at last transferred the cause before the see of Rome.

All this time Cardinal Wolsey seemed to be in the same dilemma with the pope, and indeed much worse; not only as his holiness possessed. On the one hand, he was very solicitous to gratify the king his master, who had distinguished him by so many and extraordinary marks of favour; on the other, he feared to offend the pope, whose servant he more immediately was, and who likewise had power to punish his disobedience. He had long known that this affair was certainly to end in his ruin; and by attempting to please all parties, he fell under the displeasure of every one; so that he was at last left without a single friend in the world. The king was displeased on account of his not entering into his cause with the warmth he thought he had reason to expect; Anne Boleyn impeded to him the disappointment of her hopes; while even Queen Catharine and her friends expressed the greatest indignation against him on account of the part he had openly taken in the affair of her divorce. In this miserable situation the king
England. king sent him a message by the dukes of Norfolk and Suffolk, demanding the great seal; the cardinal refused to deliver it without a more express warrant, upon which Henry wrote him a letter, and on receipt of this it was instantly given up. The seal was bestowed on Sir Thomas More, a man who, besides elegant literary talents, was possessed of the highest capacity, integrity, and virtue. Wolsey was next commanded to depart from York-place, which he had built in London; and which, though it belonged to the see of York, was then seized by the king, and afterwards became the residence of the British sovereigns, under the name of Whitehall. All his furniture and plate, the riches of which seemed rather proper for a monarch than a subject, was seized for the king's use. He was then commanded to retire to Esher, a country-seat which he possessed near Hampton-court, and there to wait the king's pleasure. One discharge followed another; and his fall was at length completed by a summons to London to answer a charge of high treason. This summons he at first refused to answer, as being a cardinal. However, being at length persuaded, he set out on his journey; but was taken ill, and died by the way. See the article Wolsey.

After the death of Wolsey, the king, by the advice of Cranmer, had the legality of his marriage debated in all the universities of Europe; and the votes of those were obtained in his favour by dint of money. The depositions made on the occasion have even been preserved to this day. A subdeacon gave a crown, to a deacon two crowns, and so to the rest in proportion to the importance of their station or opinion. Being thus fortified by the opinions of the universities, and even of the Jewish rabbis (for them also he had consulted), Henry began to think he might safely oppose the pope himself. He began by reviving in parliament an old law against the clergy, by which all those who had submitted to the authority of the pope's legates were condemned to severe penalties. The clergy, to conciliate the king's favour, were obliged to pay a fine of £58,000 pounds. A confession was likewise extorted from them, that the king, and not the pope, was the supreme head of the church and clergy of England. An act was then passed against laying the first-fruits, or a year's rent of all the bishoprics that fell vacant. After this the king privately married his beloved Anne Boleyn; and she, proving with child soon after marriage, he publicly owned her for his wife, and passed with her through London, with a greater magnificence than had ever been known before. The streets were strewn with flowers, the walls of the houses hung with tapestry, and a universal joy seemed to be diffused among the people. The unfortunate Queen Catherine, who had further opposed to be vain, retired to Amplifull near Dunstable, where she continued the rest of her days in privacy and peace. Her marriage with Henry was at last declared invalid, but not till after the last had been married to Anne Boleyn, though this declaration ought undoubtedly to have preceded it. See Boleyn.

The pope was never informed of these proceedings, nor passed a sentence, declaring Catherine to be the king's only lawful wife; requiring him to take her again, and dispensing his censures against him in case of a refusal. Henry, on the other hand, knowing that his subjects were entirely at his command, resolved to separate totally from the church of Rome. In the year 1534, he was declared head of the church by parliament; the authority of the pope was completely abdicated in England; all tributes formerly paid to the head of the holy see were declared illegal; and the king was excommunicated, with the collusion to all ecclesiastical benefices. The nation came into the king's measures with joy, and took an oath called the oath of supremacy; all the credit which the pope had maintained over England for ages was now overthrown at once; and none seemed to repine at the change, except those who were immediately interested by their dependence on Rome. But though the king thus separated from the church of Rome, he by no means adhered to the doctrines of Luther which had been lately published. He had written a book against this celebrated reformer, which the pope pretended greatly to admire; and honoured King Henry, on its account, with the title of "Defender of the faith." This character seemed to be determined to maintain, and therefore persecuted the reformers most violently. Many were burnt for denying the popish doctrines, and some also were executed for maintaining the supremacy of the pope. The courtiers knew not which side to take, as both the new and old religions were equally persecuted; and as both parties equally courted the favour of the king, he was by that means enabled to assume an absolute authority over the nation. As the monks had all along shown the greatest resistance to Henry's ecclesiastical character, he resolved at once to deprive them of the power of injuring him. He accordingly empowered Cromwell, secretary of state, to send commissioners into the several counties of England to inspect the monasteries; and to report, with rigorous exactness, the conduct and department of such as were found there. This employment was readily undertaken by some creatures of the court, whose names were Layton, London, Price, Gage, Petre, and Belasis. They are said to have discovered monstrous disorders in many of the religious houses; whole convents of women abandoned to all manner of lewdness; friars accomplices in their crimes; pious frauds everywhere committed, to increase the devotion and liberality of the people; and cruel and invertebrate factions maintained between the inhabitants. Thus a general horror was excited against supression these communities; and therefore the king, in 1536, suppressed the lesser monasteries, amounting to 375 in number. Their revenues, computed at 32,000 pounds a-year, were confiscated to the king's use, besides their plate and other goods, computed at 200,000 pounds more. In 1538, the greater monasteries also were demolished. The better to reconcile the people to this great innovation, stories were published, perhaps with exaggerations, of the detestable lives which the friars led in their convents. The relics also, and other objects of superstitious veneration, were now brought forth, and became objects of devotion to the reformers. A great number of these are enumerated by Protestant writers, such as the graven images of St. Edward's crown; some of the seals that rested at St. Laurence; the girdle of the virgin Mary, shown in no fewer than eleven different places; two or three heads of St. Ursula; the feet of St. Thomas of Lancaster, an infallible cure for the headaches; part of St. Thomas of Canterbury's shirt, much
much revered among big-bellied women; some re-
licks, an excellent preservative against rain, others
against weeds in corn, &c. Some impostures, how-
ever, were discovered, which displayed a little more
ingenuity in the contrivance. At Hales in the county
of Gloucester had been shown, during several ages, the
blood of Christ brought from Jerusalem. The vena-
tion for this precious relic may easily be imagined;
but it was attended with a most remarkable circum-
stance not observed in any other relics. The sacred
blood was not visible to any one in mortal sin, even
when set before him; nor could it be discovered till he
had performed good works sufficient for his absolution.
At the dissolution of the monastery, the whole con-
trivance was discovered. Two of the monks who were
let into the secret, had taken the blood of a duck, which
they renewed every week: they put it into a
phial, one side of which was thin and transparent crys-
tal, the other thick and opaque. When any rich pil-
grim arrived, they were sure to show him the dark side,
till masses and offerings had expiated his offences;
after which they made him happy, by turning the
phial. A miraculous crucifix had been kept at Boxely
in Kent, and bore the appellation of the rood of grace.
The lips, eyes, and head of the image, moved on the
approach of its votaries. Helsey bishop of Rochester
broke the crucifix at St Paul's cross, and showed to all
the people the springs and wheels by which it had
been secretly moved. A great wooden idol, called
Dorcas Gatherin, was also brought to London and cut
in pieces: and, by a cruel refinement of vengeance, it
was employed as fuel to burn Friar Forest; who was
punished for denying the king's supremacy, and for
some pretended herezies. A finger of St Andrew,
covered with a thin plate of silver, had been pawned for
a debt of 50 pounds; but as the king's commissioners
refused to release the pawn, people made themselves
very merry with the poor creditor on account of his
security. On this occasion also was demolished the noted
shrine of Thomas Becket, commonly called St
Thomas of Canterbury. The riches of it were in-
conceivable: when broken down, the gold with which
it was adorned filled two large chests that eight strong
men could scarcely carry out of the church. The king,
on the whole, suppressed 645 monasteries, of which 28
had abbeys who enjoyed seats in parliament. Ninety
colleges were demolished in several counties; 2374
chantries and free chapels, and 110 hospitals.
The whole revenue of these establishments amounted to
161,100 pounds.

It is easy to imagine the indignation which such an
uninterrupted course of sacrilege and violence would
occasion at Rome. In 1535, the king had executed
Bishop Fisher, who was created a cardinal while in
prison, and Sir Thomas More, for denying or speak-
ing ambiguously about his supremacy. When this was
reported in Italy, numerous libels were published all
over the country, comparing the king of England to
Nero, Domitian, Caligula, and the most wicked ty-
ants of antiquity. Clement VII. died about six months
after he had threatened the king with a sentence of ex-
communication; and Paul III. who succeeded him in
the papal throne, entertained some hopes of an accom-
modation. But Henry was so much accustomed to do-
mineering, that the quarrel was soon rendered totally
incurable. The execution of Fisher was reckoned such
a capital injury, that at last the pope passed all his cen-
sures against the king, citing him and all his adherents
A.D. 1539-
170
for their crimes. If they failed, he communicated
them; deprived the king of his realm; subjected the
kingdom to an interdict; declared his issue by Anne
Boleyn illegitimate; dissolved all leagues which any
Catholic princes had made with him; gave his king-
dom to any invader; commanded the nobility to take
up arms against him; freed his subjects from all oaths
of allegiance; enticed them off their commence with foreign
states; and declared it lawful for any one to seize them,
to make slaves of their persons, and to convert their
effects to his own use. But though these censures were
then passed, they were not openly denounced. The
pope delayed the publication till he should find an
agreement with England totally desperate, and till the
emperor, who was then hard pressed by the Turks and
the Protestant princes of Germany, should be in a con-
tdition to carry the sentence into execution. But in
1538, when news arrived at Rome that Henry had pro-
cceeded with the monasteries as above related, the pope
was at last provoked to publish the censures against him.
Libels were again dispersed, in which he was anew
compared to the most furious persecutors of antiquity,
and the preference was now given on their side. Henry,
it was said, had declared war with the dead, whom the
Pagans themselves respected; was at open enmity with
heaven; and had engaged in professed hostility with all the
saints and angels. Above all, he was reproached
with his resemblance to the emperor Julian, whom (it
was said) he imitated in his apostacy and learning,
though he fell short of him in his morals. But these
terrible fulminations had now lost their effect.
Henry had long ago denied the supremacy of the pope,
and therefore had appealed from him to a general council;
but now, when a general council was summoned at
Mantua, he refused to be subject to it, because it was
called by the pope, and lay entirely under subjection to
that spiritual usurer. He engaged his clergy to make
a declaration to the like purpose, and prescribed to them
many other alterations with regard to their ancient
tenets and practices. It was expected that the spirit of
opposition to the church of Rome would have at last
and tyrannical con-
parliament by informing the house of lords, that it was his majesty's earnest desire to extirpate from his kingdom all diversity of opinions with regard to religion; and as this enterprise was, he owned, difficult and important, he desired them to choose a committee from among themselves, who might frame certain articles, and communicate them afterwards to parliament. The lords named the vicar-general Cromwell, now created a peer, the archbishops of Canterbury and York, the bishops of Durham, Carlisle, Worcester, Bath and Wells, Bangor, and Ely. This small committee itself was agitated with such diversity of opinion, that it could not come to no conclusion. The duke of Norfolk then moved, that since there was no hope of having a report from the committee, the articles of faith proposed to be established should be reduced to six, and a new committee be appointed to frame an act with regard to them. As this peer was understood to speak the king's mind, his motion was immediately complied with; and, after a short preconception, the bill of the six articles, or the bloody bill, as the Protestants justly termed it, was introduced; and having passed the two houses, received the king's assent. By this law the doctrine of the real presence was established; the communion in one kind; the perpetual obligation of vows of chastity; the utility of private masses; the celibacy of the clergy; and the necessity of auricular confession. The denial of the real presence subjected the person to death by fire, and to the same forfeitures as in cases of treason; and admitted not the privilege of abjuring: an unheard-of cruelty, unknown even to the inquisition itself. The denial of any of the other articles, even though recanted, was punishable by the forfeiture of goods and chattels, and imprisonment during the king's pleasure: an obstinate adherence to error, or a relapse, was adjudged to be felony, and punishable by death. The marriage of priests was subjected to the same punishment. Their commerce with women was, for the first offence, forfeiture and imprisonment; and for the second, death. Abstaining from confession, and from receiving the eucharist at the accustomed times, subjected the person to fine, and to imprisonment during the king's pleasure; and if the criminal persevered after conviction, he was punishable by death and forfeiture as in cases of felony. Commissioners were to be appointed by the king for inquiring into these heresies and irregular practices, and the criminals were to be tried by a jury.

The parliament having thus surrendered their ecclesiastical privileges, next proceeded to surrender their civil ones also. They gave to the king's proclamations the same force as to statutes enacted by parliament, and thus by one blow made a total subversion of the English constitution; and to render the matter worse, if possible, they framed this law as if it were only declaratory, and intended to explain the natural extent of the royal authority. Notwithstanding this, however, they afterwards pretended to make some limitations in the regal power, and they enacted, that no proclamation should deprive any person of his lawful possessions, liberties, inheritances, &c. nor yet infringe any common law or laudable system of the realm.

As soon as the act of the six articles had passed, the Catholics were extremely vigilant to inform against offenders; and, in a short time, no fewer than 500 persons were thrown into prison. But some of the chief officers of state remonstrating against the cruelty of punishing such a number of delinquents, they were all of them set at liberty; and soon after this, Henry, as if he had resolved to give each party the advantage by turns, granted every one permission to have a translation of the Bible, which had been newly made, in his family.

In 1540, the king again complained to parliament of the great diversity of religious tenets which prevailed among his subjects: a grievance, he affirmed, which ought the less to be endured, because the scriptures were now published in England, and ought universally to be the standard of belief to mankind. But he had appointed, he said, some bishops and divines to draw up a list of tenets; and he was determined that Christ and the truth should have the victory; whence he seems to have expected more from this new book of his doctors, than had ensued from the publication of the scriptures. Cromwell, as vicar-general, also made a speech in the upper house; and the peers in return told him, that he deserved to be vicar-general to the universe: To such a degree of mean and servile submission was the English parliament at this time reduced.

This year also the king suppressed the only religious order remaining in England; namely, the knights of St John of Jerusalem, or the knights of Malta, as they are commonly called. This order had by their valour done great service to Christendom; and had very much retarded, at Jerusalem, Rhodes, and Malta, the rapid progress of the barbarians. During the general surrender of the religious houses in England, they had obstinately refused to give up their revenues to the king; and Henry who would endure no society that professed obedience to the pope, was obliged to have recourse to parliament for the dissolution of this order. Their revenues were large, and formed a considerable addition to the acquisitions which the king had already made. But he had been such a bad economist, that, notwithstanding the immense plunder afforded him by the church, he now demanded from parliament a very considerable supply. The commons, however, though lavish of the blood of their fellow-subjects, were extremely frugal of their money; and it was not without murmuring that the grant could be obtained, even by this absolute and dreaded monarch.

The king all this time continued to punish with unrelenting severity the Protestants who offended against the law of the six articles, and the Papists who denied his supremacy; which gave occasion to a foreigner at that time to say, that those who were against the pope were burned, and those who were for him were hanged. The king even seemed to display in an ostentatious manner his tyrannical justice and impartiality, which reduced both parties to subjection. This year he executed three Protestants and three Papists coupled together. The latter declared, that the most grievous part of their punishment was the being coupled to such heretical miserable as suffered with them.

In 1542, Henry proceeded to the further dissolution of colleges, hospitals, and other foundations of that nature. The courtiers had been dealing with the &c. presidents and governors to make a surrender of their revenues.
revenues to the king; and they had succeeded with
eight. But there was an obstacle to their farther pro-
gress: it had been provided by the local statutes of
most of these foundations, that no president nor any
fellows could make such a deed without the unanimous
consent of all the fellows. This consent would not
have been easily obtained; but the parliament proceed-
ed in a summary manner to annul all these statutes: by
which means the revenues of these houses were exposed
to the rapacity of the king and his favourites. Henry
also now extorted from many bishops a surrender of
their chapter-houses, by which means he pillaged the
sees of Canterbury, York, and London, and enriched
his favourites with their spoils. He engaged the par-
liament to mitigate the penalties of the six articles, as
far as regarded the marriage of priests, which was now
only subjected to a forfeiture of goods, chattels, and
lands during life: he was still equally bent on main-
taining a rigourous privity in speculative principles. He
had appointed a commission consisting of two archi-
bishops and several bishops of both provinces, together
with a considerable number of doctors of divinity; and
by virtue of his ecclesiastical supremacy he had charged
them to choose a religion for his people. Before the
commissioners, however, had made any progress in this
arduous undertaking, the parliament had passed a law
by which they ratified all the tenets which these divine
sects establish with the king's consent; and thus they
were not ashamed of declaring expressly that they took
their religion upon trust, and had no other rule either
in religious or temporal concerns than the arbitrary will
of their master. One clause of the statute, however,
seems to savour somewhat of the spirit of liberty. It
was enacted, that the ecclesiastical commissioners should
establish nothing repugnant to the laws and statutes of
the realm. But in reality this proviso was inserted by
the king, to serve his own purposes. By introducing
a confusion and contradiction into the laws, he became
more the master of every one's life and property; and
as the ancient independence of the church still gave him
jealousy, he was well pleased, under colour of such a
clause, to introduce appeals from spiritual to civil
courts. For the same reason he would never promul-
gate a body of canon law; and he encouraged the
judges in all occasions to interpret in ecclesiastical cau-
ses, wherever they thought the law or the prerogative
concerned. Being thus armed by the authority of par-
lament, or rather by their acknowledgment of his spir-
Itual supremacy, the king employed his commissioners
to select a system of tenets for the assent and belief
of the nation. A small volume was published, under
the title of The Institution of a Christian Man, which
was received by the convocation, and made the infal-
lible standard of orthodoxy. In this book the points
of justification, faith, free-will, good works, and grace,
were discussed in a manner somewhat favourable to the
opinions of the reformers. The sacraments, which a
few years before were only allowed to be three, were
now increased to seven, conformably to the sentiments
of the Catholics. Throughout the whole of this book
the king's caprice is very discernible; and the book
is in reality to be regarded as his composition. For
Henry, while he made his opinion a rule for the na-
tion, would himself submit to no authority whatever;
not even to any which he had formerly established. The
same year the people had a further instance of the king's
inconsistency. He ordered a new book to be com-
posed, called The Erudition of a Christian Man; and with-
out asking the consent of the convocation, he published
by his own authority this new model of orthodoxy.
He was no less positive in his new creed than he had
been in the old one; but though he required the faith of
the nation to veer about at his signal, he was particularly
careful to inculcate the doctrine of passive obedience
in all his books, and he was no less careful to retain the
nation in the practice.

But while the king was thus spreading his own books
among the people, both he and the clergy seem to have
been very much perplexed with regard to the scriptu-
tures. A review had been made by the ecclesiastical
synod of the new translation of the Bible; and Bishop
Gardiner had proposed, that instead of employing En-
lish expressions throughout, several Latin words should
still be preserved, because they contained, as he pre-
tended, such peculiar energy and significance, that they
had no correspondent terms in the English tongue. A
among these were ecclesia, ^a/rar-entus, pontifex, contritus,
&c. But as this mixture would appear extremely bar-
barous, and was plainly calculated for no other pur-
pose than to retain the people in their ancient igno-
rance, the proposal was rejected. The knowledge
of the people, however, seemed to be still more danger-
ous than their ignorance; and the king and parliament,
soon after the publication of the scriptures, retracted
the concession which they had formerly made, and pro-
hibited all but gentlemen and merchants to peruse them.

Even that liberty was not granted without an ap-
parent hesitation, and dread of the consequences. These
persons were allowed to read, so it be done quietly and
with good order. And the preamblc to the act sets forth,
"That many seditionous and ignorant persons had abu-
used the liberty granted them of reading the Bible; and
that great diversity of opinion, anisonies, tumults,
and schisms, had been occasioned by perverting the
sense of the scriptures." The same book also passed
under the king's examination; but little alteration was
yet made in it. Some doubtful or fistitious saints only
were struck out; and the name of the pope was erased.
The latter precaution was also used with every new
book that was printed, and even every old one that
was sold. The word pope was carefully omitted or blot-
ted out; as if that precaution could abolish the term
from the language, or cause the people forget that
such a person existed. About this time also, the king
prohibited the acting of plays, interludes, and farces,
in derision of the popish superstitions; which the Pro-
estants had been in use to practise: and this prohibi-
tion was in the highest degree pleasing to the Roman
Catholics.

In this tyrannical and headstrong manner Henry
proceeded with regard to ecclesiastical affairs. In
other respects his conduct was equally violent. With
regard to his domestic concerns, history scarce affords
his parallel. We have already taken notice of his ex-
trcme love for Anne Boleyn, whom he married, con-
trary even to his own principles, before the marriage
with Catherine was dissolved. His affection for the
former was carried to such a height, that he even
procured an act excluding from the succession the is-
ssue of Queen Catherine, in favour of the children of
Anne
Anne Boleyn; and, falling them, to the king's heirs for ever. An oath to this purpose was likewise enjoined, under penalty of imprisonment during the king's pleasure, and forfeiture of goods and chattels. All slander against the king and his new queen or their issue was subjected to the penalty of treason or misprision of treason. The reason given for this extreme severity towards his own child was, that her mother had obstinately refused to quit the kingdom, notwithstanding all the methods he could take to induce her to do so. The oath was generally taken throughout the kingdom; Sir Thomas More the chancellor, and Fisher bishop of Rochester, being the only persons who refused; for which both of them were imprisoned, and soon after executed. Unfortunatae Queen Catherine died in her retreat at Ampthill, in the year 1536. On her death-bed she wrote a most pathetic letter to the king, in which she forgave him all the injuries she had received, and recommended to him in the strongest terms their daughter, the princess Mary. This letter affected Henry so much, that he could not read it without tears; but the new queen is said to have exclaimed in such a manner on hearing of the death of her rival, as was quite inconsistent with either decency or humanity. Her return, however, was of short duration. Henry had no sooner possessed her, secure from every disquieting thought, by the death of Queen Catherine, than his passion began to decline; and to this her delivery of a dead son did not a little contribute; for so impetuous and absurd were his passions, and such was his desire for male issue, that the disappointment in this respect alone was sufficient to alienate her affection from his wife. The levity of her temper, and her extreme vanity of behaviour, bordering upon licentiousness, as related under the article Boleyn, also gave an opportunity to her enemies of inflaming the king's jealousy against her. The viscountess of Rochford, in particular, a woman of profligate manners, and who was married to the queen's brother, had the cruelty to report to the king that her husband committed incest with her own sister; and, not content with this, she interpreted every instance of favour shown by her to a man, as proof of a criminal intercourse between them. At the same time it must not be forgot, that he who insisted on such rigid fidelity from his wives, was himself the most faithless of mankind. He had doubts, it may be allowed, about the legality of his marriage with Queen Catherine, but his doubts were evidently confirmed by the charms of Anne Boleyn. After being satiated with the possession of her for six years, perhaps he really doubted her fidelity; but here again his doubts were confirmed by the beauty of Jane Seymour, with whom he had now fallen in love. It may easily be believed, that from this conclusion alone there was no reason to hope that even the unfortunate Catherine would be able to excite herself. Had she really been guilty, her monster of a husband might have allowed her to live; but her cruelty was as unbounded and inatissable as his other perverse passions. She was condemned; and the sentence pronounced against her was, that she should be burned or beheaded at the king's pleasure. On hearing this dreadful denunciation she exclaimed, "O Father! O Creator! thou art the way, the truth, and the life! thou knowest that I have not deserved this fate." She then made the most solemn protestations of innocence before her judges; but these, as they had been England from the beginning insensitibler, so it was not to be supposed that they could now avail any thing. Anne was by the executioner of Calais, who was reckoned more expert than any in England; and Henry of Anne enjoyed the pleasure of marrying his beloved Jane Boleyn, and Seymour. His satisfaction, however, was of no long duration; for the queen, becoming pregnant immediately after marriage, died in two days after the birth of the child; who being a son, was baptized by the queen's name of Edward VI. As this lad had been more beloved by Henry than any of his other wives, his grief for his loss was extreme. However, it did not hinder him from entering very soon afterwards into a new matrimonial scheme; in which he met with extraordinary difficulties. His first proposals were made to the duchess dowager of Milan, niece to the emperor, to the former queen, and to Catherine his own former queen; but as he had behaved so indifferently to the aunt, it is scarce probable that he would be disposed to bestow his addresses on the niece. On this he demanded the duchess dowager of Longueville, daughter of the duke of Guise; but on making the proposal to the French monarch, Francis I., he was informed that the princess had been already betrothed to the king of Scotland. Henry, however, would take no refusal. He had learned that the object of his affections was endowed with many accomplishments, was very beautiful, and of a large size, which last property he looked upon to be necessary for him who was now become somewhat corpulent himself. Francis, to prevent any more solicitations on this subject, sent the princess to Scotland, but at the same time made Henry an offer of Mary of Bourbon, daughter of the duke of Vendome. This princess was rejected by Henry, because he had heard of her being formerly refused by the king of Scotland. He was then offered the choice of the two younger sisters of the queen of Scotland, both of them being equal in merit as well as size to the one whom he had desired; but Henry, unwilling to trust to any reports concerning the beauty of those ladies, or even to their pictures, proposed to Francis, that they should have a conference at Calais under pretence of business, and that the latter should bring with him the two princesses of Guise, with the finest ladies of quality in France, that he might make a choice. This inadulate proposal shocked Francis; he returned for answer that he was too much impressed with regard to the fair sex to carry ladies of the first quality, like geldings, to a market, to be chosen or rejected according to the humour of the purchaser. Henry demnstrated and stormed as usual; but though Francis at this time earnestly wished to oblige him, he at last totally rejected the proposal. Negotiations were then entered into with Cleves, and the princess of Cleves was proposed by Cranmer. The marriage of the great interest her father had with the Protestant princes of Germany. Henry had also become enamoured of Cleves, of her person from a picture of her he had seen: but this, though drawn by an eminent artist, was unluckily done so much to the advantage, that when the negotiation was quite finished, and the bride arrived in England, he lost all patience, swearing that she was a great Flemings mare, and that he could never bear her the smallest affection. The matter was still worse, when he found that she could
ENGLAND.

A.D. 1547

116

England. could speak no language but Dutch, of which he was entirely ignorant. Notwithstanding all these objections, however, he resolved to complete the marriage, telling Cromwell, that, since he had gone so far, he must now put his neck into the yoke. The reason of this was, that the friendship of the German princes was now more than ever necessary for Henry; and it was supposed that the afront of sending the princess back to her own country might be resented. Cromwell, who knew that his own life depended on the event of the matter, was very anxious to learn from the king how he liked his spouse after having passed a night with her; but was struck with terror when he replied that he now hated her more than ever that he was resolved not to cohabit with her, and even suspected that she was not a virgin; a matter in which he pretended to be a connaissieux, and about which he was extremely scrupulous. In a little time his aversion increased to such a degree, that he determined at any rate to get rid of his queen and prime minister both at once. Cromwell had long been an object of aversion to the nobility, who hated him on account of his obscure birth; his father being no other than a blacksmith, though the son had obtained the first employments in the kingdom. By his office of vicar-general, he had an almost absolute authority over the clergy; he was also lord privy-seal, lord chamberlain, and master of the wards. He had also been invested with the order of the Garter, and was created Earl of Essex. This was sufficient to raise the envy of the courtiers: but he had also the misfortune to fall under the displeasure of both Protestants and Papists; the former hating him on account of his conformity with Henry in their persecution, and the latter looking upon him as the greatest enemy of their religion. To these unfortunate circumstances on the part of Cromwell was added the usual situation of Henry himself, who had now fallen in love with Catharine Howard, niece to the Duke of Norfolk; to enjoy whom, he now determined to divorce Anne of Cleves. By the insinuations of this lady and her uncle, Cromwell's ruin was accomplished: and he was condemned, not only without any trial, but even without examination. The charge was of heresy and high treason; but the instances of the latter were quite absurd and ridiculous. He submitted, however, to his sentence without murmuring, as knowing that his complaints on this subject would be revenged on his son. He was terribly mangled by the executioner before his head could be struck off. His death was soon followed by the dissolution of the marriage with the princess of Cleves, which was annulled by the consent of both parties. The princess parted from him with great indifference; and accepted of twenty-thousand-a-year as a compensation, but refused to return to her own country after the afront she had received.

The king's marriage with Catharine Howard soon followed the dissolution of that with Anne of Cleves; but the event may surely be regarded as a providential punishment upon this tyrant, whose cruelty, lust, and other bad qualities, can scarcely be matched in history. We have already mentioned his insinuations against the virtue of the unfortunate princess of Cleves: these were amply repaid by the actual infidelities of his new queen, whom we must suppose he believed to be a pure and perfect virgin at the time he married her. So happy indeed did he imagine himself in this new marriage, that he publicly returned thanks for his conjugal felicity, when a most unfortunate information concerning the queen's incontinence was given to Cranmer by one of the name of Lascelles, whose sister had been servant to the duchess-dowager of Norfolk. He not only gave intelligence of her amours before marriage, but affirmed that she had continued the same criminal practices ever since. Two of her paramours were arrested, and confessed their crimes: the queen herself also confessed guilt before marriage, but denied having ever been false to the king's bed; which, however, had very little probability. She was beheaded on Tower-hill, along with the viscountess of Rochford, who had been a confidant in her amours. The latter, as has already been observed, was a principal instrument in procuring the destruction of the unhappy Anne Boley, and therefore died unpitied; while the virtuous character of that unfortunate lady received an additional confirmation from the discovery of this woman's guilt.

To secure himself from any farther disasters of this absurdity kind, Henry passed a most extraordinary law, enacting, that any one who should know, or strongly suspect, any guilt in the queen, might, within 20 days, disclose it to the king or council, without incurring the penalty of any former law against defaming the queen; though at the same time every one was prohibited from spreading the matter abroad, or even privately whispering it to others. It was also enacted, that if the king married any woman who had been incontinent, taking her for a true maid, she should be guilty of treason if she did not previously reveal her guilt to him. These laws afforded diversion to the people, who now said that the king must look out for a widow; as no reputed maid would ever be persuaded to incur the penalty of the statute. This in truth happened to be the case at last; for about a year after the death of Catharine Howard, he married, for his sixth wife, Catharine Parr, widow of Nevil Lord Latimer. This lady, being somewhat inclined to the doctrines of the reformation, and having the boldness to tell her husband her mind upon the subject, had like to have shared the fate of the rest. The furious monarch, incensed at the insolence, ordered her husband to put her to death.

A.D. 1549

126

Sixth marriage of Henry with Catharine Parr, whom he intends also to put to death. At this time Henry had tyrannized over his nobility in the most cruel manner. The old countess of Salisbury, last of the house of Plantagenet, was executed with circumstances of great cruelty. She had been condemned, as usual, without any trial; and when she was brought to the scaffold, refused to lay her head on the block in obedience to a sentence, to the justice of which she had never consented. She told the executioner, therefore, that if he would have her head, he must win it the best way he could; and thus she ran about the scaffold, pursued by the executioner,
England.

England, who aimed many fruitless blows at her neck before he was able to put an end to her life. Soon after her, the lord Leonard Grey was likewise executed for treason, but we have very little account of this transaction.

The last instances of the king's injustice and cruelty were the duke of Norfolk and his son the earl of Surry. The former had served the king with fidelity, and the latter was a young man of the most promising hopes. His qualifications, however, were no security against the violence of Henry's temper. He had expressed some expressions of contempt against the king's ministers, who had displaced him from the government of Bouloges; and the whole family had become obnoxious on account of the late queen Catharine Howard. From these motives, orders were given to arrest both the father and son; and accordingly they were arrested both on the same day, and confined to the Tower. The duchess-dowager of Richmond, Surry's own sister, was among the number of his accusers; and Sir Richard Soothwell also, his most intimate friend, charged him with infidelity to the king. Surry denied the charge, and challenged his accuser to a single combat. This favour was denied him; and, notwithstanding his eloquent and spirited defense, he was condemned and executed at Tower-hill. — The duke of Norfolk vainly endeavoured to mollify the king by letters and submissions. An attainer was found against him, though the only crime his accusers could allege was, that he had once said that the king was sickly, and could not hold out long; and that the kingdom was likely to be torn between the contending parties of different religion. Cranmer, though engaged for many years in an opposite party to that of Norfolk, and though he had received many and great injuries from him, would have no hand in such an unjust prosecution; but retired to his seat at Croydon. The death-warrant, however, was made out, and immediately sent to the lieutenant of the Tower; but a period was put to the cruelties and violence of the king by his death, which happened on the 14th of January 1547, the night before Norfolk was to have been executed.

Henry was succeeded by his only son Edward, a boy of nine years of age. The most remarkable transactions of his reign are those with regard to religion. The restraint which Henry VIII. had laid upon the Protestants was now taken off; and they not only maintained their doctrines openly, but soon became the prevailing party. Henry had fixed the majority of his son at 18 years of age; and, in the mean time, appointed 16 executors of his will, to whom, during the minority, he entrusted the government of the king and kingdom. This will, he imagined, would be obeyed as implicitly after his death as though he had been alive. But the first act of the executors was to choose the earl of Hertford, afterwards duke of Somerset, protector of the realm; and in him was lodged all the regal power, together with a privilege of naming whom he pleased for his privy council.

The duke of Somerset had long been reckoned a secret partisan of the reformers; and immediately on his elevation to his present high dignity, began to express his intention of reforming the abuses of the ancient religion. Under his direction and that of Cranmer, therefore, the reformation was carried forward and completed. The only person of consequence who opposed the reformers was Gardiner bishop of Winchester; and, to the disgrace of their own principles, the reformers now showed that they could persecute as severely as the Papists had formerly persecuted them. Gardiner was committed to the Fleet prison, where he was treated with great severity. He was afterwards sent to the Tower; and having con

The reformers persecuted the Catholics. He was then committed to close custody; his books and papers were seized; all company was denied him, and he was not even permitted the use of pen and ink. The bishops of Chichester, Worcester, and Exeter, were in like manner deprived of their offices; but the bishops of Llandaff, Salisbury, and Coventry, escaped by sacrificing the most considerable share of their revenues. The libraries of Westminster and Oxford were ordered to be ransacked, and purged of the Romish legends, missals, and other superstitious volumes; in which search, great devastation was made even in useful literature. Many volumes clasped in silver were destroyed for the sake of their rich bindings; many of geometry and astronomy were supposed to be magical, and destroyed on that account; while the members of the university, unable to put a stop to these ravages, trembled for their own safety.

The reformers, however, were not contented with severities of this kind. A commission was granted to the primate and others, to search after all Anabaptists, heretics, or contemners of the new liturgy. Among the numbers who were found guilty upon this occasion, was one Joan Boucher, commonly called Joan of Kent; who was so very obstinate, that the commissioners could make no impression upon her. She maintained an abstruse metaphysical sentiment, that Christ, as man, was a sinful man; but, as the Word, he was free from sin, and could be subject to none of the frailties of the flesh with which he was clothed. For maintaining this doctrine, the poor woman was condemned to be burnt to death as a heretic. The young king, who it seems had more sense than his teachers, refused at first to sign the death-warrant; but at last, being overcome by the importunities of Cranmer, be reluctantly complied; declaring, that if he did wrong, the sin should be on the head of those who had persuaded him to it. The primate, after making another unsuccessful effort to reclaim the woman from her opinions, committed her to the flames. Some time after, one Van Paris, a Dutchman, was condemned to death for Anabaptism. He suffered with so much satisfaction, that he hugged and caressed the faggots that were consuming him.

The rest of this reign affords only the history of intrigues and cabals of the courtiers one against another. The protector was first opposed by his own brother Admiral Sir Thomas Seymour, who had married Catharine Parr the late king's widow. She died soon after the marriage; and he then made his addresses to the princess Elizabeth, who is said not to have been averse to the match. His brother the duke, who was at that time in the north, being informed of his
England.

A. D. 1553

his ambitious projects, speedily returned; had him attainted of high treason, and at last condemned and executed. The duke of Somerset himself, however, was some time afterwards deprived of his office by Dudley, duke of Northumberland; who at last found means to get him accused of high treason, and executed. Not satisfied with the office of protector, which he assumed on the death of Somerset, this ambitious nobleman formed a scheme of engrossing the sovereign power altogether. He represented to Edward, who was now in a declining state of health, that his sisters Mary and Elizabeth, who were appointed by Henry's will to succeed, in failure of direct heirs, to the crown, had both been declared illegitimate by parliament; that the queen of Scots his aunt stood excluded by the king's will; and, being an alien also, lost all right of succeeding. The three princesses being thus excluded, the succession naturally devolved to the marchioness of Dorset, eldest daughter of the French queen, Henry's sister, who had married the earl of Suffolk, after her husband's death. The next heir to the marchioness was Lady Jane Grey, a lady universally respected, both on account of the charms of her person, and the virtues and endowments of her mind. The king, who was accustomed to submit to the politic views of this minister, agreed to have the succession submitted to council, where Northumberland hoped to procure an easy concurrence. The judges, however, who were appointed to draw up the king's letters patent for this purpose, warmly objected to the measure; and gave their reasons before the council. They begged that a parliament might be summoned, both to give it force, and to free its partesans from danger: they said that the form was invalid, and would not only subject the judges who drew it, but every counsellor who signed it, to the pains of treason. Northumberland could not brook their demurs; he threatened them with his authority, called one of them a traitor, and said he would fight with any man in his shirt in such a just cause as that of Lady Jane's succession. A method was therefore found out of screening the judges from danger, by granting them the king's pardon for what they should draw up; and at length the patent for changing the succession was completed, the princesses Mary and Elizabeth were set aside, and the crown settled on the heirs of the duchess of Suffolk (for she herself was contented to forego her claim).

For some time the king had languished in a consumption. After this settlement of the crown, his health visibly declined every day, and little hopes were entertained of his recovery. To make matters worse, his physicians were dismissed by Northumberland's advice, and by an order of council; and he was put into the hands of an ignorant old woman, who undertook in a little time to restore him to health. After the use of her medicines all his bad symptoms increased to the most violent degree. He felt a difficulty of speech and breathing; his pulse failed, his legs swelled, his colour became livid, and many other signs of approaching death made their appearance. He expired at Greenwich on the 6th of July 1553, in the 16th year of his age and 7th of his reign.

After the death of Edward, very little regard was paid to the new patent by which Lady Jane Grey had been declared heir to the throne. The undoubted title of Mary, notwithstanding the scandalous behaviour of her father and his servile parliaments, was acknowledged by the whole nation. Northumberland, however, was resolved to put the late king's will in execution. He therefore carefully concealed the death of Edward, in hopes of securing the person of Mary, who by an order of council had been required to attend her brother during his illness; but she being informed of his death, immediately prepared to assert her right to the crown. Northumberland then, accompanied by Lady Jane Grey the deke of Suffolk, the earl of Pembroke, and some other noblemen, saluted Lady Jane Grey queen of England. Jane was in a great measure ignorant of these transactions, and it was with the utmost difficulty she was persuaded to accept of the dignity conferred upon her. At least she complied, and suffered herself to be conveyed to the Tower, where it was then usual for the sovereigns of England to pass some days after the succession. Mary, however, who had retired to Kenning-hall in Norfolk, in a very few days found herself at the head of 40,000 men; and Lady Jane resigned the sovereignty in ten days, with much more pleasure than she had received it. She retired with her mother to their own habitation; and Northumberland finding his affairs quite desperate, attempted to quit the kingdom. But he was stopped by the band of pensioners, who informed him that he must stay to justify their conduct in taking arms against their lawful sovereign. He therefore surrendered himself to Mary; and was soon after executed, together with Sir John Gates and Sir Thomas Palmer, two infamous tools of his power. Sentence was also pronounced against Lady Jane Grey and her husband Lord Guildford; but without any intention of putting it in execution against them at present, as their youth and innocence pleased so strongly in their favour, neither of them having yet reached their 17th year.

Mary now entered London, and was peaceable set on the throne without any effusion of blood. The shared English, however, soon found reason to repeat their queen's attachment to her predecessor. Though she had at first solemnly promised to defend the religion and laws of her predecessor, she no sooner saw herself firmly established on the throne, than she resolved to restore the Popish religion, and give back their former power to the clergy. Gardiner, Bonner, and the other bishops who had been imprisoned or suffered loss during the last reign, were taken from prison, reinstated in their sees, and now triumphed in their turn. On pretence of discouraging controversy, the queen by her prerogative silenced all preachers throughout England, except such as should obtain a particular license, and this she was resolved to give only to those of her own persuasion. The greater part of the foreign Protestants took the first opportunity of leaving the kingdom; and many of the arts and manufactures, which they had successfully introduced, fled with them. Soon after the queen called a parliament, which seemed willing to concur in all her measures. They at once repealed all the statutes with regard to religion that had passed during the reign of Edward VI. and the sacramental religion was again placed on the same footing in which it had been at the death of Henry VIII.

To strengthen the cause of the Catholics, and give the
ENGLAND.

This rebellion had almost proved fatal to the Princess Elizabeth, who for some time past had been treated with great severity by her sister. Mary, who possessed a most malignant and cruel heart, had never for a moment got the quarrel between their mothers; and when a declaration was made after her own accession, recognizing Queen Catherine's marriage as legal, she was thus furnished with a pretence for accounting Elizabeth illegitimate. She was likewise obnoxious on account of her religion, which Elizabeth at first had not prudence sufficient to conceal; though afterwards she learned to disguise her sentiments. But, above all, her standing so high in the affection of the earl of Devonshire, was a crime not to be forgiven: and Mary made her sensible of her displeasure by numberless mortifications. She was ordered to take place at court after the duchess of Suffolk and the countess of Lennox; to avoid which, and other indignities, Elizabeth at last retired from court altogether into the country. After the suppression of Wyatt's rebellion she was committed to the Tower, and underwent a strict examination before the council; but as Wyatt had made a declaration on the scaffold that she was in no manner of way concerned, the queen found herself under a necessity of releasing her. To get rid of such a troublesome rival, however, she was offered in marriage to the duke of Savoy; and on Elizabeth's declining the proposal, she was committed close prisoner to Woodstock. The rebellion proved fatal, however, to many persons of distinction, and gave the queen an opportunity of manifesting that unbounded cruelty which reigned in her heart. The Tower, and all the prisons in the kingdom, were filled with nobility and gentility, who became objects of royal vengeance, more on account of their credit and interest with the people than any concern they were supposed to have had with Wyatt. Sir Nicholas Throgmorton was tried in Guildhall; but as no satisfactory evidence appeared against him, the jury gave a verdict in his favour. The queen was so much enraged at this disappointment, that she recommitted him to the Tower, summoned the jury before the council, and at last sent them all to prison, fining them afterwards some of 1000l. and others of 2000l. each. Sir John Throgmorton, brother to Sir Nicholas just mentioned, was condemned and executed upon evidence which had been already rejected as insufficient. But of all those who perished on this occasion, Execution our executors more universal compassion than the unfortunates. Lady Jane Grey and her husband Lord Guildford Dudley. They had already received sentences of death, as has been mentioned; and two days after the execution of Wyatt, they received orders to prepare for eternity. Lady Jane, who had been in expectation of this blow, was no way intimidated, but received the news with the most heroic resolution. The place intended at first for their execution was Tower-hill; but the council, dreading the effects of the people's compassion for their youth, beauty, and innocence, gave directions that they should be beheaded within the verge of the Tower. The duke of Suffolk was soon after tried, condemned, and executed; but would have met with more compassion, had not his ambition...
ENGLAND.

Ambition been the cause of his daughter's unhappy fate just mentioned. Sir Thomas Grey also lost his life on the same account; but the cruel spirit of Mary was still unsatisfied, and finding herself universally odious, that she might free herself from any apprehensions for what was past, as well as tyrannize with the more freedom.

The people in time to come, she disabled the people from resistance, by ordering general musters, and causing the commoners seize their arms and lay them up in forts and castles.

Notwithstanding this unpopularity, however, the rebellion of Wyatt had so strengthened the hands of government, that a parliament was assembled in hopes of gratifying the queen's wishes in regard to her marriage with Philip of Spain. To facilitate this purpose also, the emperor of Germany sent over to England 400,000 crowns to be distributed among the members of parliament in bribes and pensions; a practice of which there had hitherto been no example in England. The queen, notwithstanding her bigotry, resumed the title of Supreme Head of the Church, which she had dropped three months before. Gardiner made a speech, in which he proposed, that they should invest the queen with a legal power of disposing of the crown, and appointing her successor; but the parliament, however obsequious in other respects, did not choose to gratify their sovereign in a measure by which the kingdom of England might become a province of the Spanish monarchy. They would not even declare it treason to imagine or attempt the death of the queen's husband during her lifetime, though they agreed to ratify the articles of marriage. Finding therefore that the parliament even yet was not sufficiently obsequious, it was thought most proper to dissolve them. Soon after this the marriage with Philip was solemnized; but as the latter had espoused the queen merely with a view to become king of England, he no sooner found himself disappointed in this than he showed a total want of affection for her as a wife. He passed most of his time at a distance from her in the Low Countries; and seldom wrote to her except when he wanted money, with which Mary would at all times gladly have supplied him, even had it been at the expense of her husband, if in her power.

The enemies of the state being supposed to be suppressed, those of the Protestant religion were next persecuted. The old sanguinary laws which had been rejected by a former parliament were now revived. Orders were given, that the priests and bishops who had married should be ejected; that the mass should be restored, and the pope's authority established; and that the church and its privileges, all but its goods and estates, should be put up the same footing on which they were before the commencement of the reformation. But as the gentry and nobility had already divided the church-lands among them, it was thought inconvenient, and indeed impossible, to make a restoration of these. The persons who chiefly promoted these measures were Gardiner bishop of Winchester, and Cardinal Pole, who was a kinsman of Henry VIII. but had been long in Italy, and was now returned from it. The latter was for tolerating the Protestants; but the former, perceiving that rigorous measures would be most agreeable to the king and queen, declared himself against it. He was too prudent, however, to appear in person at the head of the persecution; and therefore consigned that England office to Bonnar bishop of London, a man of a very abandoned character. The bloody scene began by the execution of Hooper bishop of Gloucester, and Rogers of Worcester. These executions soon became See Crows of excellence to the whole nation, and the perpetrators of them were all willing to throw the blame from themselves upon others. Philip endeavoured to fasten the whole reproach upon Bonnar; but that bishop would not take the whole, and therefore retorted on the court. A bold step was now taken to introduce a court similar to the Spanish inquisition, that should be empowered to try heretics, and condemn them without any other law but its own authority. But even this was thought a method too dilatory in the present exigence of affairs. A proclamation issued against books of heresy, treason, and sedition, declared, that whosoever had such books in his possession, and did not burn them without reading, should suffer as a rebel. This was attended with the execution of such numbers, that at last the magistrates who had been instrumental in these cruelties refused to give their assistance any longer. It was computed, that during this persecution, 277 persons suffered by fire, besides those punished by imprisonments, fines, and confiscations. Among those who suffered by fire were 5 bishops, 21 clergy-men, 8 lay-gentlemen, 84 tradesmen, 100 husbands, 55 women, and 4 children.

The only remarkable transaction which happened during this reign with regard to the temporal affairs of the kingdom was the loss of Calais, which had been in the possession of the English for upwards of 200 years. This loss filled the whole kingdom with complaints, and the queen with grief. She was heard to say, that, when dead, the name of Calais would be found engraven on her heart. She did not long survive this loss; but died in the year 1558, of a lingering illness, after a reign of five years four months and Elizabeth eleven days.

After the death of Mary, the princess Elizabeth succeeded to the throne without opposition. She was at Hatfield when news of her sister's death were brought to her; upon which she hastened up to London, where she was received with great joy. This princess was well qualified for government. She had judgment sufficient to make choice of proper ministers, and authority enough to keep her subjects in awe. The restrictions also, to which she had been subjected during her sister's reign, had taught her so well to conceal her sentiments, that she had become a perfect mistress of dissimulation; which, though no commendable part of her character, proved occasionally of great service to her government. She perfected the reformation, and put the religion of England upon the same plan which subsists at present. This was accomplished without the least difficulty; for the persecution in Mary's reign had served only to give the whole nation an aversion for popery. In the time of Edward VI. the people had been compelled to embrace the Protestant religion, and their fears induced them to conform; but now, almost the whole nation were Protestants from inclination. The reformation was confirmed by act of parliament in 1559, and thus
England. Thus England was seen to change its religion four times in the space of 32 years. A.D. 1587. During the time that the queen and her counsellors were employed in settling the religious affairs of the nation, negotiations were likewise carried on for a peace between England and France; which was at last concluded on the following terms, viz. that Henry should restore Calais at the expiration of eight years; that in case of failure, he should pay 500,000 crowns, and Elizabeth's title to Calais be still retained; that for the payment of that sum he should find the security of eight foreign merchants, not natives of France; and until that security were provided he should deliver five hostages. If during this interval Elizabeth should break the peace with France or Scotland, she should forfeit all title to Calais; but if Henry made war on Elizabeth, he should be obliged to restore the fortress immediately. This pacification was soon followed by an irreconcilable quarrel with Mary queen of Scotland; which was not extinguished but by the death of the Scottish princess; and that with such circumstances of accumulated treachery, hypocrisy, and dissimulation, as have stamped an indelible disgrace on the memory of Elizabeth. See the articles Mary and Scotland.

Elizabeth having at last got rid of her rival in the year 1587, began to make preparations for resisting the Spanish invasion. Hearing that Philip was secretly fitting out a great navy to attack her, she sent Sir Francis Drake with a fleet to pillage his coasts and destroy his shipping. On this expedition he set sail with four capital ships furnished by the queen, and 26 others of various sizes furnished by him to the merchants of London in hopes of sharing the plunder. Having learned that a Spanish fleet richly laden was lying at Cadiz in readiness to set sail for Lisbon, he directed his course towards the former port, where he boldly attacked the enemy. Six galleys were obliged to take shelter under the cannon of the forts: he burned about 100 vessels laden with ammunition and naval stores; and destroyed a great ship belonging to the marquis de Santa Croce. Thence setting sail for Cape St Vincent, he took by assault the castle situated on that promontory, with three other fortresses. Having next insulted Lisbon, he sailed to the island Tercera, one of the Azores, where, after lying in wait for some time, he took a rich prize, and then returned to England; having by this short expedition taught the English to despise the huge and unwieldy ships of the enemy, and thus prepared them to act with more resolution against the formidable armament that now threatened to invade them.

But though the expedition of Sir Francis Drake had retarded the intended invasion of England for a twelvemonth, it had not by any means induced Philip to abandon his design. During that interval he continued his preparations with the greatest assiduity, the more especially as the invasion of England seemed to be a necessary preparative for regaining his authority over the Netherlands, the revolted provinces having been strongly supported by Elizabeth. The fleet prepared at this time was superior to any thing then existing in the world; and no doubt being entertained of its success, it was ostentatiously styled the Invincible Armada. The miserable event of this expedition, and the total failure of all the mighty hopes of Philip, are related under the article Armada. The spirit and courage of the English were now excited to attempt invasions in their turn; which they executed in numerous descents on the Spanish coasts; though these were only temporary, and designed not for permanent conquest, but to harass the enemy. It would be endless to relate all the advantages obtained over the enemy at sea, where the capture of every ship must have been a separate narrative. It is sufficient to observe, that the sea-captains of that reign are still considered as the boldest and most enterprising set of men that England ever produced; and among this number we are to reckon Raleigh and Howard, Drake, Cavendish, and Hawkins. The English navy then began to take the lead; and has since continued irresistible in all parts of the ocean.

Elizabeth continued to reign with great glory till the year 1603; but all her greatness could not prevent her from being extremely miserable before her death. She had caused her greatest favourite, and probably her lover, the earl of Essex, to be executed. Though this execution could not be called unjust, the queen's affection (on being informed that he had at last thrown himself entirely on her clemency) returned to such a degree, that she thenceforth gave herself entirely over to despair. She refused food and sustenance; she continued silent and gloomy; sighs and groans were the only vent she gave to her despondence; and she lay for ten days and nights upon the carpet, leaning on cushions, which her maids brought her. Perhaps the faculties of her mind were impaired by long and violent exercise; perhaps she reflected with remorse on some past actions of her life, or perceived, but too strongly, the decays of nature, and the approach of her dissolution. She saw her courtiers remitting in their assiduity to her, in order to pay their court to James the apparent successor. Such a concurrence of causes was more than sufficient to destroy the remains of her constitution; and her end was now visibly seen to approach. Feeling a perpetual heat in her stomach, attended with an unquenchable thirst, she drank without ceasing, but refused the assistance of her physicians. Her distemper gaining ground, Cecil and the lord admiral desired to know her sentiments with regard to the succession. To this she replied, that as the crown of England had always been held by kings, it ought not to devolve upon any inferior character, but upon her immediate heir the king of Scotland. Being then advised by the archbishop of Canterbury to fix her thoughts upon God, she replied, that her thoughts did not in the least wander from him. Her voice soon after left her; she fell into a lethargic slumber, which continued some hours; she expired gently without a groan, in the 70th year of her age, and 43rd of her reign. She was succeeded by James I. king of Scotland; since which time, the history of both England and Scotland is comprehended under the article Britain.

Since the Norman conquest, England has been divided into six circuits, each circuit containing a certain number of counties. Two judges are appointed for each circuit, which they visit in the spring and autumn, for administering justice to the subjects who are at a distance from the capital. In holding the Lent (or spring) assizes, the northern circuit extends only to York and Lancaster; the assizes at Durham, Newcastle, Carlisle, and Appleby, being held only in autumn.
The established religion of England is Episcopacy. Since the reign of Henry VIII., the sovereigns of England have been called, in public writs, the supreme heads of the church; but this title conveys no spiritual meaning, as it only denotes the regal power to prevent any ecclesiastical differences, or, in other words, to substitute the king in place of the pope before the reformation, with regard to temporalities and the internal economy of the church. The kings of England never intermeddle in ecclesiastical disputes, and are contented to give a sanction to the legal rights of the clergy.

The church of England, under this description of the monarchical power over it, is governed by two archbishops, and 24 bishops, besides the bishop of Sodor and Man, who, not being possessed of an English barony, does not sit in the house of peers. See Archbishops and Bishop.

England contains about 60 archdeaconies. Subordinate to them are the rural deacons, formerly styled archdeaconets, who signify the bishop's pleasure to his clergy, the lower class of which consists of parish-priests (who are called rectors or vicars) deacons and curates. See the articles Curate, Deacon, Parson, and Vicar.

The following is a list of the English bishops with their revenues, as charged in the king's books, though that sum is far from being the real annual value of the see, yet it assists in forming a comparative estimate between the revenues of each see with those of another.

### Archbishop of Canterbury
- **L.** 2682
- **s.** 12
- **d.** 2

### Archbishop of York
- **L.** 1610
- **s.** 0
- **d.** 0

### Bishop of London
- **L.** 2000
- **s.** 0
- **d.** 0

### Bishop of Durham
- **L.** 1821
- **s.** 1
- **d.** 3

### Bishop of Winchester
- **L.** 3124
- **s.** 12
- **d.** 8

These three bishops take precedence of all others in England, and the others according to the seniority of their consecrations.

### Anglicans
- **Ely,** 2134
- **s.** 18
- **d.** 6

- **Bath and Wells,** 533
- **s.** 1
- **d.** 3

- **Hereford,** 768
- **s.** 11
- **d.** 0

- **Rochester,** 358
- **s.** 4
- **d.** 9

- **Lichfield and Coventry,** 559
- **s.** 17
- **d.** 3

- **Chester,** 420
- **s.** 1
- **d.** 8

- **Worcester,** 929
- **s.** 13
- **d.** 3

- **Chichester,** 677
- **s.** 1
- **d.** 3

- **St. Asaph,** 187
- **s.** 11
- **d.** 8

- **Salisbury,** 1385
- **s.** 5
- **d.** 0

- **Bangor,** 131
- **s.** 16
- **d.** 3

- **Norwich,** 834
- **s.** 11
- **d.** 7

- **Gloucester,** 315
- **s.** 7
- **d.** 3

- **Llandaff,** 154
- **s.** 14
- **d.** 2

- **Lincoln,** 894
- **s.** 18
- **d.** 1

- **Bristol,** 297
- **s.** 11
- **d.** 0

- **Carlisle,** 531
- **s.** 4
- **d.** 9

- **Exeter,** 500
- **s.** 0
- **d.** 0

- **Peterborough,** 414
- **s.** 14
- **d.** 8

- **Oxford,** 381
- **s.** 11
- **d.** 0

- **St. Davids,** 426
- **s.** 2
- **d.** 1

The ecclesiastical government of England is, properly speaking, lodged in the convocation; which is a national representative or synod, and answers pretty nearly to the ideas which we have of a parliament. They are convoked at the same time with every parliament; and their business is to consider of the state of the church, and to call those to an account who have advanced new opinions, inconsistent with the doctrines of the church of England. Some high-flying clergymen during the reign of Queen Anne, and in the beginning of that of George I., raised the powers of the convocation to a height that was inconsistent with the principles of religious toleration, and indeed of civil liberty: so that the crown was obliged to exert its prerogative of calling the members together, and of dissolving them; and ever since they have not been permitted to sit for any time, in which they could do business.

The following table exhibits a view of the population of England, taken from the returns made to the house of commons in consequence of an act of parliament which was passed in 1801, for the purpose of ascertaining the number of inhabitants in the kingdom. From this table it appears that the total number of persons in England amounts to 8,331,434.
## England

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<th>1811</th>
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<td>in the country,</td>
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<td>5,317,013</td>
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### New England

New England, late a province of the British empire in America, is bounded on the north by Canada, on the east by Nova Scotia and the Atlantic ocean, on the south by the Atlantic and Long Island sound, and on the west by New York. It lies in the form of a quarter of a circle. It includes the five states of Connecticut, Rhode Island, Massachusetts, Vermont, and New Hampshire; and extends from 41° to 46° of north latitude, and from 68° to 74° of west longitude. This country was discovered in the beginning of the 16th century, and called North Virginia; but no European settlers there till the year 1608. The first colony, which was weak and ill-directed, did not succeed; and, for some time, there were only a few adventurers who came over at times in the summer, built themselves
themselves temporary huts for the sake of trading with the savages, and like them, disappeared again for the rest of the year. At last some Brownists, headed by Mr Robinson, whom Neai styles the Father of the Independents, who in 1619 had been driven from England by persecution, fled to Holland, and settled at Leyden; but in 1621 determined, with Mr Brewster assistant-priest to Mr Robinson, to found a church for their sect in the new hemisphere. They therefore purchased, in 1621, the charter of the English North Virginia company. Forty-one families, making in all 120 persons, landed in the beginning of a very hard winter, and found a country entirely covered with wood, which offered a very melancholy prospect to men already exhausted with the fatigues of their voyage. Near one half perished either by cold, the scurrvy, or other distress. The courage of the rest was beginning to fail; when it was revived by the arrival of 60 savage warriors, who came to them in the spring, headed by their chief. The old tenants assigned for ever to the new ones all the lands in the neighbourhood of the settlement they had formed, under the name of New Plymouth; and one of the savages who understood a little English said to teach them how to cultivate the maize, and instruct them in the manner of fishing upon their coast.

This kindness enabled the colony to wait for the companions they expected from Europe with seeds, with domestic animals, and with every assistance they wanted. At first these succours arrived but slowly; but the persecution of the Puritans in England increased the number of refugees to such a degree in America, that in 1630 they were obliged to form different settlements, of which Boston soon became the principal. These first settlers were not merely ecclesiastics, who had been deprived of their preferments on account of their opinions; nor those sectaries influenced by new opinions, that are so frequent among the common people. There were among them several persons of high rank, who, having embraced Puritanism, had taken the precaution to secure themselves an asylum in these distant regions. They had caused houses to be built, and lands to be cleared, with a view of retiring there, if their endeavours in the cause of civil and religious liberty should prove abortive.

New England.

The inhabitants of New England lived peaceably for a long time, without any regular form of policy. Their charter had indeed authorized them to establish any mode of government they might choose; but these enthusiasts were not agreed among themselves upon the plan of their republic, and government did not pay sufficient attention to them to urge them to secure their own tranquility. At length they grew sensible of the necessity of a regular legislation; and this great work, which virtue and genius united have never attempted but with difficulty, was boldly undertaken by blind fanaticism. It bore the stamp of the rude prejudices on which it had been formed. There was in this new code a singular mixture of good and evil, of wisdom and folly. No man was allowed to have a share in the government except he were a member of the established church. Witchcraft, perjury, blasphemy, and adultery, were made capital offences; and children were also punished with death, either for cursing or striking their parents. Marriages, however, were to be solemnized by the magistrate. The price of corn was fixed at 2s. 11d. per bushel. The savages who neglected to cultivate their lands were to be deprived of them; and Europeans were forbidden under a heavy penalty to sell them any strong liquors or warlike stores. All those who were detected either in lying, drunkenness, or dancing, were ordered to be publicly whipped. But at the same time that amusements were forbidden equally with vices and crimes, one might be allowed to swear by paying a penalty of 11d. and to break the Sabbath for 2s. 11d. 52d. Both indulgences allowed was, to stone, by a fine, for a neglect of prayer, or for uttering a rash oath. But it is still more extraordinary, that the worship of images was forbidden to the Puritans on pain of death; which was also inflicted on Roman Catholic priests, who should return to the colony after they had been banished; and on Quakers who should appear again after having been whipped, branded, and expelled. Such was the abhorrence for these sectaries, who had themselves an aversion for every kind of cruelty, that whoever either brought one of them into the country, or harboured him but for one hour, was liable to pay a considerable fine.

Those unfortunate members of the colony, who, less violent than their brethren, ventured to deny the coercive power of the magistrate in matters of religion, were persecuted with still greater rigour. This was considered as blasphemy by those very divines who had rather chosen to quit their country than to show any deference to Episcopal authority. This system was supported by the severities of the law, which attempted to put a stop to every difference in opinion, by inflicting capital punishment on all who dissented. Those who were either convicted, or even suspected, of entertaining sentiments of toleration, were exposed to such cruel oppressions, that they were forced to fly from their first asylum, and seek refuge in another. They found one on the same continent; and as New England had been first founded by persecution, its limits were extended by it.

This intemperate religious zeal extended itself to matters in themselves of the greatest indifference. A proof of this is found in the following public declaration, transcribed from the registers of the colony.

"It is a circumstance universally acknowledged, that the custom of wearing long hair, after the ancient manner of immoral persons and of the savage Indians, can have been introduced into England only in sacrilegious contempt of the express command of God, who declares that it is a shameful practice for any man who has the least care for his soul to wear long hair. As this abomination excites the indignation of all pious persons; we, the magistrates, in our zeal for the purity of the faith, do expressly and authentically declare, that we condemn the impious custom of letting the hair grow; a custom which we look upon to be very indecent and disgraceful, which horribly disfigures men, and is offensive to modest and sober persons, in as much as it corrupts good manners. We therefore, being justly incensed against this scandalous custom, do desire, advise, and earnestly request all the elders of our continent, zealously to show their aversion for this odious practice, to exert all their power to put a stop to it, and especially to take care that the members of their churches be not infected with it; in
“order that those persons who, notwithstanding these rigorous prohibitions, and the means of correction that shall be used on this account, shall still persist in this custom, shall have both God and man at the same time against them.”

This severity soon exercised itself against the Quakers. They were whipped, banished, and imprisoned. The behaviour of these new enthusiasts, who in the midst of terrors and ignomy praised God, and called for blessings upon men, inspired a reverence for their persons and opinions, and gained them a number of proselytes. This circumstance exasperated their persecutors, and hurried them on to the most atrocious acts of violence; and they caused five of them, who had returned clandestinely from banishment, to be hanged. This spirit of persecution was, however, at last suppressed by the interposition of the mother-country, from whence it had been brought. Charles II. moved with the sufferings of the Quakers, put a stop to them by a proclamation in 1661; but he was never able totally to extinguish the spirit of persecution that prevailed in America.

The colony had placed at their head Henry Vane, the son of that Sir Henry Vane who had such a remarkable share in the disturbances of his country. This obstinate and enthusiastic young man had continued to reserve the questions of grace and free will. Disputes upon these points ran very high; and would probably have plunged the colony into a civil war, if several of the savage nations united had not happened at that very time to fall upon the plantations of the disputants, and to massacre great numbers of them. The colonists, heated with their theological contests, paid at first very little attention to this considerable loss. But the danger at length became so urgent and so general, that all took up arms. As soon as the enemy were repulsed, the colony resumed its former dissensions; and the frenzy which they excited broke out in 1692 in a way marked with as many atrocious instances of violence as any ever recorded in history.

These lived in a town of New England, called Salem, two young women who were subject to convulsions, accompanied with extraordinary symptoms. Their father, minister of the church, thought that they were bewitched; and having in consequence cast his suspicions upon an Indian girl who lived in his house, he compelled her by harsh treatment to confess that she was a witch. Other women, upon hearing this, immediately believed, that the convulsions, which proceeded only from the nature of their sex, were owing to the same cause. Three citizens, casually named, were immediately thrown into prison, accused of witchcraft, hanged, and their bodies left exposed to wild beasts and birds of prey. A few days after, 16 other persons, together with a counsellor, who, because he refused to plead against them, was supposed to share in their guilt, suffered in the same manner. From this instant, the imagination of the multitude was inflamed with these horrid and gloomy scenes. Children of ten years of age were put to death, young girls were stripped naked, and the marks of witchcraft searched for upon their bodies with the most indecent curiosity; and those spots of the scurvy which age impresses upon the bodies of old men were taken for evident signs of the infernal power. In default of these, torments were employed to extort confessions dictated by the executioners themselves. If the magistrates, tired out with executions, refused to punish, they were themselves accused of the crimes they tolerated; the very ministers of religion raised false witnesses against them, who made them forfeit with their lives the tardy remorse excited in them by humanity. Dreams, apparitions, terror, and consternation of every kind, increased these prodigies of folly and horror. The prisons were filled, the gibbets left standing, and all the citizens involved in gloomy apprehensions. The most prudent quitted the country stained with the blood of its inhabitants; and nothing else than the total and immediate subversion of the colony was expected, when, on a sudden, all eyes were opened at once, and the excess of the evil awakened the minds which it had at first stupefied. Bitter and painful remorse was the immediate consequence; the mercy of God was implored by a general fast, and public prayers were offered up to ask forgiveness for the presumption of having supposed that Heaven could be pleased with sacrifices with which it could only have been offended.

Posterity will probably never know exactly what was the cause or remedy of this dreadful disorder. It had, perhaps, its first origin in the melancholy with which those elevated enthusiasts had brought with them from their own country, which had increased with the scurry they had contracted at sea, and had gathered fresh strength from the inconveniences and hardships inseparable from a change of climate and manner of living. The contagion, however, ceased like all other epidemic distempers, exhausted by its very communication. A perfect calm succeeded this agitation; and the Puritans of New England have never since been seized with so gloomy a fit of enthusiasm.

But though the colony has renounced the persecuting spirit which hath stained all religious sects with blood, it has preserved some remains, if not of intolerance, at least of severity, which remind us of those melancholy days in which it took its rise. Some of its laws are still too severe.

New England had, however, some remedy against bad laws, in the constitution of its mother-country, where the people who have the legislative power in their own hands are at liberty to correct abuses; and it has persons derived from its situation, which upon a vast field, to industry and population.

The clearing of the lands in this colony was not directed by chance as in the other provinces. This settlement from the first was subjected to laws which are still religiously observed. No citizen whatever had the liberty of settling even upon unoccupied land. The government, desirous of preserving all its members from the inroads of the savages, and of placing them in a condition to share in the protection of a well-regulated society, had ordered that whole villages should be formed at once. As soon as 60 families offered to build a church, maintain a clergyman, and pay a schoolmaster, it was usual for the general assembly to allot them a situation, and permit them to have two representatives in the legislative body of the colony. The district assigned them always bordered upon the lands already cleared. These new people choose the situation most convenient for their habitation, which is usually.
usually of a square figure. The church is placed in the
centre; the colonists divide the land among themselves,
and each incloses his property with a hedge. Some
woods are reserved for a common; and thus New Eng-
land constantly enlarged its territory. Such was the
mode of forming new settlements while it was a British
province.

The country was at first divided into four states,
which had no connexion with one another. The ne-
necesity of maintaining an armed force against the savages,
oblige them to form a confederacy in 1643, when they
took the name of the United Colonies. In consequence
of this league, two deputies from each establishment
were used to meet in a stated place to deliberate upon
the common affairs of New England, according to the
instructions they had received from the assembly by
which they were sent. This association laid no con-
straint upon the right of every individual to act entire-
lly as he pleased, without either the permission or ap-
proval of the mother-country. All the submission
required of these provinces was merely to acknowledge
the kings of England for their sovereigns. Charles II.
wished to make them more dependent. The province
of Massachusetts's bay, which, though the smallest, was
the richest and the most populous of the four, being
guilty of some misdemeanour against government, the
king seized that opportunity of taking away its char-
ter in 1684; and it remained without one till the re-
volution; when it received another, which, however,
did not answer its claims or expectations. The crown
reserved to itself the right of nominating the governor,
and appointing to all military employments, and to all
principal posts in the civil and judicial departments:
it allowed the people of the colony their legislative
power, and gave the governor a negative voice and the
command of the troops, which secured him a sufficient
influence to enable him to maintain the prerogative of
the mother-country in all its force. The provinces of
Connecticut and Rhode-Island, by timely submission,
prevented the punishment which that of Massachusetts
had incurred, and retained their original charter. That
of New-Hampshire had been always regulated by the
same mode of administration as the province of Mas-
sachusetts's-bay. The same governor presided over the
whole colony, but with regulations adapted to the
constitution of each province. To the above states,
another has been added since the revolution, viz. VER-
MONT. These states are subdivided into counties, and
the counties into townships.

New England is a hilly, and in some parts a
mountainous country, formed by nature to be inhab-
ited by a hardy race of free, independent republicans.
—The mountains are comparatively small, running
nearly north and south in ridges parallel to each other.
Between these ridges flow the great rivers in majes-
tic meanders, receiving the innumerable rivulets and
larger streams which proceed from the mountains on
each side. To a spectator on the top of a neigh-
bouring mountain, the vales between the ridges, while in a
state of nature, exhibit a romantic appearance.
They seem an ocean of woods, swelled and depressed in its
surface like that of the great ocean itself. A richer
though less romantic view is presented, when the val-
leys, by industrious husbandmen, have been cleared of
their natural growth; and the fruit of their labour ap-
pears in loaded orchards, extensive meadows, covered
with large herds of sheep and neat cattle, and rich
fields of flax, corn, and the various kinds of grain.
These valleys, which have received the expressive name
of interval lands, are of various breadths, from two to
20 miles; and by the annual inundations of the rivers
which flow through them, there is frequently an accumu-
lation of rich fat soil left upon their surface when the
waters retire.

There are four principal ranges of mountains, pass-
ing nearly from north-east to south-west through
New England. These consist of a multitude of paral-
el ridges, each having many spurs, deviating from the
course of the general range; which spurs are again
broken into irregular billy land. The main ridges
terminate, sometimes in high bluff heads, near the
sea-coast, and sometimes by a gradual descent in the
interior part of the country. One of the main ranges
runs between Connecticut and Hudson's rivers. This
range branches and bounds the vales through which
flows the Housatonic river. The most eastern ridge
of this range terminates in a bluff head at Meriden;
a second ends in like manner at Willingford, and a
third at New Haven. In Lyme, on the east side of
Connecticut river, another range of mountains com-
cences, forming the eastern boundary of Connecticut
vale. This range trends northerly, at the distance,
generally, of about 20 or 12 miles east from the
river, and passes through Massachusetts, where the range
takes the name of Chicopee Mountain; thence crossing
into New Hampshire, at the distance of about 20 miles
from the Massachusetts line, it runs up into a very
high peak, called Monadnock, which terminates this
ridge of the range. A western ridge continues, and
in about latitude 43° 20' runs up into Sunipee mount-
tains. About 50 miles further, in the same ridge, is
Moosecoo mountain. A third range begins near Sto-
nington in Connecticut. It takes its course north-eas-
terly, and is sometimes broken and discontinued; it
then rises again, and ranges in the same direction in-
to New Hampshire, where, in latitude 43° 25', it runs
up into a high peak called Cownooneak. The fourth
range has a humbler beginning about Hopkinton in
Massachusetts. The eastern ridge of this range runs
north by Watertown and Concord, and crosses Mer-
rime river at Pantucket Falls. In New Hampshire,
it rises into several high peaks, of which the White
mountains are the principal. From these White mount-
cains a range continues north-east, crossing the east
boundary of New Hampshire, in latitude 44° 30', and
forms the height of land between Kennebec and Chaudiere rivers. These ranges of mountains are full
of lakes, ponds, and springs of water, that give rise to
numberless streams of various sizes, which, interlock-
ing each other in every direction, and falling over the
rocks in romantic cascades, flow meandering into the
rivers below. No country on the globe is better wa-
tered than New England.

On the sea-coast the land is low, and in many parts
level and sandy. In the valleys, between the foremen-
tioned ranges of mountains, the land is generally bro-
en, and in many places rocky, but of a strong rich
soil, capable of being cultivated to good advantage,
which also is the case with many spots even on the tops
of the mountains.
The principal river in New England is Connecticut.

Soil, productions, &c.

The soil, as may be collected from what has been said, must be very various. Each tract of different soil is distinguished by its peculiar vegetation, and is pronounced good, middling, or bad, from the species of trees which it produces; and from one species generally predominating in each soil, has originated the descriptive names oak land, birch, beech, and cherry lands, pine, barren, maple, ash, and cedar swamps, as each species happens to predominate. Intermingled with these predominating species are maple, fir, elm, hemlock, magnolia, moose-wood, sassafras, &c. &c. The best lands produce walnut and chestnut; the next, beech and oak; lands of the third quality produce fir and pitchpine; the next whortleberry and barberry bushes; and the poorest produce nothing but marshy imperfect shrubs. Among the flowering trees and shrubs in the forests are the red-flowering maple, the sassafras, the locust-tree, the tulip-tree, honeysuckle, wild rose, dogwood, elm, leather-tree, laurel, hawthorn, &c. which in the spring of the year give the woods a most beautiful appearance, and fill them with a delicious fragrance. Among the fruits which grow wild, are the several kinds of grapes; which are small, sour, and thick skinned. The vines on which they grow are very luxuriant, often overspreading the highest trees in the forests; and without doubt, may be greatly meliorated by proper cultivation. Besides these, are the wild cherries, white and red mulberries, cranberries, walnuts, hazel nuts, chestnuts, bitter nuts, beechnuts, wild plums and pears, whortleberries, bilberries, gooseberries, strawberries, &c.

The soil in the interior country is calculated for the culture of Indian corn, rye, oats, barley, flax, and hemp (for which the soil and climate are peculiarly proper), buck wheat, beans, pease, &c. In many of the inland parts wheat is raised in large quantities; but on the sea-coast it has never been cultivated with success, being subject to blasts. The fruits which the country yields from culture, are apples in the greatest plenty; of these cyder is made, which constitutes the principal drink of the inhabitants; also pears of various sorts, quinces, peaches (from which is made peach brandy), plums, cherries, apricots, &c. The culinary plants are such as have already been enumerated. New England is a fine grazing country; the valleys between the hills are generally intersected with brooks of water, the banks of which are lined with a tract of rich meadow or interval land. The high and rocky ground is, in many parts, covered with honeysuckle, and generally affords the finest pasture. It will not be a matter of wonder, therefore, that New England boasts of raising some of the finest cattle in the world; nor will she be envied, when the labour of raising them is taken into view. Two months of the hottest season in the year the farmers are employed in procuring food for their cattle; and the cold winter is spent in dealing it out to them. The pleasure and profit of doing this, is however a satisfying compensation to the honest and industrious farmer.

New England is the most populous part of the United States. It contained 1,461,301 freemen, free- men in 1810, and 418 slaves. New England then, should any great and sudden emergency require it, could furnish an army of 200,000 men. The great body of these are land-holders and cultivators of the soil. New England may, with propriety, be called a nursery of men, whence are annually transplanted, into other parts of the United States, thousands of its natives. The state of Vermont, which is but recently formed, and contains 217,000 souls in 1810, has received more inhabitants from Connecticut than from any other state; and yet between the years 1774 and 1810, notwithstanding her numerous emigrations to Vermont, Susquehannah, and other places, and the depopulation occasioned by a seven years bloody war, it is found, from an actual census of the inhabitants in the years before mentioned, that they have increased from 197,856, their number in 1774, to 261,942, their number in 1810. Vast numbers of the New Englanders, since the war, have emigrated into the northern parts of New York, into Kentucky and the Western Territory, and into Georgia; and some are scattered into every state, and every town of note in the union.

The New Englanders are generally tall, stout, and well built. They glory, and perhaps with justice, in possessing that spirit of freedom which induced their ancestors to leave their native country, and to brave the dangers of the ocean and the hardships of settling in a wilderness. Their education, laws, and situation, serve to inspire them with high notions of liberty. Their jealousy is awakened at the first motion toward an invasion of their rights. They are indeed often jealous to excess; a circumstance which is a frightful source of imaginary grievances, and of innumerable groundless suspicions and unjust complaints against government. A law, respecting the descent of estates which are generally held in fee simple, which for substance is the same in all the New England states, is the chief foundation and protection of this liberty. By this law, the possessions of the father are to be equally divided among all the children, excepting the eldest son, who has a double portion. In this way is preserved that happy mediocrity among the people, which, by inducing economy and industry, removes from them temptations to luxury, and forms them to habits of sobriety and temperance. At the same time, their industry and frugality exempt them from want, and from the necessity of submitting to any encroachment on their liberties.

In New England, learning is more generally diffused among all ranks of people than in almost any other part of the globe; arising from the excellent establishment of schools in every township. Another source of information to the people is the newspapers, of which not less than 200,000 are printed every week in New England, and circulated in almost every town and village in the country. A person of mature age, who cannot both read and write, is rarely to be found. By means of this general establishment of schools, the extensive circulation of newspapers, and the consequent spread of learning, every township throughout the country is furnished with men capable of conducting...
The people of New England generally obtain their estates by hard and persevering labour. They of consequence know their value, and spend with frugality. Yet in no country do the indigent and unfortunate fare better. Their laws oblige every citizen to provide a competent maintenance for their poor; so the necessitous stranger is protected and relieved from their humane institutions. It may in truth be said, that in no part of the world are the people happier, better furnished with the necessaries and conveniences of life, or more independent, than the farmers in New England.

As the great body of the people are hardy independent freeholders, their manners are, as they ought to be, congenial to their employment, plain, simple, and unpolished. Strangers are received and entertained among them with a great deal of artless sincerity and friendly unformal hospitality. Their children, those imitative creatures, to whose education particular attention is paid, early imbibe the manners and habits of those around them; and the stranger, with pleasure, notices the honest and decent respect that is paid him by the children as he passes through the country.

As the people, by representation, make their own laws and appoint their own officers, they cannot be oppressed; and living under governments which have few lucrative places, they have few motives to bribery, corrupt canvassings, or intrigue. Real abilities, and a moral character unblemished, are the qualifications requisite in the view of most people for offices of public trust. The expression of a wish to be promoted is the direct way to be disappointed.

The inhabitants of New England are generally fond of the arts, and have cultivated them with great success. Their colleges have flourished beyond any others in the United States. The illustrious characters they have produced, who have distinguished themselves in politics, law, divinity, the mathematics and philosophy, natural and civil history, and in the fine arts, particularly in poetry, evince the truth of these observations.

Many of the women in New England are handsome. They generally have fair, fresh, and healthful countenances, mingled with much female softness and delicacy. Those who have had the advantages of a good education (and they are considerably numerous) are genteel, easy, and agreeable in their manners, and are sprightly and sensible in conversation. They are early taught to manage domestic concerns with neatness and economy. Ladies of the first rank and fortune make it a part of their daily business to superintend the affairs of the family. Employment at the needle, in cookery, and at the spinning-wheel, with them is honourable. Idleness, even in those of independent fortunes, is universally disreputable. The women in the country manufacture the greatest part of the clothing of their families. Their linen and woolen clothes are strong and decent. Their butter and cheese are not inferior to any in the world.

Dancing is the principal and favourite amusement in New England; and of this the young people of both sexes are extremely fond. Gaming is practised by none but those who cannot or rather will not find a reputable employment. The gamester, the horse-jockey, and the knave, are equally despised, and their company is avoided.
avoided by all who would sustain fair and irreproachable characters. The odious and inhuman practices of duelling, gouging, cock-fighting, and horse-racing, are scarcely known here. — The athletic and healthy diversions of cricket, football, quoits, wrestling, jumping, foot-races, &c., are universally practised in the country, and some of them in the most populous places, and by people of almost all ranks. Squirrel-hunting is a noted diversion in many places, where this kind of game is plentiful. Some divert themselves with fox-hunting, and others with the more profitable sports of fishing and duck-hunting; and in the frontier settlements, where deer and fur-game abound, the inhabitants make a lucrative sport of hunting them. In the winter season, while the ground is covered with snow, which is commonly two or three months, sleighing is the general diversion. A great part of the families throughout the country are furnished with horses and sleighs.

New England has no one staple commodity. The ocean and the forests afford the two principal articles of export. Cod-fish, mackerel, shad, salmon, and other fish, whale-oil and whale-bone, masts, boards, scantling, staves, hoops, and shingles, have been and are still exported in large quantities. The annual amount of cod and other fish for foreign exportation, including the profits arising from the whale-fishery, is estimated at upwards of half a million. — Besides the articles enumerated, they export from the various parts of New England ships built for sale, horses, mules, live stock, pickled beef and pork, pot-ash, pearl-ash, flax-seed, butter and cheese, rum, &c. From a view of the annual imports into New England, it appears that the greatest part of them consists of the luxuries, or at best the dispensable conveniences of life; the country affords the necessaries in great abundance. See the articles CONNECTICUT, RHODE ISLAND, MASSACHUSETTS, VERMONT, and NEW HAMPSHIRE.

ENGLISH, or the English Tongue, the language spoken by the people of England, and, with some variation, by those of Scotland, as well as part of Ireland, and the rest of the British dominions. The ancient language of Britain is generally allowed to have been the same with the Gallic, or French; this island, in all probability, having been first peopled from Gaul, as both Caesar and Tacitus affirm, and prove by many strong and conclusive arguments, as by their religion, manners, customs, and the nearness of their situation. But now we have very small remains of the ancient British tongue, except in Wales, Cornwall, the islands and highlands of Scotland, part of Ireland, and some provinces of France; which will not appear strange, when what follows is considered.

Julius Caesar, some time before the birth of our Saviour, made a descent upon Britain, though he may be said rather to have discovered than conquered it; but about the year of Christ 45, in the time of Claudius, Aulus Plautius was sent over with some Roman forces, by whom two kings of the Britons, Togodumnus and Caractacus, were both overcome in battle: whereupon a Roman colony was planted at Malden in Essex, and the southern parts of the island were reduced to the form of a Roman province: after that, the island was conquered as far north as the friths of Don.

Vol. VIII. Part I.

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barton and Edinburgh, by Agricola, in the time of Domitian; whereupon a great number of the Britons, in the conquered part of the island, retired to the west part called Wales, carrying their language with them.

The greatest part of Britain being thus become a Roman province, the Roman legions, who resided in Britain for above 200 years, undoubtedly disseminated the Latin tongue; and the people being afterwards governed by laws written in Latin must necessarily make a mixture of languages. This seems to have been the first mutation the language of Britain suffered.

Thus the British tongue continued, for some time, mixed with the provincial Latin, till the Roman legions being called home, the Scots and Picts took the opportunity to attack and harass England: upon which King Vortigern, about the year 440, called the Saxons to his assistance; who came over with several of their neighbours, and having repulsed the Scots and Picts, were rewarded for their services with the isle of Thanet, and the whole county of Kent; but growing too powerful, and not being content with their allotment, dispossessed the inhabitants of all the country on this side of the Severn: thus the British tongue was in a great measure destroyed, and the Saxon introduced in its stead.

What the Saxon tongue was long before the Conquest, about the year 700, we may observe in the most ancient manuscript of that language, which is a gloss on the Evangelists, by Bishop Eadfrid, in which the three first articles of the Lord's prayer run thus:

"Urn fader this art in heofonu, sic gehalgdu thine noms, so cymeth thin ric. Sic thin willa sue is heofonu, and in eorthe," &c.

In the beginning of the ninth century the Danes invaded England; and getting a footing in the northern and eastern parts of the country, their power gradually increased, and they became sole masters of it in about 200 years. By this means the ancient British obtained a tincture of the Danish language; but their government being of so long continuance, did not make so great an alteration in the Anglo-Saxon as the next revolution, when the whole land, A.D. 1067, was subdued by William the Conqueror, duke of Normandy in France: for the Normans, as a monument of their conquest, endeavoured to make their language as generally received as their commands, and thereby rendered the British language an entire medley.

About the year 1200, the Lord's prayer, in the ancient Anglo-Saxon, ran thus:

"Thine ur fader the eart on heofenum, si thin nama gehalgdu; cumo thin rice sithin willa x on eorthe swa, two on heofenum," &c.

About the year 1160, under Henry II. it was rendered thus by Pope Adrian, an Englishman, in rhyme:

"Urn fader in heaven rich,
Thy name be halyed ever lich,
Thou bring us thy michel blesse,
Als hit in heaven y doe,
Evar in yeart been it also," &c.

Dr. Hicks gives us an extraordinary specimen of the English, as spoken in the year 1385, upon the very subject of the English tongue.

"As
was in a manner extirpated by the Romans, Danes, and Saxons, and succeeded by the Saxon, and after that the Saxon blended with the Norman French, we shall now mention two other causes of change in the language. The first of these is owing to the Britons having been a long time a trading nation, whereby offices, dignities, names of wares, and terms of traffic, are introduced, which we take with the wares from the persons of whom we have them, and form them anew, according to the genius of our own tongue; and besides this change in the language, arising from commerce, Britain's having been a considerable time subject to the see of Rome, in ecclesiastical affairs, must unavoidably have introduced some Italian words among us. Secondly, As to the particular properties of a language, our tongue has undergone no small mutations, or rather has received no small improvement upon that account: for, as to the Greek and Latin, the learned have, together with the arts and sciences now rendered familiar among us, introduced abundance; so, almost all the terms of art in the mathematics, philosophy, physics, and anatomy; and we have entertained many more from the Latin, French, &c. for the sake of elegance and dignity. And so that, at this day, our language, which, about 800 years ago, was the ancient British, or Welsh, &c. is now a mixture of Saxon, Teutonic, Dutch, Danish, Norman, and modern French, embellished with the Greek and Latin. Yet this, in the opinion of some, is so far from being a disadvantage to the English tongue as now spoken (for all languages have undergone changes, and do continually participate with each other), that it has so enriched it, as now to render it the most copious, significant, fluent, courteous, and masculine language in Europe, if not in the world.

ENGRAFING, in Gardening. See Granting.

ENGRAILED, or ENGRAILED, in Heraldry, a term derived from the French grave, "bail;" and signifying a thing the bail has fallen upon and broken off the edges, leaving them ragged, or with half rounded, or semicircular, struck out of their edges.

ENGRAVING, the art of cutting metal and precious stones, and representing thereto figures, letters, or whatever device or design the artist fancy.

Engraving, properly a branch of sculpture, is divided into several other branches, according to the manner wherein it is employed, and the manner of performing it. For the rudest branch, that of

ENGRAVING on Wood, see Wood, Engraving on.

ENGRAVING on Copper, the making, correspondently to some delineated figure or design, such concave lines on a smooth surface of copper, either by cutting or corrosion, as render it capable, when charged properly with any coloured fluid, of imprinting by compression an exact representation of the figure or design to paper or parchment.

Whether we consider the art of engraving, with regard to the utility and pleasure it affords, or the difficulty that attends its execution, we cannot but perceive, that on every account it deserves a distinguished rank among the polite arts. As it is by means of this art that the objects of the cunning are adorned with the most salient ornaments of the greatest men of all ages and all nations;
Engravings, that their memories, their most remarkable and most glorious actions, are transmitted to the latest posterity. It is by this art also, that the paintings of the greatest masters are multiplied to a boundless number; and that the lovers of the polite arts, diffused over the face of the whole earth, are enabled to enjoy those beauties from which their distant situations seemed to have for ever debarred them; and persons of moderate fortune are hereby enabled to become possessed of all the spirit, and all the poetry, that are contained in those miracles of art, which seemed to have been reserved for the temples of Italy, or the cabinets of princes. When we reflect, moreover, that the engraver, beside the beauties of poetic composition, and the artful ordinance of design, is to express, merely by the means of light and shade, all the various tints of colour and clair obscur; to give a relief to each figure, and a truth to each object; that he is now to paint a sky serene and bright, and then loaded with dark clouds; now the pure tranquil stream, and then the foaming, raging sea; that here he is to express the character of the man, strongly marked in his countenance, and there the minutest ornament of his dress; in a word, that he is to represent all, even the most difficult objects in nature; without sufficient admixture of the vast and immensity of the whole earth; and that degree of perfection to which it is at this day arrived. See the article Prints.

Engraving is an art, for the greatest part, of modern invention; having its rise no earlier than the middle of the 15th century. The ancients, it is true, practised engraving on precious stones and crystals with very great success; and there are still many of their works remaining equal to any production of the later ages. But the art of engraving on plates and blocks of wood, to afford prints or impressions, was not known till after the invention of painting in oil.

The different modes of engraving are the following:

In strokes cut through a thin wax, laid upon the copper, with a point, and these strokes bitten or corroded into the copper with aquafortis. This is called etching.

In strokes with the graver alone, unassisted by aquafortis. In this instance, the design is traced with a sharp tool, called a dry point, upon the plate; and the strokes are cut or corroded through the copper, and the instrument distinguished by the name of a graver.

In strokes first etched and afterwards finished with the graver: by this expedient the two former methods are united.

In dots without strokes, which are executed with the point upon the wax or ground, bitten in with the aquafortis, and afterwards harmonized with the graver, by the means of which instrument small dots are made; or with the graver alone, as in the flesh and finer parts, unassisted with the point.

In dots first etched and afterwards harmonized with the dry point, performed by a little hammer, called opus mlater, or the work of the hammer, as practised by Lotms and others.

In mezzotinto, which is performed by a dark barb or ground being raised uniformly upon the plate with a toothed tool. The design being traced upon the plate, the light parts are scraped off by instruments for that purpose, in proportion as the effect requires.

In aquatint, a newly invented method of engraving.

The outline is first etched, and afterwards a sort of engraving wash is laid by the aquafortis upon the plate, resembling drawings in Indian ink, hister, &c. On wood, performed with a single block, on which the design is traced with a pen; and those parts which should be white carefully hollowed out; and this block is afterwards printed by the letter-press printers, in the same manner as they print a book.

On wood, performed with two, three, or more blocks, the first having the outlines cut upon it; the second is reserved for the darker shadows; and the third for the shadows which terminate upon the lights; and these are substituted in their turn, each print receiving an impression from every block. This mode of engraving is called chiaro-securo, and was designed to represent the drawings of the old masters.

On wood and on copper: in these the outline is engraved in a bold dark style upon the copper; and two or more blocks of wood are substituted to produce the darker and lighter shadows, as before.

Of all those modes of engraving, the most ancient is that on wood; or, to speak more properly, the first impressions on paper were taken from carved wooden blocks. From this invention it appears that Bombastus was indebted to the brief-malers or makers of playing-cards, who practised the art in Germany about the beginning of the 15th century. From the same source may perhaps be traced the first idea of moveable types, which appeared not many years after: for these brief-malers did not entirely confine themselves to the printing and painting of cards, but produced also subjects of a more devout nature; many of which, taken from holy writ, are still preserved in different libraries in Germany, with the explanatory text facing the figures; the whole engraved in wood. In this manner they even formed a species of books; such as, Historia sancti Johannis, ejusque Visiones Apocalypiticae; Historia Veteris et Novi Testamenti, known by the name of the Poor Man's Bible. These short momentes were printed only on one side; and two of them being pasted together, had the appearance of a single leaf. The earliest date on any of these wooden cuts is 1423. The subject is St Christopher carrying the Infant Jesus over the Sea, preserved at a convent at Bonn near Meiningen. It is of a folio size, illuminated in the same manner as the playing cards; and at the bottom is this inscription, Christosferi faciem die quacunque tuiris. Hila nempe die morte mala non meritis. Milleimo CCCXX° tertio.

Upon the invention of moveable types, that branch Strutt's of the brief-malers business, so far as it regarded the Hit of Enmaking of books, was gradually discontinued; but the art itself of engraving on wood continued in an improving state; and towards the end of the 15th and beginning of the 16th century, it became customary for almost every one of the German engravers on copper to engrave on wood also. The works of Albert Durer in this style of engraving are justly held in the highest esteem. Italy, France, and Holland, have produced many capital artists of this kind; but for boldness and spirit, we must see the prints of Christopher Jegher, who worked under the direction of Rubens, and was without doubt assisted by that great master.

The invention of that species of engraving distinguishe
Engraving, guished by the appellation of chiario-secuo, seems also to be justly claimed by the Germans, and first practised by Mair; one of whose prints of this kind is dated 1499. Many excellent works in chiario-secuo have been produced in France; and in Italy it was honoured with the performances of Titian and Parmegiano; but the attempts of Jackson, Kirkall, and others in England, have not been equally successful. A set of excellent prints in this way have lately been published by J. Skippe, Esq., a connoisseur and dilettante.

In Germany, about the year 1450, prints from engraved copper first made their appearance. The earliest date of a copperplate print is indeed only 1461; but however faulty this print may be with respect to the drawing, or defective in point of taste, the mechanical part of the execution of it has by no means the appearance of being one of the first productions of the graver. We have also several other engravings, evidently the work of the same master; in which the impressions are so neatly taken from the plates, and the engravings so clearly printed in every part, that according to all appearance they could not be executed in a much better manner in the present day, with all the conveniences which the copperplate printers now possess, and the additional knowledge they must necessarily have acquired in the course of more than three centuries. Hence we may fairly conclude, that if they were not the first specimens of the engraver's workmanship, they were much less the first efforts of the copperplate printer's ability. It is likewise to be observed, that Martin Schoen, who is said, with great appearance of truth, to have worked from 1460 to 1486, was apparently the scholar of Stoltzheim; for he followed his style of engraving, and copied from him a set of prints, representing the passion of our Saviour. Now, allowing Stoltzheim to have preceded his disciple only ten years, this carries the era of the art back to 1450, as was said above. There is no ground to suppose that it was known to the Italians till at least ten years afterwards. The earliest prints that are known to be theirs are a set of the seven planets, and an almanack by way of frontispiece; on which are directions for finding Easter from the year 1465 to 1517 inclusive; and we may be well assured, that the engravings were not antedated, for the almanack of course became less and less valuable every year. In all probability, therefore, these prints must have been executed in the year 1464, which is only four years later than the Italians themselves lay any claim to. The three earliest Italian engravers are, Finiguerra, Boticelli, and Baldini. If we are to refer these prints to any of the three, we shall naturally conclude them to be the work of Finiguerra or Baldini; for they are not equal either in drawing or composition to those ascribed to Boticelli, which we know at least were designed by him; and as Baldini is expressly said to have worked from the designs of Boticelli, it will appear most probable that they belong to Finiguerra.

With respect to the invention of etching, it seems to be not well known to whom it is to be ascribed. One of the most early specimens is that print by Albert Durer, known by the name of the Canon, dated 1518, and thought by some, with little foundation, to have been worked on a plate of iron. Another etching by the same artist is Moses receiving the Tables of the Law, dated 1524. It was also practised in Italy soon after this by Parmegiano, in whose etchings we discover the hand of the artist working out a system as it were from his own imagination, and striving to produce the forms he wanted to express. We see the difficulty he laboured under; and cannot doubt, from the examination of the mechanical part of the execution of his works, that he had no instruction; and that it was something entirely new to him. If the story is true, that he kept an engraver by profession in his house, the novelty of the art is rendered so much the more probable. He died in 1540.

As to that species of engraving in which the modes of etching and cutting with the graver are united, it must have been found necessary immediately upon the invention of etching; it was, however, first carried to perfection by G. Audran, and is now almost universally practised, whether the work is in strokes or in dots.

Engraving in dots, the present fashionable method, is a very old invention, and the only mode discovered by the Italians. Agostina de Musis, called Augustine of Venice, a pupil of Marc Antonio, used it in several of his earliest works, but confined it to the flesh, as in the undated print of An Old Man seated upon a Bank, with a cottage in the back ground. He flourished from 1500 to 1536. We also find it in a print of "A single figure standing, holding a cup and looking upwards," by Giulio Campagnola, who engraved about the year 1516. The back ground is executed with round dots, made apparently with a dry point. The figure is outlined with a stroke deeply engraved, and finished with dots, in a manner greatly resembling those prints which Delmarci engraved at Paris in imitation of red chalk. The hair and beard are expressed by strokes. Stephen de Laulme, a native of Germany, followed the steps of Campagnola; and many of his slight works are executed in dots only. John Boulanger, a French artist, who flourished in the middle of the last century, and his cotemporary Nicholas Van Plattenberg, improved greatly on this method, and practised it with much success. It is only, however, of late, that it has been considered as an object worthy of general imitation. John Lutma executed this kind of work with a hammer and a small punch or chisel.

The method of engraving in mezzotinto was invented about the middle of the 17th century; and the invention has generally been attributed to Prince Rupert, though it has also been asserted that he learnt the secret from another. See MEZZOTINTO.

Or the method of engraving in aquatinta, a short and general account has already been given under that word. See AQUATINTA. But as some farther information relating to this branch of the art of engraving has fallen in our way, we embrace this opportunity of laying it before our readers.

Engraving in aquatinta, was originally invented by Le Prince, a French artist. For a long time, his process was kept secret; and his prints, it is said, were at first sold for drawings. As a proof that the art rose at once to perfection, as has already been mentioned, the prints
prints which were executed by him, are still admired as the finest and best specimens of the art. It appears, however, that he was only acquainted with the powdered grain, and the common method of stopping out. The first who practised this art in England, was Mr. Paul Sandby. By him, we are informed, it was communicated to Mr. Jukes, whose works afford excellent examples to what perfection the art has been carried; and although it is now generally practised all over Europe, yet in no country with greater success than in Britain.

The principle of this process consists in corroding the copper in such a manner, that an impression from it exhibits the appearance of a tint laid on paper, or a drawing in Indian ink. This is accomplished by covering the copper with some substance which assumes a granulated form, and prevents the acid from acting where the particles adhere; and thus the copper is only partially corroded. The more minute the particles are, it is obvious the impression from the plate will more nearly resemble a wash of Indian ink, or a drawing; but the larger the particles are, the granulation becomes more distinct. The powder or granulation is called the aquatint grain. It is produced in two ways.

The process for using the powdered grain, which was first employed, is the following. The outline being etched on a copper plate, some substance which easily melts with heat, adheres to the plate when cold, and resists the action of the aquafortis, is to be finely powdered and sifted. Besides asphaltum, resin, and gum sandarcio, the substances which have been mentioned in the article already referred to, Burgundy pitch, gum copal, gum mastic, as well as some other resins and gum resins, may be employed. Gum copal, it is observed, produces a grain which resists the aquafortis extremely well. Whatever the substance is which is to be employed, the great object of the artist in its application is, to have it equally distributed over the plate. This is an essential part of the operation, and requires considerable attention. The usual method is, to tie up a quantity of the powder in a piece of muslin, and to strike it against a stick held at a considerable height above the plate. Thus managed, the powder settles equally over it, in the same uniform manner that hair powder settles on the furniture of an apartment, where the operations of the bair-dresser are performed. The plate being thus covered equally with the dust or powder, it is to be fixed upon it by the application of a gentle heat, to melt the particles. This is usually done by holding lighted pieces of brown paper, rolled up, and moving them about till the whole of the powder is melted, which is known by its changing to a brown colour. It is now allowed to cool, and after being examined with a magnifying glass, if the particles appear to be uniformly distributed, the artist proceeds to the next part of the process.

Those parts of the design or drawing to be engraved, which are perfectly white, are to be observed and marked, and the corresponding parts of the plate must be covered or stopped out. This is best done by means of mastic varnish, diluted to such a consistence with turpentine as to work freely with the pencil. To give it colour, lamp-black should be mixed with it, that the touches of the pencil may be distinctly seen. When those parts of the plate which are stopped out, are sufficed dry, a border of wax is raised round the plate, in the same manner as in etching, and the aquafortis diluted with water is poured on. This being the most precarious part of the process, requires the greatest experience. When it is supposed that the aquafortis has remained on the plate for such a length of time, that when an impression is taken, it will produce the lightest shade in the drawing, it is poured off, and the plate is washed with water and dried. The lightest tints are then stopped out, and the aquafortis is again poured on; and this process is repeated as often as there are tints or shades to be produced in the plate.

Many plates are entirely etched in this way, by alternating stopping out and biting in. It is, however, found to be extremely difficult, and indeed impossible, to produce impressions of minute and complicated objects with the requisite degree of delicacy and freedom. To obviate this difficulty, another process has been proposed, by which the touches are laid on the plate, with equal ease and expedition as on drawings with Indian ink. Fine washed whitening is mixed with treacle or sugar, and diluted with water in the pencil, that it may work freely. This is laid on the plate covered with the aquatint ground, in the same way as ink on a drawing. When this is dry, the whole of the plate is varnished over with a thin turpentine or mastic varnish, and when this is dry, the aquafortis is poured on. The varnish immediately breaks up those parts of the plate where the treacle mixture was laid, and thus they are exposed to the action of the acid, while the other parts of the plate remain untouched. Thus the touches or places of the plate where the treacle has been applied, are bit in deeper than the rest, and have the precision of touches done with Indian ink. The plate being thus completely bit in, the bordering wax is removed, by gently heating it, with a piece of lighted paper. It is then cleared from the ground, and varnished by means of oil of turpentine; and being wiped clean with a rag and a little fine whitening, it is ready for the printer.

But in this method of aquatinting, it is found difficult to produce the necessary degree of coarseness or fineness in the grain; and plates which are engraved in this manner afford a small number of impressions before they are worn out. On this account it is now more rarely followed.

The other method of producing the aquatint ground, which is more generally adopted, is the following. A resinous substance, as common resin, Burgundy pitch, or mastic, is dissolved in spirits of wine. This solution is poured all over the plate, which is inclined, till the whole of the superfluous fluid drains off, and what adheres to the plate becomes quite dry in a few minutes. The plate being then examined with a magnifying glass, it will appear that the whole of the spirit having evaporated, the resinous matter is left in a granulated state, or is cracked in every direction, and adheres strongly to the copper. In this way a regular and beautiful grain is easily produced, which will be found preferable, at least for most purposes, to that which is produced by the former method. The grain being thus formed, the other parts of the process are conducted in the same manner as before described.

Such
Engraving. — Such are the usual methods of conducting this process. We shall add a few hints which the young artist may find useful in the different parts of it. With regard to the materials which are employed, it is to be observed, that the spirits of wine should be rectified, and only the best quality. Resinous matters, as common resin, Bur- gas, cedrel, and gum mastic, yield grains of a different appearance and form; so that advantage may be taken of this circumstance, by using them sometimes separately, and sometimes mixed in different proportions, according to the views and taste of the artist. Different proportions of resin may be employed, to produce grains of different kinds. When a coarse grain is intended, a greater proportion is to be employed; and when a fine grain is wanted, a smaller proportion of resin only is required. The proper proportions may be ascertained by providing a number of spare pieces of copper; on these the liquid may be poured, and the grain examined, before it is applied to the plate which is to be engraved. After the solution is made, it should remain undisturbed for a day or two, till the impurities of the resin have subsided, and the liquid becomes quite limpid. This is the best method of freeing it from impurities; for if it is strained through linen or muslin, it is mixed with hairs, which are extremely injurious to the grain. It may be added, that the apartment in which the fluid is poured on the plate, should be perfectly still, and entirely free from dust; for if any fall on the plate while it is wet, the grain forms a white spot which cannot be removed. Great care should be observed in cleaning the plate. This is done with a bit of rag and whitewash. The smallest stain or particle of grease produces a streak or blishm in the grain. Still, however, with all the attention which can be employed, and with the utmost delicacy in the management, it is necessary to observe, that the process is extremely precarious and uncertain; and even the most experienced artists find themselves frequently subject to very unaccountable accidents.

Artists have frequently complained of the inconvenience from the fumes which proceed from the section of the acid upon the copper, when the plate is large.

To remedy this inconvenience, the following arrangement, which seems well calculated to answer the purpose, has been suggested by Mr Cornelius Varley, a young artist who distinguishes himself no less by his mechanical abilities than by the exquisite productions of his pencil in water colours. — Get a frame made of common deal or any kind of wood, three or four inches deep, covered with a plate of glass, and open on one side; and let the side opposite to this have a round opening communicating, by means of a common iron pipe, with the sub-pit of any little stove or other fireplace, shot up from all other access of air but what must pass through the pipe. It is obvious that any fumes rising from a copper-plate laid under such a frame will be carried backward into the iron-pipe by the current of air required to maintain combustion in the stove, and will by this means be carried up the chimney in place of being allowed to fly about in the apartment. The pipe may be very conveniently used by carrying it down through the table to the floor, and so along to the place where the chimney may chance to stand; and when the frame is not wanted, the pipe at one of the joinings may be made to answer the purpose of a bridge, by which to turn up the frame against the wall, where it may be secured, while out of use, by a button or any other contrivance.

This method of engraving in aquatint seems to be chiefly adapted for slight subjects in general, for imitations of sketches and wash drawings. But for the production of prints from finished pictures, it is by no means calculated; because it is not susceptible of that accuracy in the nice management of the tints which is necessary for this purpose. It is equally unsuitable for book plates; because, without retouching the plates, the number of impressions that can be thrown off is very small. On these accounts, therefore, it is to be considered greatly inferior to the other modes of engraving. But as it is more expedient, and may be attained with more facility, it is undoubtedly useful when it is confined to those subjects for which it is peculiarly calculated. This rapidity of execution, however, and facility in acquainting the practice of the art, are followed with the unfortunate circumstance, that they favour the production of an indiscriminate multitude of prints, which, it is to be feared, may rather tend to vitiate the public taste.

Engraving with the tool was the kind originally practised, and it is yet retained for many purposes. For though the manufacture of etching be more easy, and other advantages attending it; yet where great regularity and exactness of the stroke or lines are required, the working with the graver is much more effectual: on which account it is more suitable to the precision necessary in the execution of portraits; as there every thing the most minute must be made out and expressed, according to the original subject, without any licence to the fancy of the designer in deviating from it, or varying the effect either by that masterly negligence and simplicity in some parts, or these bold sallies of the imagination and hand in others, which give spirit and force to history painting.

The principal instruments used in engraving with the tool are, gravers, scrapers, a burnisher, an oil-stone, and a cushion for bearing the plate.

Gravers are made in several forms with respect to the points, some being square, others lozenge; the square graver for cutting broad and deep, and the lozenge for more delicate and fine strokes and initials. La Bourcet recommends, as the most generally useful, such as are of a form betwixt the square and lozenge: and be advises, that they should be of a good length: small towards the point, but stronger upwards, that they may have strength enough to bear any stress there may be occasion to lay upon them: for if they be too small and mounted high, they will bend: which frequently causes their breaking, especially if they be not employed for very small subjects.

The burnisher is used to assist in the engraving on some occasions, as well as to polish the plates. It is seven inches in length, and made of fine steel well polished. The burnisher is formed at one end, and a scraper on the other, each about an inch and a half long from the point: betwixt them, about four inches of the instrument is made round, and serves as a handle; and is thicker in the middle than at the necks, where the burnisher and scraper begin, which necks are only one quarter of an inch in diameter. The principal
The application of it in engraving, besides its use in polishing the plates, is to take out any scratches or accidental detachments that may happen to the plates during the engraving; or to lessen the effect of any parts that may be too strongly marked in the work, and require to be taken down.

A cushion, as it is called, is likewise generally used for supporting the plate in such a manner that it may be turned every way with ease. It is a bag of leather filled with sand, which should be of the size that will just suit the plate it is intended to bear. They are round, and about nine inches over, and three inches in thickness.

The cushion, made as above directed, being laid on the table, the plate must be put upon it; and the graver being held in the hand in a proper manner, the point must be applied to the plate, and moved in the proper direction for producing the figures of the lines intended: observing, in forming straight lines, to hold the plate steady on the cushion; and where they are to be finer, to press more lightly, using greater force where they are to be broader and deeper. In making circular or other curved lines, hold your hand and graver steadily; and as you work, turn your plate against your graver, otherwise it will be impossible for you to make any circular or curved line with that smoothness and command of hand you by this means may.

After part of the work is engraved, it is necessary to scrape it with the scraper or graver, passed in the most level direction over the plate, to take off the roughness caused by the cutting of the graver; but great care must be taken not to incline the edge of the scraper so as to cut the engraved work. And that the engraved work may be rendered more visible, it may afterwards be rubbed over with a roll of felt dipped in oil. In using the graver, it is necessary to carry it at as level as possible with the surface of the plate; for otherwise, if the fingers slip betwixt them, the line that will be produced, whether curve or straight, will become deeper and deeper in the progress of its formation; which entirely prevents strokes being made at one part, that will be fine at their extremities, and larger in the middle; and occasions the necessity of retouching to bring them to that state. For this reason, it is very necessary for those who would learn to engrave in perfection, to endeavour, by frequent trials, to acquire the habit of making such strokes both straight and curved, by lightening or sinking the graver with the hand, according to the occasion. If, after finishing the design, any scratches appear, or any part of the engraving be falsely executed, such scratches, or faulty parts, must be taken out by the burnisher, and further polished, if necessary, by the above-mentioned roll.

The plate being thus engraved, it is proper to round off the edges, by using first a rough file, and afterwards a smoother; and to blunt the corners a little by the same means: after which, the burnisher should be passed over the edges to give it a feather polish.

The dry-point, or needle, which has been of late much used in engraving, is a tool like an etching point, which being drawn hard on the copper, cuts a stroke, and raises a burr; the burr is scraped off, and these remain a stroke more soft and delicate than can be produced in any other way.

In the conduct of the graver and dry point consists all the art; for which there are no rules to be given; all depending on the habit, disposition, and genius of the artist. However, besides the explanations already given, some general observations and directions may not be improper. As the principles of engraving are the same with those of painting, a person cannot expect to attain any considerable degree of perfection in this art who is not a good master of design; and therefore he ought to be well acquainted both with perspective and architecture; for the former, by the proper degradations of strong and faint colours, will enable him to throw back the figures and other objects of the picture or design which he proposes to imitate; and the latter will teach him to preserve the due proportion of its several orders, which the painter often entrusts to the discretion of the engraver. In order to preserve equality and union in his works, the engraver should always sketch out the principal objects of his picture before he undertakes to finish them. In working, the strokes of the graver should never be pressed too much in a lozenge manner, particularly in the representation of flesh, because sharp angles produce the unpleasant effect of lattice-work, and take from the eye the repose which is agreeable to it in all kinds of picturesque designs: we should except the case of clouds, tempes, waves of the sea, the skins of hairy animals, or the leaves of trees, where this method of crossing may be admitted. But in avoiding the lozenge, it is not proper to get entirely into the square, which would give too much of the hardness of stone. In conducting the stroke, the motion of the figures, and all of their parts, should be considered; and it should be observed how they advance towards, or recede from the eye; and the graver should be guided according to the rising or cavities of the muscles or folds, making the strokes wider and fainter in the light, and closer and firmer in the shades. Thus the figures will not appear jagged; and the hand should be lightened in such a manner, that the outlines may be formed and terminated without being cut too hard; however, though the strokes break off where the muscle begins, yet they ought always to have a certain connection with each other, so that the first stroke may often serve by its return to make the second, which will show the freedom of the engraver.

In engraving the flesh, the effect may be produced in the lighter parts and middle tints by long peaks of the graver, rather than by light lines; or by round dots; or by dots little lengthened by the graver; or, best of all, by a judicious mixture of these together.

In engraving the hair and the beard, the engraver should begin his work by laying the principal grounds, and sketching the chief shades in a careless manner, or with a few strokes; and he may finish it at leisure with finer and thinner strokes to the extremities. When architecture or sculpture is to be represented, except it be old and ruins buildings, the work ought not to be made very black; because, as edifices are commonly constructed either of stone or white marble, the
Engraving the colour, being reflected on all sides, does not produce dark or brown shades as in other substances. White points must not be put in the pupils of the eyes of figures, as in engravings after paintings; nor must the hair or beard be represented as in nature, which makes the locks appear flowing in the air; because in sculpture there can be no such appearances.

In engraving cloths of different kinds, linen should be done with finer and closer lines than any other sorts, and be executed with single strokes. Woollen cloth should be engraved wide, in proportion to the coarseness or fineness of the stuff, and with only two strokes; and when the strokes are crossed, the second should be smaller than the first, and the third than the second. Shining stuffs, which are generally of silk or satin, and which produce flat and broken folds, should be engraved more hard and more straight than others, with one or two strokes, as their colours are bright or brown; and between the first strokes other smaller must be joined, which is called interlining. Velvet and plush are expressed in the same manner, and should always be interlined. Metals, as armour, &c. are also represented by interlining, or by clear single strokes.

In architecture, the strokes which form the rounding object should tend to the point of sight; and when whole columns occur, it is proper to produce the effect as much as possible by perpendicular strokes. If a gross stroke is put, it should be at right angles, and wider and thinner than the first stroke. In engraving mountains, the strokes ought to be frequently discontinued and broken, for sharp and craggy objects; and they should be straight, in the lozenge manner, and accompanied with longer points or dots; and rocks should be represented by cross strokes more square and even. Objects that are distant towards the horizon should be kept very tender, and slightly charged with black. Waters that are calm and still are best represented by strokes that are straight, and parallel to the horizon, interlined with those that are finer: omitting such places as, in consequence of gleams of light, exhibit the shining appearance of water; and the form of objects reflected from the water at a small distance upon it, or on the banks of the water, are expressed by the same strokes, retouched more strongly or faintly as occasion may require, and even by some that are perpendicular.

For agitated waters, as the waves of the sea, the first strokes should follow the figure of the waves, and may be interlined, and the cross strokes ought to be very lozenge. In cascades, the strokes should follow the fall, and be interlined. In engraving clouds, the graver should sport when they appear thick and agitated, in turning every way according to their form and their agitation. If the clouds are dark, so that two strokes are necessary, they should be crossed more lozenge than the figures, and the second strokes should be rather wider than the first. The flat clouds, that are lost insensibly in the clear sky, should be made by strokes parallel to the horizon, and a little waving; if second strokes are required, they should be more or less lozenge; and when they are brought to the extremity, the hand should be so lightened, that they may form no outline. The flat and clear sky is represented by parallel and straight strokes, without the least turning. In landscapes, the trees, rocks, earth, and herbage, should be etched as much as possible; nothing should be left for the graver but perfecting, softening, and strengthening. The dry point produces an effect more delicate than the graver can, and may be used to great advantage in linen, skies, distances, ice, and often in water, especially in small engravings. In most things it is proper to etch the shadows, only leaving the lighter tints for the dry point, graver, &c.

To imitate chalk-drawings, a mixture of varied and irregular dots are used, made more or less soft, so as to resemble the grain produced by the chalks on paper. Every stroke of the chalks on paper may be considered as an infinite number of adjoining points, which are the small eminences of the grain of the paper touched by the chalk in passing over it. When the copperplate has been polished and varnished, or properly prepared, as is the common method of engraving, the drawing to be imitated may be counterproven on the varnish of the plate. If this cannot be conveniently done, black lead pencil, or red chalk, must be applied to varnished or oiled paper; and by means of this chalk or pencil, all the traces of the original will be transmitted to the varnish. The outlines of the object must be formed in the etching by points, whose magnitude and distance must be determined by the quality of the strokes in the original drawing. The artist may be provided with pointed instruments or needles of various sizes with single or double points. In forming the light and shade, he should distinguish between those hatches which serve to express the perspective of the object and those which form the ground of it. The principal hatches should be more strongly marked; the middle tints, if etched, should be marked lightly, or they may be left till the varnish is taken off, and be perfected with a greater degree of softness by needles or the point of the graver, as the original may require. There is nothing peculiar in the method of applying the aquafortis in this kind of engraving; but it may be observed, that it should not be left so long as to corrode the lighter parts too much: if the light parts are sufficiently corroded, they must be stopped up with turpentine varnish, and lamp-black mixed together; and the aquafortis may be applied again to the stronger parts; for it will be no detriment to them, if the points which compose the shade burst into one another, provided the extreme be avoided. When the work of the aquafortis is finished, and the varnish taken off the copper, it will be necessary in the softest parts, such as the flesh, &c. to interstipple with proper points; as an effect will be thus produced more delicate than it is possible to attain with the aquafortis only; and the strongest shades will require additional strength to be given them with small strokes of the graver. Drawings made with chalks of different colours may be imitated in this manner, if a plate be provided for every colour. This method of engraving is intended to form a kind of deception, so that the connoisseur may not be able, on the first inspection, to distinguish between the original drawing and the engraving made in imitation of it; and it is extremely useful, as it serves to multiply copies of drawings left by those masters who excel in the use of chalks, and thus to form and improve young artists, who could not have access to the originals in the practice of drawing.
To this account of the history and practice of the art of engraving, we shall annex the following ingenious observations by an eminent living artist (A). We present them to our readers without alteration or abridgment.

On the linear art in general.

When compared with painting, the art of engraving is but a recent invention, being exclusive only with that of printing; and like that noble art, it possesses not only a similar but a greater power, of multiplying and extending the productions of genius over the world; for its language is universally understood.

It would have been well for the arts, if it could boast of a more remote date, as we might then have had many more of the finest designs of the first painters of antiquity, now doomed to oblivion, saved from the rude ravages of time.

But this invention seemed to be reserved for the fourteenth century, and its improvements for the age of Louis XIV., an age in which a number of artists, who may be said to have invigorated the art, and invested it with beauty, arose both in France and Italy.

Lines, in the first state of the art, like every other pursuit, whose excellence is progressive, were comparatively rude and unmeaning, and had nothing more to recommend them, than merely representing a particular sort of markings, or slight hatchings with the pen, without any other apparent degree of execution or expression. Although it is our pride to acknowledge, that it has not been a little behooved to the elegant etchings of the great masters in painting, as well as to their drawings in pen and ink, in its early stages, by which means an eminent degree of taste was introduced into the art, particularly in the department of linear disposition. Amongst those, the drawings of a Raphael, Michael Angelo, and the learned da Vinci; some of which we have occasionally seen and admired. Some by da Vinci were hatched in a square but delicate manner, with a white fluid, on a dark-coloured paper. Those of Michael Angelo and Raphael inclined more to the lozenge, in black or brown pink. They even carried this style of hatching with the pencil into their pictures, some of which adorn the Vatican; and in the famous cartoons in his majesty's collection by Raphael. Baccio Bandinelli generally hatched his lines in one direction, particularly a Traut, down from the Cross, which was sold in London at the sale of the late Sir Joshua Reynolds' drawings. Vicenzo Dante, hatched in a similar way about the year 1550. Julius Romano used also to draw in this style with the pen, severals of which are still to be found in the most select cabinets of men of taste; and for near a century and a half after the invention of etching, it is rare to mention a person of eminence, who was distinguished in drawings who did not annex this art to that of painting. But with the application of the burin, the art has been gradually improving till the present period. (a) Linear engraving is nothing more than drawing elegantly on copper. It became more studied as it was found capable of representing the various appearances of nature. The texture or surface of objects became proportionally discriminated by such peculiar modifications of the line, as seemed most suitable to the subject represented, although, at the same time, it rendered it much more arduous in the execution. Hence arose that diversity of style, and that scope for succeeding excellence, which, by combining elegance with simplicity and beauty, distinguished those artists who have been most conspicuous in its improvement.

It has been said, that we are indebted for the origin of this art to an ingenuous Florentine, Masso Finnuguer, the sculptor. He was succeeded by a number of other ingenuous men, among whom we rank Botticelli, Andrea Mantegna, and other able designers;—and in Germany, Albert Durer, Altdarve, and Lucas Van Leyden, who severally contributed their labours. But in the fifteenth century, the works of the divine Raphael began to be multiplied by the correct graver of Marc Antonio, an artist whose prints were the delight of that great painter. Antonio had many imitators, but none who equalled him for justness of contour, for which his works will be very highly appreciated among the early productions of the art.—Having had occasion to mention a few of the principal artists who reared the scaffolding of this elegant art, we shall proceed to those who have so much distinguished themselves in finishing the superstructure. Amongst those, Augustino of Venice began to introduce a better disposition of line in his shades, as well as the ingenuous Bolognesi, Augustino Carrachi; whilst Egidius Sadeler displayed no less zeal in Germany. In the sixteenth century, the art displayed still more vigour and taste, and seemed to have but little more wanting; for all that meagre dryness of line began to disappear, which so manifestly marks the early works of Il Todesca, Algadraef, and other artists of a former period. Their works became consequently more rich in style, by embracing the best productions of the pencil; and as they were applied to a greater number of ideas they became still more interesting and successful.

Patrons were numerous and liberal; and it is but proper to remark, that the various artists, on their part actuated by a becoming zeal which was highly creditable to themselves, were indefatigable. This is a circumstance not less worthy of imitation, than the many admirable monuments of the art which they produced. Few but admired the works of Masson, Pilly, Nantua, and Rousselet; and some time after the death of the ingenuous Cornelius Bloemart, who had given a grace to his lines, hitherto unknown at Rome, the matchless Audran and Edelinck displayed their excellent productions at Paris. But arts are liable to fluctuate; and when the art of engraving began to decline abroad, it gradually displayed a high degree of lustre in our own country; and the variety of styles which has since sprung from the original manner of engraving shall be the subject of the following sketch.

We shall therefore treat more particularly of the disposition of the lines and their consequent effects, distinguished-

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(a) Francis Legat, Esq. historical engraver to his royal highness the prince of Wales, and F. A. S. E.

(b) The author has taken the liberty of here adopting the word linear, from its strict analogy to this mode of engraving, and with the approbation of some of the first professors, both in painting and engraving.

VOL. VIII. Part I. 1 8
tonguished by the terms, linear expression, imitation, disposition and harmony; with a strict investigation of the first and most approved subjects, either in etching or engraving; and of their essential beauties, as far as they may tend to illustrate the subject.

As the great object of this mode of engraving is, to adopt those lines the most expressive of the form and character of whatever happens to be represented, by maturely investigating not only the action but the cause and correspondent effects of the original picture; in order that the artist may avail himself of all that is most beautiful in his translation, and efficient in the aggregate either with respect to the expression, spirit, or sentiment.

When historical subjects consist of several figures where there is generally a variety of draperies, some of them appearing thin and cumbersome, others more thin and flexible, sitting close and elegant on the limbs, being composed of a finer texture, or thread; the coarse stuffs are consequently more effectually represented by a bolder line, as the thinner sort, by the application of a fine line, gives a more lively representation; a discrimination which has been observed of late, by the most approved modern artists in linear engraving. Observations of this description, when treated in a liberal manner, not only superadd a degree of truth, but even render the subjects sweeter to the eye of fancy. In the early stages of the art, some excellent artists have been led into particular and limited systems. In the works of such as have affected to describe every subject in the same line indiscriminately, even the arms of the most delicate women are often engraved as if perfectly polished, by approaching to a metallic appearance, a mode not uncommon among the second or third class of artists about the beginning of the last century; by which manner, all that softness and delicacy was neglected, which was so happily effected in the linee productions of Bartolozzi, Morgan, Sharp, Heath and others, at present of the first masters in Europe. Those who are acquainted with the works of the ingenious Chaffery, must with pleasure have perceived in his folios, how even the texture of flowers are imitated from the delicate line-like fibres of which they are composed, issuing from the stem, and spreading their silken beauties in the sun; and in this class of imitation, the clear transparency of glass, the rough texture of woolen, the thinness of lawn, the flickerings of satin, or the lightnings of steel, as well as the rude rock, the lucid lake, or the flashing of the torrent, are all admirably adapted to linear effect by the almost infinite diversity, of their construction, and general constituent principles, strictly observing on what laws the beauty of lines consists, by ever keeping in view the due balance of taste, and a noble simplicity of style throughout. It is the business of the skilful artist to overawe and subdue the difficulties in his profession; for no excellence of art is of itself an object of worship. Let it be remembered that with forming lines, even the enchanting graces of the Venus de Medicis were been from rock, and the almost breathing Apollo, from a block of Parian stone.

An elegant English poet, in a critical essay on poetry, observes, that the sound should seem an echo to the sense; so should the lines in a fine print seem to harmonize with the subject, by flowing with the external cast of the features, and the predominant passion expressed in the original picture; for the same character and disposition of the lines that suit the action of the muscles in one passion, will be found to appear more vacant and less expressive when applied to others, however graceful they may appear.

As this is a point of view to which the art has never yet been fully extended, perhaps it may meet with some degree of attention, as it will be found of utility in forming a principle respecting disposition, more particularly in historical subjects, where the passions are required to be nicely expressed; and although it may admit of some slight exceptions, it is a principle that will in general be found to be true.

For example, let it be supposed that the passion of the figure represented, is that of joy; the lines should seem to expand and swell, with every acting muscle, in the most delicate manner possible.

But, on the contrary, if the subject displays deep sorrow, they should rather incline downward, partaking somewhat of the half straight, seeming to act apparently in perfect union and conformity with the features of the face, with all due subordination to the general effect of light and shadow.

Various observations may be made in this manner on the principal passions expressed in the human countenance, which are but few comparatively, even from the slightest movement to the boldest action. We often find, on examining the works of those masters who are not so conspicuous for great clearness of execution, that they have been occupied by the disposition and energy of the lines, as in the magnificent and masterly prints of the Battles of Alexander, from the pictures of Carlo Buon, engraved by Gerard Audran; where the executive department is no less conspicuous from the burin of the Curialier Edelinc; in the fine print of the tent of Darius; whilst Audran displays the true spirit of art, but rarely attains his object of much of the mechanical principles. The field, and tumult of battle, seemed admirably calculated to call forth his rapid powers, particularly in works of magnitude.

The less active scenery of the tent of Darius was equally appropriated to the splendid talents of Edelinc as he seems to have been better qualified to display subjects of that nature in general. This is sufficiently obvious from the beautiful and interesting groups of the queen mother, and her illustrious family, kneeling at the feet of the conqueror; his impressive print of the magdalene, or his most admirable portraits of the dignified president, distinguished authors, and eminent artists. These, in point of engraving, are no less remarkable for taste in the execution, than for truth and nature in expression.

In one of the Battles of Alexander, the groups where Pirus is wounded and supported by the soldiers, the rough discrimination of line finely accords with that bold deportment of character in the grim visage of that gigantic prince, whilst the delicate line marks the youthful countenance of Alexander; a discrimination which is totally lost in the large Dutch copy by de Vos.

In the same print, the figures of Alexander and Clytus, are finely relieved from the distant scenery by the varied description of engravings on their armour, drapery, and horses. The latter are managed, with such freedom and spirit, that it is difficult to say whether the horses or figures seem the most with mastery execution; particularly
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particularly the white war-horse on the right extremity

of the print (c).

Had Audran superseded a still greater portion of the
delicacy and clearness of handling so conspicuous in
Edelinck and other eminent artists since that period, it
would undoubtedly have given an additional beauty to
his other transcendent acquisitions; namely, the vast
spirit of history, and power in drawing.

But it is seldom the lot of an individual to combine
every excellence. Arts too have their infancy; for
they generally require the labour of ages to bring them
to maturity and perfection, and it yet remained to unite
and ameliorate the polish of Edelinck, to the spirited
style of Audran. Without prejudice or partiality, a con-
siderable degree of this excellence will be found in the
best works of British art, as we shall hereafter exemplify.

Another fine specimen of lineal engraving, and of a
different class, is the celebrated Storm of Balechow,
from a picture of the famous Vernet. In this print he
has transmitted with the graver a certain fluidity and
action in representing the liquid element, to which the
art had never before attained. To a grandeur of style
in the bold swelling of the waves, he has superadded
the utmost transparency of line; at the same time, hav-
ing attended to all that light rests on spray which seems
spouting to the gales as they roll along. In a fanciful
mood, one might almost imagine they heard the motion
of the water; so finely did this discriminating artist
translate, (if I may be allowed the expression) this ad-
irable picture.

When we consider the period in which this distin-
guished work was engraved, and that little or noth-
ing had been previously done in that department of a
similar excellence; it is hoped it will be a sufficient
apology for the degree of admiration here expressed:
for, as Lord Verulam truly observes, "we are too prone
to pass those ladders by which the arts are reared, and
generally reflect all the merit to the last new perform-
er." We have already observed, they are seldom reared
with rapidity, and oftentimes that which is consid-
ered as invention, is only a long succession of trials and
experiments, which have generally followed each other,
and ought rather to be considered as a series of human
mind than the knowledge of an individual, being the
works of ages. In any point of view, the present work
just mentioned, can be considered as an high improve-
ment and an elegant acquisition in the annals of the linear
art. But in historical subjects this artist is by no means
equal in point of taste or discrimination. His print of
St Genevieve undoubtedly ranks high in the first classes
of engraving. Had his taste in other respects been
equal to his powerful clearness of execution, it would
have been almost unparalleled; but it betrays a want
of that essential, even in his mode of thinking. Patience
and labour are everywhere too prevalent. It remain-
ed for Woollet to excel both in figures and in landscap-

In the various styles and modifications of this expres-
sive art, from the next to the facile, and from the
bold to the extravagant, Taste stands sole arbiter; in
brief, it is she who distributes variety with spirit, and
conceals the appearance of intricacy and labour; who,
by a due modification of line, unites clearness to soft-
ness, arresting the hand of the skilful artist from every
effort inconsistent with her powers; producing at once
to the mind all that agreeable finished combination or
harmony which ever accompanies and constitutes
the perfection of true art.

In the execution of subjects of imagination, there is a
penetrating scope for calling forth the fancy of the en-
graver, as the various combinations of lines are inex-
haustible, uncommon effects, such as aerial spirits, or
celestial beings blended with the light, or ghosts com-
ingled with the gloom, or fairy elves by moonlight,
who trip the sands, and yet no footstep seen; or wood-
nymphs, laving their taper limbs in the limpid ele-
ment. Such subjects, in point of style, depend entirely
upon the beauty, lightness, and transparency of execu-
tion; for those that are merely ornamental or grotesque,
demand a style of a different cast from that of the
serious or historical, as they require a less degree of
truth even from the burin. In these cases the style
may be as capricious as the subjects. Those of Raphael,
in the Vatican, display an uncommon degree of taste,
and particularly in the elegant flow of line with which
they are composed.

In all works of taste and genius, those which may
appear the most simple at a transient glance, will be often
found to contain the most art on a more mature in-
vestigation. The first impression may strike the fancy,
but the second generally calls up the discriminating
powers of the judgment.

Arts generally rise in our esteem according to the
degree of exertion of the mental powers which they
erquire; and, as lines are capable of various styles, those
which are most congenial to the subject represented
ought to be adhered to in preference to every other
consideration. Teniers, and Garrand Donv, demand all
the fidelity and delicacy of the burin in describing the
various draperies and individualities which belong to
that class of painting; but, in proportion as the contour
is composed of fewer parts, and the forms more full and
elegant, the beautiful flowing qualities of the graver is
increased, and its lines glide more gracefully over the
figures, as may be found in the works of Strange- and
others from Gains and Careges. This distinction will
probably occur to the first view of the art. But, on a
full investigation, it will be found, that not only a different
description of style is requisite to characterize some of
the masters in each particular class, from the sublime
elevated figures of a Raphael and Michael Angelo,
to the simple cottagers of Adrian Ostade.

When we take a more comprehensive view of the
art, we often find, that the styles which are adopted in
the different countries in Europe by the artists where
the art has in any degree been cultivated, are generally
regulated by the modes of painting, drawing, and even
the colouring respectively in each, whether historical,
portrait, or landscape, and is proportionably appreciated
according to the effective beauty and elegance of the
execution.

82

(c) Whenever M. Bartolozzi happened to speak of those prints to me, he always expressed himself with a great
degree of enthusiasm, thinking himself extremely fortunate in having works of such excellence in his possession.
fully displayed the true spirit of Salvator Rosa, particularly in the original mode of treating the rocks, and the bold style of the surrounding scenery; in short, in the aggregate it is a chef d’œuvre unparalleled in any country. This is freely acknowledged, not only by every man of taste, but by the finest landscape engravers (D).

But Brown was perhaps less happy in the companion to the above, from the celebrated Both, by adapting a similar mode to that finished and delicate painter. For the style should ever vary with the subject.

"What a'er Lorrain light touched with softening hue, Or savage Rosa dash'd, or learned Poussin drew."

— THOMSON's Castle of Indolence.

His admirable etchings of the cottage and its companion, and the Celand and Amelia, are fine specimens of his discriminating powers, and characterized with so near an approach to truth, that we cannot help exclaiming with the poet,

"He sees no other, nature's self who sees."

The engraving of the above subjects was finished by the matchless Wollet, with the same happy taste. And it must be acknowledged that it is but seldom that we see so many excellencies united; for it is equally rare to see the finest lines united to the finest drawing, as to find it in painting combined with the choicest colouring; yet each have their decided fascinations in the gallery, the cabinet, or the portfolio.

Woollet, whose works abound with nerve and intelligence in point of character, his style of landscape is delightfully descriptive; whether rocks, water, trees, or sky; as the Niobe, the Ceyz and Aleyone, and other master-pieces from the great Wilson ęnice. In the winter scene from Smith of Chichester, he has admirably contrived to convey the effect of the drifted snow, by delicate dotting, and with no less precision he has described the transparent ice with clear lines. Of trees, he was the first that ever faithfully characterized the graceful arch; as may be seen in his views of the noblemen's seats. In the print of the fishery, he is indebted to the masterly etching of John Brown, particularly the shipping, in which there is perhaps no subject more articulate and perspicuous. The engraving of this subject is finished by himself. In his study, most happily adapted for modern dresses, and historical portraiture; a style in which he moved with unrivalled reputation. His print of the death of General Wolfe, painted by Mr West, is an admirable example, and does honour to the British nation. It occupied him no less than four years. The print of the battle at La Hogue is another fine specimen of his knowledge of linear discrimination. In short, when we consider the talents of this artist, it is difficult to decide whether he most excelled in modern history or landscape. The art has to regret that he, who was so eminently qualified to adorn any line of the profession, has left no works in ancient history. We have little doubt, from his knowledge, and a real love of the art, he would have left a sufficient monument in that department also, for the pleasure and contemplation of the

(D) Were I at liberty to mention eminent living artists, I would have been induced here, among others, to have mentioned the subject of the Tempest in the Twelfth Night, from the late ingenious Wright of Derby, engraved by Mr Middleman, in the Messrs Boydell's large-edition of the immortal bard of Avon.
Engraving, the real connoisseur and of posterity. Engraving in this country sustained a heavy loss when he died; and if the death of so excellent an artist may be considered as a public loss, it is certainly the more felt with respect to Woollet, who died while he was yet improving in that excellence (x).

Challertain has been a mannerist in his drawings, but he must certainly be deemed to be an excellent one: his etchings are variety itself. Perhaps in the department of etching no artist has so happily translated the pictures of Claude de Lorraine as Francis Vivares; that is, with respect to aerial perspective, the peculiar characteristic of Claude. But his merits are not confined to this master alone; for he followed Raysale, Bergam, Gainesborough, and Cuype, with great success. He has such a free delivery of style, that almost every one who examines his works is irresistibly impressed with an idea of performing the very same. Few artists, it has been mentioned, have excelled in the etching department. We cannot, however, omit the name of Pereanexi; who, to originality of style, which is apparently spontaneous, joins a certain grandeur which had never been surpassed. He has transmitted to posterity so spirited a representation of the Greek and Roman edifices and ruins, that travellers have often confessed that they have raised their ideas beyond the magnitude of the superstructures themselves. It is certain that in works of this stupendous nature, a degree of ruggedness in the execution corresponds with the sublimity of the subjects; and thus produces a still greater power over the mind, than if they had been more polished. Some have censured his figures, and not without cause. This defect has ingeniously palliated by an excellent artist, M. Bartolozzi. "For (said he) if the purchasers of the works of Pereanexi, get so much for their money in the building way, the figures may be supposed to be given for nothing." Doubtless these vast piles of perishable grandeur, were never more judiciously presented to the eye, than by this astonishing artist, or better calculated to affect the mind by calling forth its most sublime ideas.

We have another striking instance of spirited etching in a different pursuit of the art, in the works of Ridinger, a name which brings along with it all the savage scenery of nature.

"Assembling wolves in raging troops descend—
---They fasten on the steed and pierce his mighty heart."

Thomson's Winter.

For we shall ever find some peculiar beauty to admire, even in the slightest productions of genius, as well as in the most perfect productions of the burin. There are few artists who do not regret, that etching was unknown to Bolswert, who has done so much without its aid; from which we may easily suppose how much more he could have effected with this charming acquisition. For the truth of this remark we may appeal to his landscapes from Rubens, his animated portraits from Vandyke, and his productions from the Flemish school of history, particularly his large print of the Engraving. Taking down from the Cross from Rubens.

There is a fine instance of linear effect in a print of a Flemish conversation piece by Wille. One of the figures is drinking out of a glass, and the artist has most deceptively described the texture of the drinker’s face through the glass. In the same print, a female figure shows great skill in this way, even the floor is characterized by lines; and the whole strongly marks the most proper mode of treating subjects of a mere local nature. The beautiful print of the Petit Physicium, is also an admirable imitation, particularly the little pellucid globe which has just mounted from the shell. When lines are engraved in a square acute method of crossing, they generally convey the idea of hardess to the subject represented. The scientific Picart seems to have been so much aware of this, that in a print of his engraving of a large marble group of horses, from the animated chisel of Perriere, he adopted this style in order to heighten the imitation.

Mason’s print of Marshal Harcourt is one of the many fine efforts of portrait engraving; and although it was executed at an early period of the art, it abounds with no small degree of taste. The celebrated print (called the Table-cloth) from Titian, of the Last Supper, also contains a considerable degree of linear discrimination, although he sometimes carries it to affectation. He is rather singular in his mode of engraving hair. Yet the portraits of Marshal Harcourt and Brissiatiere the secretary may be deemed exceptions.

While, by the magic of his tooling, is too apt at times to give his works indiscriminately the appearance of bronze; and we frequently find the same in the figures of Baleshaw: but it seems to have been reserved for Strange to give the softness of carnation to copper; and to Woollet, to give force and clearness with discriminating taste. Bartolozzi in his lines elegance delicacy and drawing; while the works of Audran teem with boldness and simplicity. In the prints of Sir Robert Strange, the greatest excellence is perhaps his rich and harmonious tones, as well as the whole effect, which is supported by an expressive style; which seems in a great measure to have invented for his most favourite painters, Corregio, Titian, Guido, and Guercino. The softness, the gusto, and the flowing draperies in the works of these masters, were his delight. His sleeping Cupid from Guido, and the prints of the Venus and Danae from Titian, will ever be esteemed as chef d’oeuvres in the linear art.

Having thus attempted to fulfill our original intention of discriminating the most expressive combinations of lines, and of analyzing and illustrating their various powers and effects in engraving, we shall now conclude these observations; and if, from the nature of the subject, and from the limits of the sketch, we have failed in marking every brilliant star in the galaxy of the art; it must at least be acknowledged, that we have not omitted some of those of the first magnitude.

Engraving upon Glass. See Glass, Engraving on. Engraving.

(x) Although we are now-contemplating linear engraving, it is but proper here to observe, that chalk engraving, mezzotinto, and aquatint, have also made ample improvements in this country, in their various styles of excellence.
ENGRAVING on Precious Stones, is the representing of figures, or devices, in relieve, or incised, on divers kinds of hard polished stones.

The art of engraving on precious stones is one of those wherein the ancients excelled; there being divers antique agates, cornelians, and onyxes, which surpass any thing of that kind the moderns have produced. Pyrgotites among the Greeks, and Diocorides under the first emperors of Rome, are the most eminent engravers we read of; the former was so esteemed by Alexander, that he forbade any body else to engrave his head; and Augustus's head, engraved by the latter, was deemed so beautiful, that the succeeding emperors chose it for their seal.

All the polite arts having been buried under the ruins of the Roman empire, the art of engraving on stones met with the same fate. It was retrieved in Italy at the beginning of the 16th century, when one John of Florence, and after him Dominick of Milan, performed works of this kind no way to be despised. From that time such sculptures became common enough in England, and particularly in Germany, where great numbers were sent into other countries; but the same sort of the beauty of those of the ancients, especially those on precious stones; for, as to those on crystal, the Germans, and, after their example, the French, &c. have succeeded well enough.

In this branch of engraving, they make use either of the diamond or of emery. The diamond, which is the hardest of all stones, is only cut by itself, or with its own matter. The first thing to be done in this branch of engraving is, to cement two rough diamonds to the ends of two sticks big enough to hold them steady in the hand, and to rub or grind them against each other till they be brought to the form desired. The dust or powder that is rubbed off serves afterwards to polish them, which is performed with a kind of mill that turns a wheel of soft iron. The diamond is fixed in a brass dish; and, thus applied to the wheel, is covered with diamond dust, mixed up with oil of olives; and when the diamond is cut out face-wise, they apply first one then the other, to the wheel. Bottles, sapphires, and topazes, are cut and formed the same way on a copper wheel, and polished with tripoli diluted in water. As to agates, amethysts, emeralds, hyacinths, granites, rubies, and others of the softer stones, they are cut on a leaden wheel, moistened with emery and water, and polished with tripoli on a pewter wheel. Lapis-lazuli, opal, &c. are polished on a wooden wheel. To fashion and engrave vases of agate, crystal, lapis-lazuli, or the like, they make use of a kind of lathe, like that used by pewterers, to hold the vessels, which are to be wrought with proper tools: that of the engraver generally holds the tools, which are turned by a wheel: and the vessel is held to them to be cut and engraved, either in relieve or otherwise; the tools being moistened from time to time with diamond dust and oil, or at least emery and water. To engrave figures or devices on any of these stones, when polished, such as medals, seals, &c. they use a little iron wheel, the ends of whose axis are placed within two pieces of iron, placed upright, as in the turner's lathe; and to be brought closer, or set further apart, at pleasure: at one end of the axis are fitted the proper tools, being kept tight by a screw. Engraving Lastly, The wheel is turned by the foot, and the stone applied by the hand to the tool, and is shifted and conducted as occasion requires.

The tools are generally of iron, and sometimes of brass; their form is various, but it generally bears some resemblance to chisels, gouges, &c. Some have small round heads like buttons, others like ferrules, to take the pieces out, and others flat, &c. When the stone has been engraved, it is polished on wheels of hair-brushes and tripoli.

ENGRAVING on Steel is chiefly employed in cutting seals, punches, matrices, and dies, proper for striking coins, medals, and counters: The method of engraving with the instruments, &c. is the same for coins as for medals and counters: All the difference consists in their greater or less relieve; the relieve of coins being much less considerable than that of medals, and that of counters still less than that of coins.

Engravers on steel commonly begin with punches, which are in relieve, and serve for making the creux or cavities of the medals, but though sometimes they begin with the creux or hollowness of them, it is only when the intended work is to be cut very shallow. The first thing done, is that of designing the figures; the next is the moulding them in wax, of the size and depth they are to lie, and from this wax the punch is engraved. When the punch is finished, they give it a very high temper, that it may the better bear the blows of the hammer with which it is struck to give the impression to the matrixe.

The steel is made hot to soften it, that it may the more readily take the impression of the punch; and after striking the punch on it in this state, they proceed to touch up and finish the strokes and lines, where by reason of their fineness or the too great relieve they are any thing defective, with steel gravers of different kinds; chisels, flatters, &c. being the principal instruments used in engraving on steel.

The figure being thus finished, they proceed to engrave the rest of the medal, as the mouldings of the border, the engraved ring, letters, &c. with little steel punches, well tempered, and very sharp. ENGUAGE', in Heraldry, is said of the great mouth of a hunting horn, when its rim is of a different colour from that of the horn itself.

ENHARMONIC, in Music. The Greeks had three different species of music; the diatonic, the chromatic, and the enharmonic. This last was esteemed by much the most agreeable and powerful of the three; but the difficulty of its execution rendered its duration short, and latter artists were upbraided for having sacrificed it to their indolence. It proceeded upon lesser intervals than either the diatonic or chromatic; and as the chromatic semitone is still less than the diatonic, the enharmonic intervals must have consisted of that semitone divided into parts more minute. In Houssaye's Musical Dictionary (at the word Enharmoique), the reader may see how that interval was found in the trachords of the ancients. It is by no means easy for modern ears, inured to intervals so widely different, to imagine how a piece of music, whose transitions were formed either chiefly or solely upon such minute divisions, could have such wonderful effects; yet the melody of speech, which rises or falls by intervals still more
ENNIS, [143] ENO

made use of heroic verses. He wrote the Annals of Rome; he translated several tragedies from the Greek, and wrote others, besides several comedies. We have only some fragments of his works, which were first collected by the two Stephanius, and afterwards published at Naples, with a learned commentary, by Jerome Columba, in quarto, 1590; and reprinted at Amsterdam in 1707, in quarto, with additions by Hasselius.

ENOCH, the son of Cain (Gen. iv. 17.), in honour of whom the first city taken notice of in Scripture was called Enoch by his father Cain, who built it. It was situated to the east of the province of Eden.

ENOCH, the son of Jared and father of Methuselah, was born in the year of the world 622. At the age of 65 he begat Methuselah, and lived 300 years after, and had several sons and daughters. Enoch walked with God; and after that he had lived in all 365 years, "he was not, for God took him." Some construe these last words, as if they intended that Enoch died a natural death, because in reality he lived not so long as the other patriarchs of those times; as if God, to exculpate him from corruption, had been pleased to take him early out of this world. But the generality of the fathers and commentators assert that he did not, but was translated out of the sight of men, in like manner as Elijah was. The apostle Paul (Heb. xi. 5.) shows very clearly that Enoch was translated, and did not see death.

The apostle Jude (ver. 14, 15.) cites a passage from the book of Enoch, which has very much exercised interpreters. The question is, whether the apostle took this passage out of any particular book written by Enoch, which might be extant in the first age of the church, whether he received it by tradition; or lastly, by some particular revelation. It is thought probable, that he read it in the book we have been speaking of, which, though apocryphal, might contain several truths that St. Jude, who was favoured with a supernatural degree of understanding, might make use of to the edification of the faithful.

The ancient greatly esteemed the prophecy of Enoch. Tertullian expresses his concern that it was not generally received in the world. That father, on the authority of this book, deduces the origin of idolatry, astrology, and unlawful arts, from the revolted angels, who married with the daughters of men. St. Augustine allows indeed that Enoch wrote something divine, because he is cited by St. Jude; but he says it was not without reason that this book was not inserted in the canon which was preserved in the temple at Jerusalem. This father sufficiently intimates, that the authority of this book is doubtful, and that it cannot be proved that it was really written by Enoch. Indeed the account it gives of giants engendered by angels, and not by men, has manifestly the air of a fable, and the most judicious critics believe it ought not to be ascribed to Enoch.

This apocryphal book lay a long time buried in darkness, till it was discovered. Joseph Scaliger recovered a part of it. Scaliger, Vossius, and other learned men, attribute this work to one of those Jews who lived between the time of the Babylonish captivity and that of Jesus Christ. Others are of opinion, that it was written after the rise and establishment of Christianity; by
one of those fanatics with whom the primitive church was filled, who made a ridiculous mixture of the Platonian philosophy and the Christian divinity.

The eastern people, who call Enoch by the name of Edris, believe that he received from God the gift of wisdom and knowledge; and that God sent him 30 volumes from heaven, filled with all the secrets of the most mysterious sciences. The Rabbins maintain, that when Enoch was translated to heaven, he was admitted into the number of the angels, and is the person generally known by the name of Michael.

ENORMOUS, something excessive or monstrous, especially in bulk.—The word is formed of the privative ë, and norma, “rule;” q. d. “void of, or contrary to, rule or measure;” contra normam. In the corrupt ages of Latinity they used inordinis and inornis.

In the French jurisprudence, lexicor enormis, “enormous damage,” is that which exceeds half the value of the thing sold.

ENOS, the son of Seth and father of Cainan, was born in the year of the world 233. Moses tells us (Gen. iv. 26.), that then, “men began to call upon the name of the Lord;” or, as others translate it, that “Enos began to call upon the name of the Lord;” that is to say, that he was the inventor of religious rites and ceremonies in the external worship which was paid to God. This worship was kept up and preserved in Enos’s family, while Cain’s family was plunged in all manner of irregularities and impieties. Several Jews are of opinion, that idolatry was first introduced into the world in the time of Enos. They translate the Hebrew thus, “Then men began to profane the name of the Lord.” Good men, to distinguish themselves from the wicked, began to take upon them the quality of sons or servants of God; for which reason, Moses (Gen. vi. 1, 2) says that the sons of God (that is to say, the descendants of Enos, who had hitherto preserved the true religion), seeing the daughters of men, that they were fair, took them wives of all which they chose. Enos died at the age of 905 years, in the year of the world 1140.

ENS, among metaphysicians, denotes entity, being, or existence; and they call ens reale, and ens potentiale; to distinguish it from their ens rationale, which is only an imaginary thing, or exists but in the imagination.

ENS, among chemists, imports the power, virtue, and efficacy, which certain substances exert upon our bodies.

ENS, in Geography, a city of Germany, situated at the confluence of the Danube and the river Ens, about 80 miles south of Vienna. E. Long. 14. 20. N. Lat. 48. 16.

ENSATÆ, in Botany, (from ensis, “a sword”); the name of the sixth order in Linnaeus’s natural method, consisting of plants with sword-shaped leaves. It contains the following genera, viz. Antholyza, Calilus, Cememila, Crocus, Ericocalon, Ferraria, Gladiolus, Iris, Iris, Morris, Pontederia, Sisyrinchium, Tradescantia, Wachendorfia, Xyris. See Botany Index.

ENSEELED, in Falconry, is said of a hawk that has a thread drawn through her upper eye-lid, and made fast under her beak, to take away the sight.

ENSEMBLE, a French term, sometimes used in our language; literally signifying together or one with another—being formed from the Latin in and simul.

In architecture, we say the ensemble, or tout ensemble, of a building; meaning the whole work, or composition, considered together, and not in parts; and sometimes also, the relative proportion of the parts to the whole.—“All those pieces of building make a fine ensemble.”

To judge well of a work, a statue, or other piece of sculpture, one must first examine whether the ensemble be good. The tout ensemble of a painting, is that harmony which results from the distribution of the several objects or figures whereof it is composed.—“This picture is good, taking the parts separately; but the tout ensemble is bad.”

ENSIFORMIS CARTILAGO. See XIPHIODUS.

ENSIGN, in the military art, a banner or colours under which soldiers are ranged, according to the different companies or parties they belong to. See FLAG, COLOURS, STANDARD, &c.

The Turkish ensigns are horses tails; those of the Europeans are pieces of taffety, with divers figures, colors, arms, and devices thereon. Xenophon tells us, that the ensign borne by the Persians was a golden eagle on a white flag; the Carthagians bore the winged horse, or Pegasus, in theirs; the Athenians, an owl; the Messenians, the Greek letter M; the Lacedemonians the A. The Romans had a great diversity of ensigns; the wolf, minotaur, horse, boar, and at length the eagle, where they stopped: this was first assumed in the second year of the consulship of Marius*. A See Eagle military ensign on a medal of a Roman colony denotes it a colony peopled with old soldiers.

ENSIGN is also the officer that carries the colours, being the lowest commissioned officer in a company of foot, subordinate to the captain and lieutenant. It is a very honourable and proper post for a young gentleman at his first coming into the army: he is to carry the colours both in assault, day of battle, &c. and should not quit them but with his life: he is always to carry them himself on his left shoulder: only on a march he may have them carried by a soldier. If the ensign is killed, the captain is to carry the colours in his stead.

Neural Ensign, a large standard or banner hoisted on a long pole erected over the poop, and called the ensign staff.—The ensign is used to distinguish the ships of different nations from each other, as also to characterize the different squadrons of the navy. The British ensign in ships of war is known by a double cross, viz. that of St George and St Andrew, formed upon a field which is either red, white, or blue.

ENSISHEIM, a town of France, in Upper Alsace. It is a pretty little place, well built, and consists of about 200 houses. E. Long. 7. 50. N. Lat. 47. 58.

ENT, SIR GEORGE, an eminent English physician, born at Sandwich in Kent in 1604. He was educated at Sidney college, Cambridge; and, afterwards travelling into foreign countries, received the degree of doctor of physic at Padua. After his return he obtained great practice, was made president of the college of physicians in London, and at length received the honour of knighthood from King Charles II. He was extremely intimate with Doctor Harvey; whose
be learnedly defended, in a piece entitled *Apologia pro Circulatione Sanguinis, contra Emiliium Parisiensem.* He also published, *Animadversiones in Malachiae Thrus-stoni,* and some observations in the Philosophical Transactions. Glanville, speaking of his *Plus Ultra* of the modern improvements in anatomy, numbers Sir George Ent, Doctor Goslin, and Doctor Wallis, with the most celebrated discoverers in that science. The two former were among the first members of the Royal Society. Sir George Ent died in October 1689.

**ENTABLATURE, or ENTABLEMENT,** in *Architecture,* is that part of an order of a column which is over the capital, and comprehends the architrave, frieze, and cornice. See **ARCHITECTURE,** chap. i.

**ENTABLED,** in the masonry, the fault of a horse whose crooked goes before his shoulders in working upon vats; which may be prevented by taking hold of the right rein, keeping your right leg near, and removing your left leg as far from the horse’s shoulder as possible.

This is always accompanied with another fault called *acuter.* See **ACULET**.

**ENTAIL,** in *Law,* signifies *fistail,* or *fes entailt,* that is, *abridged,* curtailed, or limited, to certain conditions. See **FISTAIL.**

**ENTE,** in *Heraldry,* a method of marshalling, more frequent abroad than with us, and signifying grafted or ingrafted.

We have indeed one instance of enté in the fourth grand quarter of his majesty’s royal ensign, whose blazon is Brunswick and Lunenburg impaled with ancient Saxony, *ente en point.*

**ENTEROCELE,** in *Surgery,* a tumor formed by a prolapse of the intestines through the rings of the abdomen and processes of the peritoneum, into the scrotum. See **SCROTUM.**

**ENTHUSIASM,** an ecstasy of the mind, whereby it is led to think and imagine things in a sublime, surprising, yet probable manner. This is the enthusiasm felt in poetry, oratory, music, painting, sculpture, &c.

**ENTHUSIASM,** in a religious sense, implies a transport of the mind, whereby it fancies itself inspired with some revelation, impels, &c. from heaven. Mr Locke gives the following description of enthusiasm. "In all ages, men in whom melancholy has mixed with devotion, or whose conceit of themselves has raised them into an opinion of a great familiarity with God, and a nearer admittance to his favour than is afforded to others, have often flattered themselves with a persuasion of an immediate intercourse with the Deity, and frequent communications from the Divine Spirit. Their minds being thus prepared, whatever groundless opinion comes to settle itself strongly upon their fancies, is an illumination from the Spirit of God. And whatsoever odd action they find in themselves a strong inclination to do, that impulse is concluded to be a call or direction from heaven, and must be obeyed. It is a commission from above, and they cannot err in executing it. This I take to be properly enthusiasm, which, though arising from the conceit of a warm and overwhelming brain, works, when it once gets footing, more powerfully on the passions and actions of men, than either reason or revelation, or both together; men being most forwardly obedient to the impulses they receive from themselves." Devotion, when it does not lie under the check of reason, is apt to degenerate into enthusiasm. When the mind finds itself inflamed with devotion, it is apt to think that it is not of its own kindling, but blown up with something divine within it. If the mind indulges this thought too far, and humours the growing passion, it at last sinks itself into imaginary raptures and ecstasies; and when once it fancies itself under the influence of a divine impulse, so wonder if it slights human ordinances, and refuses to comply with the established form of religion, as thinking itself directed by a much superior guide.

**ENTHUSIAST,** a person possessed with enthusiasm. See the preceding article.

**ENTHYMEME,** in *Logic* and *Rhetoric,* an argument consisting only of two propositions, an antecedent, and a consequent deduced from it. The word is Greek, *entheumeme,* formed of the verb *entheumen,* "to think, conceive," a compound of *in* and *theum,* "mind."

The enthymeme is the most simple and elegant of all arguments; being what a man, in arguing closely, commonly makes, without attesting at all to the enthyme. Thus, that verse remaining of Ovid’s tragedy, entitled *Medea,* contains an enthymeme; *Sciroc poni, perdere an posse regas:* "I was able to save you; consequently to have destroyed you." All the beauty would have been lost, had all the propositions been expressed; the mind is displeased with a rehearsal of what is nowise necessary.

Sometimes, also, the two propositions of an enthymeme are both included in a single proposition, which Aristotle calls an *enthyemematical sentence,* and gives this instance thereof: *Mortal, do not bear an immortal hatred.* The whole enthymeme would be, *Thou art mortal, let not, therefore, thy hatred be immortal.*

**ENTITY,** the same with *Ens.*

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**ENTOMOLOGY.**

**ENTOMOLOGY,** (from *entoma,* "an insect," and *logos,* "a discourse," is that part of zoology which treats of insects.

Many are disposed to reckon the study of Entomology trifling. Hunters of butterflies, and catchers of grasshoppers, are laughed at by the vulgar, and even by those who are more enlightened. The great numbers and diversity of insects, the beauty and configuration of some of them, and the singular instincts of others, cannot but attract notice, and excite astonishment in those who are fond of contemplating the works of nature, rendering thus the study of Entomology, to them, a source of much pleasure. A collection of the individuals which compose any of the more numerous genera, placed at the same time, before one capable of attending to the striking similarity of the whole, and tracing
the distinguishing peculiarities of each, cannot fail to create surprise. The great and almost boundless variety of their forms, the nice adaptation of their parts to the situation in which each happens to be placed, most appear truly wonderful. In every department of nature, which comes within the reach of the human mind, a pleasing and luxuriant variety is discernible. The same Supreme Intelligence, which, by varying the position of the planetary orbs with respect to the sun, and by other seemingly simple but beautiful contrivances, hath produced their different length of day and year, and alternation of seasons, is manifest in the formation of the minutest insect. Each has received that mechanism of body, those peculiar instincts, and is made to undergo those different changes, which fit it for its destined situation, and enable it to perform its proper functions. The utility of many insects, such as the bee, the crab, the silk-worm, the cecochine insect, &c. render them both interesting and important; and a more intimate acquaintance with the class, may enable us to add to the number of those that are useful to men, and to improvements in the management of those already known. The havoc many insects make in the vegetable kingdom, the vexation, harm, and destruction they occasion, among animals, should induce those who are engaged in agriculture, and in the rearing and management of animals, to pay attention to Entomology; for the better they are acquainted with their enemies, the abler they must be to attack them with advantage.

Many insects undergo three very distinct changes: which circumstance, joined to the very great difference of appearance which is often met with in the male and female, and even in the matters of some species, renders their number apparently greater than it really is, and adds considerably to the difficulty of reducing them to order.

Different naturalists have attempted to arrange them into families and genera, particularly the celebrated Linnæus, whose arrangement is followed here. He has formed them into seven families or orders, composing his sixth class of animals, Insecta. He defines an insect, a small animal, breathing through pores on its side, furnished with moveable antennæ and many feet, covered with either a hard crust, or a hairy skin. Before the distinguishing marks of the order and genera can be understood, it will be necessary to conceive and explain the terms he has given to the different parts, and the most remarkable of the epithets he has applied to them.

The body is divided into Head, Trunk, Abdomen, and Extremities.

1. CAPUT, the Head, which is distinguishable in most insects, is furnished with Eyes, Antennæ, and most frequently with a Mouth.

2. The Eyes, 2, 4, 6, or 8 in number, destitute of eye-lids, are either small and simple; or large, compound and hemispherical; or polyedral. They are commonly immovable. They are called stipitati when placed on a stalk.

3. The Antennæ are two articulated movable processes, placed on the head. They are either, 1. Simple, setaceous, 1. a. like a whisk, when they taper gradually from their base, or insertion into the head, to their point.

4. Simple, clavate, i. e. club-shaped, when they grow gradually thicker from their base to their point.

5. Filiform, filiform, i. e. thread-shaped, when they are of an equal thickness throughout the whole of their length.

6. Moniliform, moniliform, i. e. of the form of a necklace, when they are of an equal thickness throughout, but formed of a series of knobs, resembling a string of beads.

7. Capitata, capitata, i. e. with a head or knob, when they grow thicker towards the point, and terminate in a knob or head.

8. Fissile, fissile, i. e. cleft, when they are capitata, and have the head or knob divided longitudinally into three or four parts or laminae.

9. Perfoliata, perfoliata, when the head or knob is divided horizontally.

10. Posticata, posticata, i. e. resembling a comb, when they have a longitudinal series of hairs projecting from them, in form of a comb.

11. Barbata, barbed, when they have little projections or barbs placed on their sides. They are either, 1. Longiores, longer than the body; 2. Breviores, shorter than the body; or, 3. Mediores, of the same length with the body.

The Mouth, in most insects, is placed in the under part of the head; sometimes, however, it is situated in the thorax, and in a few instances, is entirely wanting. It is furnished with, 1. Palps, or feelers; 2. Rosae, i. e. beak or mouth; 3. Laciniae, or lips; 4. Mandibulae, or jaws, placed transversely, and moving laterally; 5. Dentis, or teeth; 6. Linguae, or tongues; 7. Palatina, or palate.

Palps, feelers, which are 4 or 6 in number, are attached to the mouth, and have 2, 3, or 4 articulations.

The Stigmata are three prominent shining points on the top of the head.

II. TRUNCUS, the Trunk, to which the legs are fastened, is situated between the head and the abdomen. It is divided into, 1. The Thorax, or chest, which is the superior part; 2. Sternum, i. e. small shield or escutcheon, which is the posterior part; 3. The Breast and Sternum, which is the inferior part.

III. The ABDOMEN, that part which contains the stomach, intestines, and other viscera, consists of several annual segments. It is perforated on the sides with spiracles, i. e. breathing holes. The upper part of it is termed Thymus, or back; the inferior part Venter, or belly; the posterior part Anus.

IV. ARTUS, the extremities, are, 1. the Wings; 2. Legs; 3. Tail.

1. ALÆ, the wings, are two, or four. They are either,

1. Plane, i. e. plain, such as cannot be folded up by the insect.

2. Plicate, or folding, such as can be folded up by the insect at pleasure.

3. Erectæ, erect, such as have their superior surfaces brought into contact, and stand upright when the insect is at rest.

4. Patente, spreading; such as are extended horizontally.

5. Incurvata, incurved; such as rest on the upper part of the abdomen.

6. Depressa, bent down; such as are partly incumbent,
Most insects undergo three changes. An insect is metamor-
at first hatched from a very small egg, and becomes a pha-
larva; a soft succulent animal, without wings, incap-
cable of producing its species, slow in its motions, some-
times without feet, but more frequently with them; con-
suming greedily the kind of food which is peculiar to
it, and which, in proper time, is changed into a
nymph. (Nympha, Chrysalis), is firmed and drier than
the larva, and is confined either by a naked membrane,
or enclosed in a follicle. It is common without a
mouth; sometimes it has feet, but more frequently
none.

1. Completa, complete in all their parts, and active;
as the aranea, scorpions, oniscus, &c.

2. Semicompleta, half complete, with only the resi-
duents of wings; as the gryllus, cicada, cime, libellula,
and ephemera.

3. Incompleta, incomplete, with immovable wings
and feet; as the apterus, formica, and tipula.

4. Oletus, covered, having the thorax and abdomen
enclosed in a skin, and that either naked, or enclosed
in a follicle differently composed.

5. Corneata, confined within a globe; as the musca,
caeca.

6. Porcata, ridged, when marked with elevated ridges.

7. Sulcata, furrowed.

8. Punctata, marked with dots.

9. Fastigiate, when formed like the roof of a house.

The Hemelytra, as it were half-elytra, partaking
partly of the nature of crustaceous shells, and memb-
ranaceous wings; being formed of an intermediate sub-
stance.

Halteres, or polines, are small orbicular bodies
placed on stalks, situated under the wings of insects of
the order Diptera.

II. FEDES, the Legs. They are divided into 1.
Femur, or thigh, that part which is joined to the trunk;
2. Tibia, or shank; 3. Tarsus, or foot; 4. Ungue,
bones or nails; 5. Manus, (chela), hands or claws,
simple, with a movable thumb, as in the crab.

The hind-legs are termed, 1. Curvatus, formed for
running; 2. Saluterii, formed for leaping; 3. Natatorii,
formed for swimming.

III. CAUDA, the Tail, which terminates the abdo-
men; is 1. Solidarius, i.e. single. 2. Bicornis, i.e. two-
horned or double. 3. Simplex, simple, i.e. unarmed.
4. Armatus, i.e. furnished, with Forcipes or Forceps;
2. with Furca, a fork; 3. with one or more Setae or
bristles; 4. with an Aculeus, or sting, either smooth or
barbed. A sting is a weapon, frequently hollow, with
which some insects are furnished, through which they
discharge a poison into the wound they inflict.

The sexes of insects are commonly two, male and
female. Neuters are to be met with among those insects
which live in swarms, such as ants, bees, &c.

LINNÆUS has divided the class of insects into seven
orders.

I. COLEOPTERA, (from &epis, "a sheath," and Classifica-
tion, "a wing"), are such insects as have four wings, one
the upper pair of which are elytra, or crustaceous
shells, which, when the animal is at rest, shut, and
form a straight suture down the back.

II. HEMIPTEERA, (from &epis, "half," and &epis, "a
wing"), containing such insects as have four wings,
the superior pair being half crustaceous, and incipient,
and a mouth or beak bent toward the breast.

III. LEPIDOPTERA, (from &epis, "a scale," and
&epis, "a wing"), containing such insects as have four
wings covered with minute imbricated scales, a hairy
body, and a mouth furnished with an invaginated spiral
tongue.

IV. NEUROPTERA, from &epis, "a nectar," and
&epis, "a wing," containing such insects as have
four naked wings, marked with veins crossing one an-
other like net-work; the tail unarmed.

V. HYMENOPTERA, from &epis, "a membrane," and
&epis, "a wing," containing such insects as have
four membranous wings, and a tail furnished with
a sting.

VI. DIPTERA, (from &epis, "two," and &epis, "a
wing"), such as have two wings and gooses.

VII. APTEERA, (from &epis, "without," and &epis,
"a wing"), such as have no wings or elytra in
either sex.

T a CHARACTERS
ENTOMOLOGY.

CHARACTERS OF INSECTS.

I. COLEOPTERA.

The insects belonging to this order are formed into four divisions. 1. Those that have the antenna clavata, and thickened towards their exterior side. 2. Those that have the antenna moniliform. 3. Those which have the antenna filiform. 4. Those which have the antenna setaceous.

A. Antennis clavatis, extrorum increasatis.

a. Clava lamellata.

2. Lucanus. Penicilli duo sub labio, palpi geri.

b. Clava perfoliata.

3. Derestes. Caput insexum sub thorase, vix marginato.

c. Clava solida.

15. Curculio. Rostrum elongatum corneum.

B. Antennis moniliformibus.

17. Atelus. Rostrum elongatum, incurvum.
27. Chrysolael. Corpus ovatum, immarginatum.

A. The Antennae clavatae, becoming thicker towards their exterior side.

a. The Clava or Club lamellata.

S. The shanks of the fore-legs dentate.
L. Two tufts under the lip, to which the feelers are attached.

b. The Club perforated.

D. The head bent under the thorax, which is scarcely margined.
M. The lip clavated and emarginated.
B. The lip stretched out, and bifid.
S. The thorax and elytra margined.
T. The two anterior feelers hatchet-shaped.
H. The jaw bifid.

c. The Club solid.

H. The head capable of being drawn back within the thorax.
P. The antenna consisting of two articulations. The club hooked.
B. The head bent under the thorax, which is slightly margined.
A. The jaw bifid.
N. The thorax and elytra margined.
C. The anterior feelers hatchet-shaped; the posterior filiform.
C. The beak lengthened and horny.

B. With the Antennae moniliformae.

B. The beak elongated, horny and straight.

A. The beak elongated and crooked.
E. The lip horny and emarginated.
S. The elytra half the length of the body, covering the wings. Two vesicles above the tail, which can be pushed out at pleasure.
S. The lip truncated, and entire.
Z. The lip elongated and membranaceous.
M. The thorax roundish. The head gibbous, and bent inwards.
T. The thorax margined. The head stretched out. The body oblong.
C. The body oblong. The elytra margined. The head covered with a shield.
O. The thorax and elytra margined.
M. Lamine at the base of the abdomen. Head inflected.
C. The body oval, immarginated.
ENTOMOLOGY.

C. Antennis siliiformis.

30. MANTICORA. Maxillae exsertae, dentate. Oculi prominuli.
32. CYRINUS. Antennis rigidulus. Oculi quatuor.
33. CUCUUS. Labium breve, bifidum, laciniae distantibus.
34. CRYPTOCEPHALUS. Corpus ovatum immarginatum.
35. BRUCHUS. Antennis extrorsum erasiores.
37. HISPUS. Antennis porrectae, approximatae, fusiformes.
38. BUPRESTIS. Caput dimidium, intra thoracem retractum.
39. NECYDALIS. Elytra dimidiate, alis nudis.
40. LAMPTYRIS. Elytra flexilia. Thoracis clypeus caput obumbrans receptisquesque.
41. CANTHARIS. Elytra flexilia. Abdomen lateribus plicato-papillosum.
42. NOTOXUS. Labium bifidum; laciniae consicientibus obtinis.
43. ELATER. Pectoris maiorum et parum abdominis resiliens.
44. CALOPUS. Thorax ad latera macronato-callosus.
45. AURUS. Maxilla fornicate.
46. CARABUS. Thorax obcordatus, posterius truncatus.
47. LYTTA. Thorax subrotundus. Caput gibbum, inflexum.

D. Antennis setosi.

48. SEKROPALUS. Palpi antiores profundè serratis.
49. CERAMBYX. Thorax ad latera mucronato-callosus.
50. LEPTURA. Elytra apice attenuata. Thorax teretesculus.
51. RHINOMACER. Antennis rostro insidentes.
52. ZONITIS. Labium emarginatum.
53. CICINDELIA. Maxille exsertae, dentatae. Oculi prominuli.
54. DYTISCUS. Pedes posteriores ciliati, natatorii.

II. HEMIPTERA.

58. MANTIS. Os maxillaeum. Pedes antiores serrati, singue unico.
59. CRILLUS. Os maxillaeum. Pedes posteriores salterii.
ENTOMOLOGY.

68. Coccius. Rostrum pectorale. Abdomen (maturum) posterior setosum.
69. Thrips. Rostrum esculentum. Also incum bentes, abdomen reflexile.

III. LEPIDOPTERA.

70. Papilio. Antenna extrorumm crassiores. Also erectae.
71. Sphinx. Antenna medio crassiores.

IV. NEUROPTERA.

73. Libellula. Cauda forcipata. Os multi maxillolosum. Also extensus.
75. Myrmeleon. Cauda forcipata. Os bidentatum. Also depressae.
76. Phryganea. Cauda simplex. Os odontolosum. Also depressae.
77. Hemerobius. Cauda simplex. Os bidentatum. Also depressae.
78. Panorpae. Cauda chelata. Os rostratum. Also incum bentes.

V. HYMENOPTERA.

80. Cynips. Aculeus spiralis!
82. Sirex. Aculeus serratus, sub abdominis spinis terminalibus.
83. Ichneumon. Aculeus egressus! triplex.
84. Stigmatom. Aculeus punctarius. Also planeus. Lingua inflexa, triida.
86. Thynnus. Lingua brevissima, involuta. Labium triudum.
88. Tithia. Labium breve, cuneatum, tridentatum.
89. Chalcis. Antenna brevissima, cylindrica, fusiformia.

N. Snout inflected. Hind-legs formed for leaping.
C. Snout inflected. Hind-legs fringed, and formed for swimming.
N. Snout inflected. Fore-legs furnished with claws.
C. Snout inflected. Legs formed for running. Antennae longer than the thorax.
M. Snout inflected. Antennae very short.
A. Snout inflected. Abdomen 2-horned.
C. Snout placed in the breast. Hind-legs formed for leaping.
C. Snout placed in the breast. Abdomen (in the males) terminating in bristles.
T. Snout obsolete. Wings incumbent. The abdomen capable of being turned up.

III. LEPIDOPTERA.

P. Antenna thicker towards the joint. Wings erect.
S. Antenna thicker in the middle.
P. Antenna thicker towards the base.

IV. NEUROPTERA.

L. Tail forked. Mouth with many jaws. Wings expanded.
E. Tail with 2 and 3 bristles. Mouth without teeth. Wings erect.
M. Tail forked. Mouth with two teeth. Wings deflected.
P. Tail simple. Mouth without teeth. Wings deflected.
H. Tail simple. Mouth with two teeth. Wings deflected.
P. Tail furnished with a claw. Mouth stretched out into a beak. Wings incumbent.
R. Tail ending in a simple thread. Mouth with two teeth. Wings deflected.

V. HYMENOPTERA.

C. Sting spiral.
T. Sting serrated, two-valved.
S. Sting serrated, under a spine which terminates the abdomen.
I. Sting stretched out, triple.
S. Sting pungent. Wings smooth. Tongue inflicted, and divided into three at the extremity.
S. Tongue inflicted, triised. Lip membranaceus at the extremity.
T. Tongue very short, involuted. Lip triised.

L. Lip longer than the jaw, notched. Antennae clavate.
T. Lip short, beavy, with three small divisions.
C. Antennae short, cylindrical, spindle-shaped.
C. Sting pungent. Abdomen arched beneath.
ENTOMOLOGY.

91. VEXPA. Aculeus punctatorius. Also superiores duplicatae!

92. AFIS. Aculeus punctatorius. Linguæ inflexa!

93. FORMICA. Aculeus obsolete. Also neutris nullæ!

94. MUTILL. Aculeus punctatorius. Also neutris nullæ.

VI. DIPTERA.

A. Proboscide et Haustello.

95. DIOPSIS. Caput bicornis. Oculis terminalisibus.

96. TYPHULA. Haustellum sine vagina. Palpi 2, posterior, filiformes.

97. MUSCA. Haustellum sine vagina, setis instruementum.

98. TARRANUS. Haustellum vagina univalvis, setis instructum.

99. EMPIR. Proboscis inflexa.

100. CONOPS. Proboscis prorsa, geniculata.

B. Haustello sine Proboscide.

101. OESTRUS. Haustellum retractum intra labia, connata poro perutae.

102. ASILUS. Haustellum rectum bivalve, basi gibboso.

103. STOMYX. Haustellum vagina univalve convoluta, basi geniculata.

104. CULEX. Vagina exserta, univalvis, flexilis, setis 5.

105. BOMBYLUS. Haustellum longissimum, rectum, setaceum, bivalve.

106. HIPPOBOSCA. Haustellum breve, cylindriceum, rectum, bivalve.

VII. APERTA.

A. Pedibus sex, Capiteque Thoraquo discretis.

107. LEPISMA. Cauda setis exsertis.

108. PODURA. Cauda bifurca, inflexa, saltatrix.

109. TEREM. Os maxillae doabrum. Labium corneum, quadrifidum.

110. PEDICulus. Os aculeo exserendo.

111. PULEX. Os rostro inflexo, cum aculeo. Pedes saltatorii.


117. CANCER. Oculi 2. Pedes 10, primo cheilati.

VI. DIPTERA.

A. With Proboscis and Sucker.

D. Head two-horned. Eyes terminal.

T. Sucker without a sheath. Feelers 2, projecting, filiform.

M. Sucker without a sheath, furnished with bristles.

T. Sucker with a single-valved sheath, furnished with bristles.

E. Proboscis inflected.

C. Proboscis projecting, and bent with an angular flexure.

B. With Sucker, but no Proboscis.

O. Sucker drawn back within the lips, which are perforated.

A. Sucker straight, with two valves, turgid at the base.

S. Sucker with a single-valved convoluted sheath, bent at the base, with an angular flexure.

C. Sheath stretched out, of one flexible valve, with 5 bristles.

B. Sucker very long, straight, setaceous, with two valves.

H. Sucker short, cylindrical, straight, with two valves.

VII. APERTA.

A. Legs 6. Head distinct from the Thorax.

L. Tail ending in setaceous bristles.

P. Tail forked, inflected, elastic.

T. Mouth with two jaws. Lip horny, cleft into four pieces.

P. Mouth armed with a sting capable of being pushed out at pleasure.

P. Snout inflected, armed with a sting. Feet formed for leaping.


H. Eyes 2—8. Legs 8. Abdomen furnished with papillae, with which the animal spins thread and weaves itself a web.

A. Eyes 2. Legs 8. Abdomen furnished with papillae, with which the animal spins thread and weaves itself a web.


C. Eyes 2. Legs 10, the first pair furnished with claws.

118.
ENTOMOLOGY.

C. Pedipes pluribus. Capite à Thorace discretum.
120. Scolecopendra. Corpus lineare.
121. Julius. Corpus subcylindricum.

N. B.—In the following classification, some of the more remarkable species only are enumerated. Those marked with an asterisk are natives of Britain.

I. COLEOPTERA.

Elatera covering the wings.

1. SCARABÆUS, Beetle.

Antennæ elavated, the club lamellated. Feelers 4. Jaws horns, for the most part without teeth. The shanks of the fore-legs generally dentated.

The larvae of the genus scarabæus have six feet, and a body composed of angular segments, furnished with hairs, and with vesicles at the end of the abdomen. Their heads are hard, formed of a substance like horn. They are commonly called grubs, and do much mischief, both in the fields and in the garden. They live chiefly under ground, or in dung, on which they frequently feed. The larvae of the species cotonis live on rotten wood, and those of the melolontha on the roots of plants. The papa remains under ground.—Grubs are devoured by many kinds of birds, particularly by the rooks, which, on that account, ought not to be destroyed, so eagerly as they are in many places; for, though they do much mischief themselves, in spring, and during harvest, yet it is amply compensated by the good they do through the year, in clearing the ground of grubs.

* Feelers filiform.
† Jaw arched.
a. Without teeth.
x. Thorax horned.
a. Scutellati.

herculæ. A horn on the thorax, large, and bent inwards, barbed below with one tooth; a horn on the head bent back, dentated on the upper side with many teeth. Syst. Nat. Lin. 1. It is a native of America, and varies in colour, being sometimes black, sometimes azure spotted with black. The female is without horns.

* centau-...

The horn on the thorax bent inwards, with two teeth at its base, and bifid at the point; the horn on the head bent back, furnished with one tooth. 92.

choriæus. The horn on the breast bent inwards and very thick at the base, bifid at the point; the horn on the head bent back, very long, bifid. Native of Brazil. 96.

* tylæus Bull-comber. With three horns on the thorax, the middle ones smaller than the rest, lateral ones projecting as far as the head does, which is without horns. It is a native of Europe; to be met with under cow-dung. It makes its nest in holes, which it digs deep into the ground. It is black. Head depressed, hairy at the sides, narrow. Knob of the antennæ grayish. Thorax smooth. The horns sometimes as long as the head, and sometimes twice as long; in the female hardly visible. Elytra striated. Shanks hairy. 9.

Thorax with four projections like teeth. The horn* mobile of the head bent back, and moveable. 116. Native corvus of England and Germany. Black. Elytra striated. Female without horns on the head, or projections on the breast.

Thorax with two horns; horn of the head octonius, notched with one tooth, bifid at the end; elytra smooth. 3. Native of South America. The largest of all known insects, except crabs and monoculi. Elytra black, or azure spotted with black.

u. Thorax horned.
b. Without Scutellum.

Thorax with six spines; jaws prominent; front slop-violaceus, ing; body entirely of a violet colour. 117. Native of Siberia; found under stones; small. Elytra marked with deeply excavated spots.

Horn of the thorax flat, marked with one tooth on oedipus the under side; the horn of the head terminating abruptly, with three teeth. 119. Native of the Cape of Good Hope. Middle-sized.

Thorax with three horns, the middle one obtuse, and* lamæris, bifid; horn of the head erect; shield emarginated. 10. Native of Europe; on dunghills. The female always without horns on the breast.

Thorax marked with four projections like teeth; po-camelis, anterius part of the shield slightly marked with two horns; body black. 134. Native of Germany. The female with nearly the same marks as the male.

b. Thorax unarmed; Head horned.
a. Furnished with a Scutellum.

Thorax prominent, divided into two lobes; horn of bilobus; the head simple; elytra striated. 12. Native of the south of Europe. Black.

A triple prominence on the breast; horn on the head macilormis, bent back; elytra smooth. 15. Native of Europe; met with in dunghills. Its larva gray, with a reddish head, feet, and spiracles or breathing holes. Swammerdam has supposed it to be the cause of the ancients. Vid. Plin. 17. 24. Thorax of the female roundish.

b. Without Scutellum.

Thorax prominent, formed of two lobes; horn on the jœchus, head bent back, and simple. 156. Native of the Cape of Good Hope. The horn on the head of the female very short, and terminating abruptly.

Thorax flat, angularly rough; the horn on the head carnefex, bent
Coleoptera.

ENTOMOLOGY.

22. Native of America. During the whole summer they may be seen in great numbers, rolling about balls which they form out of dung. They mutually assist one another to roll them into holes made for their reception, like the _pilularis_. Their bodies are broad, and depressed; the horn on their heads is placed backwards. It is black, and smooth. In the female it is effaced.

Both Thorax and Head without horns.

a. Furnished with a Scutellum.

* funesta-*

** Dunghill-beetle.** Body black; head marked with tubercles, commonly three in number; the elytra reddish. 32. Native of Europe; frequently to be met with in dung.

* stercorarius.

** Clock-beetle.** Body black, smooth; the elytra furrowed; the head of a rhomboidal figure; fore-head prominent. 42. Native of Europe; to be met with in dung; much infested with some species of the _accrus_ and _ichneumon_, and, on that account, frequently called _lousy beetle_. It flies about in the evening with a loud noise, and is said to foretell a fine day. It was consecrated by the Egyptians to the sun. It is sometimes of a greenish blue colour. It is likewise sometimes yellowish below, with dusky-red elytra. This is the _shard-borne beetle_ of Shakespeare. The female digs a hole, and kneads a lump of fresh dung, generally of a cylindrical shape, on which she deposits one egg, and then covers it with more dung, attaching it to the root of some grass. In a few days the larva breaks the egg, and feeds on the fresh dung. During the autumn it changes its skin four times.

b. Without Scutellum.

* squamiger.*

The shield of the head marked with six denticulations; the thorax notched; the shanks of the hind-legs fringed; top of the head marked with two slight projections. 18. Native of the southern parts of the old continent. It is frequent in dry situations in the southern parts of Russia, where it rolls about cylinders formed of cow-dung. Its figure is carved by the Egyptians on the ancient pillars at Rome.

*pilularis.*

Black, opaque, smooth, yellow underneath; the thorax rounded behind. 40. Native of the south of Europe; of the same size with the lousy beetle. In pairs, they daily roll, like _Myphus_, a ball made of excrement, seven times the bulk of their own body.

* schaefferi.*

The thorax round; the shield emarginated; the elytra triangular; the thighs of the hind-legs elongated and dentated. 41. Native of Italy, Germany, and Siberia; to be met with on the sunny hills, where it rolls and borries balls made of cow-dung. It is black.

*fusor.*

Thorax retuse; head marked with three tubercles, the middle one faintly resembling a horn. 31. A native of Europe, in sandy places, and in dung hills.

b. Juvo arched, furnished with some teeth; the point of the Abdomen naked, and obliquely truncated. Melolontha.

* foli.*

Of a brick colour, and spotted with white. The scutellum with two notches; the antennae divided into seven leaves. 57. It inhabits sandy situations in Europe and Barbary, living on the oak, _elmus armenus_, and _arundo armenia_. It is hairy below; the hooks at the ends of their legs are furnished, at their base, with Vol. VIII. Part I.

† crooked branch. It is the largest coleopterous insect to be met with in Britain, except the stag-beetle. It is but rare in England.

The head and thorax beset with bluish hair; the elytra _fruticola_.

256. Native of Germany; on the ears of rye.

The head and thorax beset with bluish hairs; the elytra _horticola_.

39. Native of Europe; to be found in gardens, where its grub proves very destructive to cabbages, &c. and the beetle to the fruit-trees.

The thorax hairy; the elytra of a livid colour, with _agricola_.

240. Native of Europe, on grass-fields. The head and thorax covered with bluish hairs; the _abdominellus reddish_; the abdomen white and hairy. 240. _natisa_.

Native of Europe; resembles the garden-beetle very much, and is very destructive.

Of a shining copper colour; the shield emarginated. 241. Native of Africa, near the equator.

Green; the sides of the thorax yellow. 249. _vittis_.

Native both of Europe and America; on the vine; very like the _frischii_, differing only from it by the elytra, which are of a brick colour.

Blackish yellow; the elytra of a brick colour. 250. _frischii_.

Is a native of Germany; on the vine, and the rose.

The elytra, sometimes, are of the same colour with the thorax.

Above smooth, and of a golden colour; the scutellum, and a line on the back of the thorax, of a blood-colour. 253. A native of New Zealand.

Door-beetle, May-bug, Cockchafer. Furnished with _melolona_.

45. Without horns; light brown; the thorax hairy; the tail bent inwards; a triangular white spot at each incisure of the abdomen. 60. It inhabits the northern parts of Europe; flies about in the evening, and feeds on the leaves of trees. It is the most destructive of all the European insects. When it happens to be more plentiful than usual, in the autumn, the vulgar entertain an opinion, that some epidemic diseases are to follow. The male is distinguished by a sharp indented tail. The grub is gray, with reddish brown head and feet. Eats the roots of plants, particularly of corn, frequently laying waste a great tract of country. They remain six years under ground, before they become beetles. Their thorax varies yearly in colour, from brown to black.

It is furnished with a scutellum, and is without horns; _solstitialis_.

The thorax is hairy; the elytra are of a pale yellow colour, marked with three white parallel lines. 61. Is a native of Europe, to be met with among trees. The claws at the end of the legs, have one little projection, like a tooth, at their base. They make their appearance somewhat later than the May-bug, and are very frequent about the summer solstice.

Body of a brick colour, and woolly below; shield vittus, margined, and bent back; scutellum white. 263. Native of Europe; of the same size with the cockchafer.

†† Jaw straight.


Furnished with a scutellum; without horns; _sterneus chrysis_.

49. Native of South America, Of the same size and colour with the golden beetle.

U Furnished
E N T O M O L O G Y.

Coleoptera.

3. DERMESTES, Leather-Eater.
Antennae clavated; club perforated; three articulations thicker than the rest. Thorax convex, slightly margined. Head bent and concealed under the breast.
The larvae, or grubs, of this tribe, devour dead bodies, skins, leather, and almost any animal substance; and are exceedingly destructive to books and furniture.

* Jaws bifid.
Black; the fore part of the elytra of an ashy colour. *lardarius.*
1. It is a native of Europe. Sometimes, though rarely, the anterior part of the elytra is of a rusty colour.
This insect is the common pest of museums, libraries, and preparations of natural history. It is also found in old bacon, whence it has received its name. When it is eating, it protrudes balls of excrement from its anus, which hang down in a string. The larva is oval and hairy.
Black; the elytra livid at the base, and marked with elongatus.
A band of the same colour, at the posterior part; the antennae and feet of a rusty colour. 2. Native of Europe; to be met with in old wood; almost filiform.
Oblong; black; the elytra marked with two white spots. *pelle.*
It is a native of Europe. Feeds on putrid animal substances.
Black; the elytra marked with two white spots. *pelle.*
It is a native of Europe. Feeds on skins, bacon, and old books. Its larva is oblong, hairy, and furnished with a bristly tail.
Oblong, of a rusty colour; with red eyes. *paniceus.*
Native of Europe. In bread that has been long kept; in bookbinders' glue; in books, &c. About the size of a millet seed. The larva is oblong, white and shining.

** Jaws furnished with one tooth. Apate.

The elytra reticulated, blunted behind and notched; muricatus.
Thorax prickly and turgid. 6. It is a native of South America; in wood, and sugar cane.
Of a dusky colour; the head drawn back; the an-rufescens.
Tenebricorne and feet reddish. 70. It is a native of Europe, and very small.

50 species of this genus have been described in the last edition of the System of Nature.

4. BOSTRICHUS.
Antennae clavated; the club solid. Thorax convex, and scarcely margined. Head inflected and concealed under the thorax.
Black; the elytra and abdomen red; the thorax capucius.
Flat. 1. It is a native of Europe, and of Siberia. It is to be found in trunks of trees, particularly dead ones, and in houses.
Of a brick colour; hairy; the elytra striated, blunted. *typogriseus.*
4. It is a native of Europe and Ameri-phus.
Ca; to be met with under the bark of trees. It is particularly hurtful to the pine tree; very prolific, and very voracious; devouring the bark from which other smaller ones proceed, in a parallel direction. They are very tenacious of life; and according to age and size, vary in colour, from a yellow to a brown, and from that to black.

Black; the elytra red, and notched. 5. It is a na-chalcogrease.

20 species of this genus have been described in the last edition of the System of Nature.
Entomology.

Cocleoptera. - tive of Europe; to be found under the bark of trees. It sometimes varies in colour.

1. Polygraphus. Blackish; the elytra are sometimes blunted, and of an azure colour. 6. It is a native of Europe. It forms winding canals under the bark of trees, and is one of the most destructive of this genus.

1. Micrographus. Of a rusty colour; the elytra entire, and of a brick colour. 7. It is a native of Europe; in wood, also within the bark of trees: small, black; the elytra, antennae, and legs, of a brick colour.

1. Piniperis. Black, and somewhat hairy: the elytra entire and black; the feet reddish. 13. It is a native of Europe; on the under branches of pine-trees, which it perforates, dries up, and destroys. It sometimes varies in the colour of the elytra.

22 species of this genus have been described in the last edition of the System of Nature.

5. Melitris.

Lip clavated, and emarginated. Antenne perforated throughout their whole length. Jaw with one tooth, and pointed.

1. Viridis. Green; the elytra marked with three elevated lines. 1. Native of the Cape of Good Hope.

2. Nigra. Black; the elytra marked with three elevated lines. About the third part of the size of the preceding species.

6. Pinus.

Antenne filiform; the articulations towards the points larger than the rest. Thorax roundish, not margined, receiving the head.

1. Feathers clavated. Anobia.

1. Nigro. Brown; thorax unequal; elytra striated. 1. It is a native of Europe; without spots, and double the size of the subsequent species.

1. Pertinax. All over brown. 2. It is a native of Europe; is very destructive to wooden furniture, particularly to articles made of oak; likewise to books, &c. When caught, it contracts itself and counterfeits death. It can be put in motion again, neither by pricking, nor any other means, except by the application of a strong heat. It is destroyed by the attelasformicarius.

1. Molli. Of a brick colour, with dark-coloured eyes. 3. It is a native of Europe, among rubbish; an unwelcome visitor in collections of plants, and to be got rid of effectually, in no other way but by the heat of an oven. The larva is white, and is capable of enduring a great degree of cold.

1. Pulsatior. Death-watch. Cylindrical, opaque, and much wrinkled, sprinkled with grey spots. 13. It is a native of Europe. It is common in trunks of old trees, particularly of the willow, and in houses. It beats, especially in the night-time, making a noise, resembling that produced by one's nail struck against a table. This is done by seven, nine, or even eleven distinct strokes, and has been considered by the vulgar, as foreboding some fatal occurrence to the family occupying the house in which the noise is heard. But it is nothing more than the call of one sex to the other.


Feathers filiform, bifid. Pinus.

Light brown, and almost without wings; the thorax fur marked with four projections like teeth; the elytra marked with two white bands. 5. It is a native of Europe, and is exceedingly destructive to seeds, museums, books, furniture, preserved subjects of natural history, and even to the leaves of tobacco. It delights in cold and moisture; and is best kept off by heat and dryness, by arsenic or alum. It is most effectually destroyed by corrosive sublimate. The female is without wings. The larva has six feet, and is soft, thick, and hairy. The pupa is enclosed in a glutinous spherical covering.

Brown; the thorax somewhat crenated; the elytra imperfectly marked with a white blotch, divided into lobes. 4. It is a native of the north of Europe; to be found in trees. It is about the size of a grain of wheat: the antennae are of the same length with the body; the legs are of a rusty colour; the scutellum white; the elytra marked with a white spot, resembling the eagle worn on the imperial standard; from whence it has received its name.

The thorax black, and smooth; the elytra connect ed, shining, brown. 22. It is a native of Europe; on the birch.

32 species of this genus have been described in the last edition of the System of Nature.


Antenne clavated. Club solid, the lower joint compressed, and bent down. Head capable of being drawn back into the body. Mouth furnished with pincers. Elytra shorter than the body. Shanks of the fore-legs notched.

Very large. 1. It is a native of India, similar to maximus. the unicolor, but ten times larger. The corners of the thorax rounded; point of the breast extended, not quite up to the mouth.

Black; the elytra obliquely striated. 3. It is a native of Europe and America; in sand, and in dung.

Black; the posterior part of the elytra red. 5. Na. bimaculatus. In cow dung.

17 species of this genus have been described in the last edition of the System of Nature.

8. Gyrrhus, Whirler, or Water-fly.

Antenne cylindrical. Jaw very sharp, and horny.

Eyes four; two above, and two below.

These little animals are found on the surface of water, on which they run very nimbly, and describe circles. When attempted to be taken, they dive down, drawing after them a bubble, resembling a globe of quicksilver.

Black; faintly striated. 1. Native of Europe; in natator. lakes and ponds.

Black above; below, of a rusty colour; hind legs bicolour, compressed. 3. Native of Europe; frequents waters; is larger than the natator.

Nine species of this genus have been described in the last edition of the System of Nature.

U 2

9. **BYRRHUS**


**gigas.** Black; the elytra of a rusty colour, and marked with points. 1. Native of Europe. The anus of the female furnished with a sting.

**pilula.** Brown; the elytra marked with black grooves. 4. Native of Europe; in sandy places. It is sometimes, though rarely, black.

**vittatus.** Black; thorax of a bright yellow; elytra brown, and marked with three short green grooves, spotted with black. 5. Native of Britain.

Nine species of this genus have been described in the last edition of the System of Nature.

10. **ANTHENUS.**


**pimpinel-la.** Black; elytra marked with a white band, and of a rusty colour towards their points, with a white stain. 4. Native of Europe; feeds on the flowers of the *pimpinella.*

**scrophularia.** Black; elytra spotted with white; nature of a blood-red colour. 1. Native of Europe; on the *scrophularia.*

**muscum.** Clouded; elytra slightly clouded. 2. Found in museums, destroying animals preserved in them, and books.

**verbacri.** Black; elytra marked with three waved bands. 3. Native of Europe; on the *verbacrum.*

Seven species of this genus have been described in the last edition of the System of Nature.

11. **SYLPHA, Corrin-Beetle.**


These are chiefly found under the loose bark of trees, or on the half-decayed carcases of animals, upon which both the grub and the insect feed.

**germanica.** Oblong, black; shield roundish, unequal, and margined; elytra very obtuse, with a rusty-coloured lateral margin. 1. Native of Germany. There are many varieties of this species. They deposit their eggs in the carcases of other insects, which they bury under ground.

**vespillo.** Oblong, black; shield almost spherical and unequal; elytra marked with a double rusty-coloured band. 2. Native both of Europe and America. There are many varieties of this species. In America, some of them are ten times larger than those in Europe. They frequently have the smell of musk, and fly very quickly, with their elytra erect, and applied close together. They are much infested by the *acorus,* and deposit their eggs in the carcases of other insects, which they bury.

**quadripustulata.** Black, oblong; elytra marked with two rusty spots. 5. Native of Europe and America, in decayed wood; very smooth; the larva oblong, gray and hairy.

**quadrimaculata.** Red; thorax and elytra black; the latter marked with two red spots. 27. Native of Europe.

**rustlens.** Oblong, smooth, black; the front, the legs, and two spots on the elytra, of a rusty colour. 41. Native of England. Antennae black; club reddish; thorax smooth, without spots; elytra smooth.

Blackish; elytra wrinkled, and marked with three *rugosa.* Elevated lines; thorax wrinkled and scoloped behind. 16. Native of Europe and Asia. It consumes dead-bodies, either flesh or fish. When caught, it vomits a very fetid fluid.

94 species of this genus are described by Gmelin, in the last edition of the System of Nature.

12. **NITIDULA.**


**Lip square.** Elophori.

Brown; thorax wrinkled, which, together with the *aquatica.* Elytra, are of a brownish yellow. 1. A native of Europe, in stagnant waters; very small, and frequently to be found among the *converv.*

Brown; thorax wrinkled, and of the colour of brass; *minuta.* Elytra pale. 4. To be found in England, in stagnant waters; very similar to the *aquatica,* but only the third part of its size.

**Lip cylindrical.**

Oval, black; elytra marked with a red dot. 5. *bipustulata.* It is a native of Europe, and feeds on animal sub-lata. stances.

Black; elytra of a dusky colour at the point. 16. *discoides.* Native of England.

30 species of this genus have been described in the last edition of the System of Nature.

13. **OPATRUM.**

Antennae moniliform, thicker towards the outside. Elytra margined. Head prominent. Thorax somewhat flat, and margined.

Of an ash-colour; thorax flat, and margined; *griestum.* Elytra marked with three elevated lines, and dentated behind. 1. Native of Italy, larger than the *subulatum.*

Brown; thorax emarginated; elytra marked with *subulata.* three elevated lines, and dentated. 2. Native of Europe; and North America, in sandy plains.

Brown; thorax and elytra hairy. 16. Native of *monilium.* Europe; not quite half an inch in length.

Of a light brown colour; eyes, thorax, elytra, and *testaceum.* antennae dark brown. The base and tips of the latter are reddish; the elytra marked at the base with a large brick-coloured spot, resembling a crescent; the thorax impressed with two dots.

22 species of this genus have been described in the last edition of the System of Nature.

14. **TRITOMA.**

Antennae clavated. Club perfoliated; Feelers, anterior pair hatchet-shaped.

Black; the elytra marked with a lateral scarlet line. *bipustulata.* Native of England; to be met with in those species *tartum.* of *boletus* which grow on trees.

Smooth,
ENTOMOLOGY.

Elytra red, marked with seven black dots. 15. Na.\* septem\-native of Europe. The dots on the elytra are placed in punctata, the form of a triangle. This insect, as well as some others of the coleoptera, is said to possess the property of giving immediate and effectual relief in the most violent paroxysms of the toothache, by rubbing them between the finger and thumb, and applying the finger to the affected tooth.

* Lady-edo. Elytra red, marked with six black spots;\* semina\-the four anterior ones transverse and arched. 68. Itculata, is a native of India. Head whitish; thorax white be\-

* The elytra yellow; with 12 black dots and a black variegata, band in the middle. 86. It is a native of the Cape of Good Hope; of a middle size.

* The elytra tawny, with a great number of black centen\-dotes, many of them running together. 118. It is a na-punctata, native of India, about three quarters of an inch long.

* * * The elytra red or yellow, marked with white.

* The elytra red; marked with 14 white, and three punctato\-black dots. 32. A native of Europe; differing per-guttata, hap; only in sex, from the descemrustulata.

* The elytra yellow, marked with 15 white spots; the quindecem\-middle one, common to both elytra, almost effaced, guttata. 127. A native of Europe.

* Elytra yellow; marked with 16 white spots. 35. sedecem\-guttata.

* * * * * Elytra black, marked with red.

* Elytra black, without dots, but marked with red at anali\-the points. 130. It is a native of Europe, very like the hemorrhoidea, but only half its size.

* Elytra black, their points red, marked with a black hemor\-band. 130. It is a native of Germany. It is fre-hemor\-quently marked on the back with a red dot common to both elytra.

* Elytra black, marked with two red spots. 41. It is cae\-cata a native of America, on the cactus; and is frequently gathered along with the cochineal insect. It is very similar to the bipustulata, which is common in Europe.

* Elytra black, marked with two red spots; abdomen\* bipustu\-of a blood-red colour. 42. It is a native of Europe, lata, common in gardens. Each of the spots on the elytra is composed of three spots uniting into one.

* * * * * Elytra black, spotted with white or yellow.

* Elytra black, marked with eight yellow dots. 48. panthe\-rino. Native of the north of Europe.

* Elytra black, marked with eight yellow dots, the two humeral\-anterior ones hooked. 146. A native of Europe.

163 species of this genus have been described by Gnelin.

17. ALUMNUS, Rose-beetle.


Black; thorax scarlet; elytra yellow. 1. It is a gressu\-native of America and India. Antenne black, half as long as the body; thorax a little rough, painted on each side at the base; the hind margin black; scutellum rounded; black; elytra larger and longer than the body.

Yellowish.
**ENTOMOLOGY.**

*Culeoptera.*

*febraturus.* Yellowish-green, with a metallic lustre; the thighs and shanks of the hind-legs dentated. 2. It is a native of India. It is large, smooth, and shining; the antennae are half as long as the body; the extreme articulations are black.

*dentipes.* Black; the thighs and shanks of the hind-legs dentated. 3. Native of the Cape of Good Hope. It is smooth, without spots, and very similar to the *febraturus.*

There have been only three species of this genus described.

18. **CHROMOSCELA.**

Antennae moniliform. Feelers six, growing thicker towards their exterior sides. Thorax margined; elytra not margined. Body (in most of the species) oval.

This numerous and beautiful tribe is found everywhere, in woods and gardens. Their motion is slow, and some of them when caught, emit an oily fluid of a disagreeable smell. The larvae of this and the next family feed on the leaves of trees and plants, the fibres and cuticle of which they leave, contenting themselves with the pulp.

*Thighs of the Hind-legs equal.*

2. *tenebrioides.* Without wings, black; antennae and legs of a violet colour. 1. It is a native of the south of Europe. The larva has a bunch on its back, of a violet colour, with a red anus; it feeds on a variety of vegetables.

3. *gottengenesis.* Black; the legs of a violet colour. 4. It is a native of Europe; very rare in England.

4. *vittata.* The elytra blue, with a yellow edge, and marked with a yellow stripe in the middle. 5. It is a native of America; very large.

5. *luzitanica.* Thorax of a copper colour; elytra resembling brass; impressed with bluish dots, of a violet colour underneath. 74. Native of Portugal.


7. *hamorrhoidalis.* Black, shining; antennae yellow at the base; anus red above. 6. Native of Europe, on the birch and alder. The elytra are marked with regular lines of dots.

8. *graminiae.* Greenish-blue, very shining; the antennae and legs of the same colour. 7. Native of Europe, on different plants, especially on grass.

9. *anea.* Green, shining; the extremity of the abdomen reddish. 8. Native of Europe; on the alder.

10. *hamoptera.* Of a violet colour; feet and wings red. 11. Native of Europe.

11. *centaurus.* Of a bright copper colour; beneath green and gold; the legs of a bright copper colour. 102. Native of Europe, on the *centaureus.* It exhibits some variety, especially in size.

12. *melanostoma.* Oblong, black; head red, the mouth and a spot on the back part of the head black; the thorax red, with a black spot on each side; the elytra red, with a black suture. 254. Native of Europe.

13. *polita.* Thorax gilts; elytra reddish. 27. Native of Europe; to be met with on the poplar and willow.

14. *cruentata.* Black; the elytra smooth; marked with red waved cross bands, and with spots of the same colour. 282. Native of South America.

Blackish-blue; the elytra blackish-yellow, marked anglica. with dots arranged in straight lines; wings red. 187. Native of England.

*The thighs of the Hind-legs thickened, and formed for leaping. Alcece.*

Of a greenish blue. 51. Native of Europe. It *oleracea* feeds on different kinds of plants, particularly on those of the class *tetradius.* This is the little insect which is so troublesome in fields and gardens, commonly called turnip-fly. It attacks turnips, radishes, and cabbages, when newly sprung above ground, and consumes their seminal leaves. It frequently destroys whole fields of turnips, so completely, as to render a second sowing unnecessary, which goes like the first. The attempts may be repeated with similar success, till the season for sowing be lost.

Blackish blue, the head and four fore-legs yellow; *chrysocce-pha.* 53. Native of Europe.

Greenish blue; the legs testaceous; the thighs of the *hypancym.* hind-legs of a violet colour. 54. Native of Europe; on the henbane, turnip, and cabbages.


Black; the elytra and lower part of the legs pale. *anglica-218. Native of England, on various sorts of vege-nta- tables.*


Of a violet colour; head and thorax reddish; legs *fuscipes.* black. 224. Native of Britain, on plants of various sorts.


Blackish, yellow; oblong, with black legs. 246. *crucifer.*

Native of Europe, on *tetradius.*

19. **CRYPTOCHEPHALUS.**


*Feelers equal, filiform.*

† Jaw furnished with one tooth.

1. Lip entire; Body cylindrical.

2. Lip entire; Body cylindrical.

3. Lip entire; Body cylindrical.

Dusky black; the elytra pale, marked with three *longipes.*

4. Lip entire; Body cylindrical.

Dusky black; the elytra pale, marked with three *longipes.*

5. Lip entire; Body cylindrical.

Blacks; the elytra red, marked with two black dots; *quadri-the antennae short and serrated. 3. Native of Europe, *punctatus.*


Black; the elytra red, marked with two black dots; *quadri-the antennae short and serrated. 3. Native of Europe, *punctatus.*

7. Lip entire; Body cylindrical.

Black; the elytra red, marked with two black dots; *quadri-the antennae short and serrated. 3. Native of Europe, *punctatus.*

8. Lip entire; Body cylindrical.

Black; the elytra red, marked with two black dots; *quadri-the antennae short and serrated. 3. Native of Europe, *punctatus.*

9. Lip entire; Body cylindrical.

Black; the elytra red, marked with two black dots; *quadri-the antennae short and serrated. 3. Native of Europe, *punctatus.*

10. Lip entire; Body cylindrical.

Black; the elytra red, marked with two black dots; *quadri-the antennae short and serrated. 3. Native of Europe, *punctatus.*

11. Lip entire; Body cylindrical.

Black; the elytra red, marked with two black dots; *quadri-the antennae short and serrated. 3. Native of Europe, *punctatus.*

12. Lip entire; Body cylindrical.

Black; the elytra red, marked with two black dots; *quadri-the antennae short and serrated. 3. Native of Europe, *punctatus.*

13. Lip entire; Body cylindrical.

Black; the elytra red, marked with two black dots; *quadri-the antennae short and serrated. 3. Native of Europe, *punctatus.*

14. Lip entire; Body cylindrical.

Black; the elytra red, marked with two black dots; *quadri-the antennae short and serrated. 3. Native of Europe, *punctatus.*

15. Lip entire; Body cylindrical.

Black; the elytra red, marked with two black dots; *quadri-the antennae short and serrated. 3. Native of Europe, *punctatus.*

16. Lip entire; Body cylindrical.

Black; the elytra red, marked with two black dots; *quadri-the antennae short and serrated. 3. Native of Europe, *punctatus.*

17. Lip entire; Body cylindrical.

Black; the elytra red, marked with two black dots; *quadri-the antennae short and serrated. 3. Native of Europe, *punctatus.*

18. Lip entire; Body cylindrical.

Black; the elytra red, marked with two black dots; *quadri-the antennae short and serrated. 3. Native of Europe, *punctatus.*

19. Lip entire; Body cylindrical.
Coleoptera.

ENTOMOLOGY.

vitis. Black; smooth; elytra reddish. 27. Native of the south of Europe; on the vine, committing sometimes great havoc.

coryli. Black; thorax and elytra reddish brown, without spots. 28. Native of Europe; on the hazel.

b. Lip bifid; Body oblong. Cistelae.

gigas. Hairy; brown; elytra, abdomen, and thighs of a brick colour. 91. Native of the south of France; very large.

cervinus. Vivid; with brown legs. 92. Native of the north of Europe.

raustiaria. Black; thorax square; elytra striated and of a brick colour. 96. Native of the south of Europe; on the ears of rye.

sulphurus. Yellow; the elytra of a sulphur colour. 98. Native of Europe. Feeds on umbelliferous plants.

marius. Black; the elytra and legs reddish brown. 103. Native of the north of Europe.

angustus. Thorax and elytra of a dark reddish colour, black in the middle. 106. Native of Britain; somewhat resembling the marius, but narrower.

pallidus. Pale; the head, and tips of the elytra, brown. 107. Native of Britain.

† † Jaw bifid; Body oblong. Criocerides.

incola. Gray; the thorax marked with a line behind; the elytra with a black dot at their base. 124. Native of Italy.

ymphaea. Brown; the margin of the elytra a little prominent and yellow. 125. Native of Europe, on the water-lily.

mellus. Of a rusty colour, the edge of the thorax and elytra yellow. 133. Native of Europe, on the willow.

cantharidae. Of a violet colour; head, thorax, and legs reddish. 139. Native of Britain.

cyanella. Blue; thorax cylindrical; prominent on the sides. 161. Native of Britain.

exomus. Blue; thorax and legs reddish. 162. Native of Europe. Feeds on the oak.

subaspis. Black; head and thorax somewhat prickly; feet reddish. 164. Native of Britain.

asperata. Thorax red, marked with two black dots; elytra yellow, marked with a black cross, and four black dots. 167. Native of Europe, feeding on asparagus. There are two or three varieties of this species. 4. With two spots on the elytra connected at the base, is to be met with in Italy. 2. With two narrow red bands on the elytra, is to be met with in France.

shellanii. Black; the edge of the thorax and two lines on the elytra yellow. 168. Native of Europe; to be found at the roots of the phellandrium aquaticum.

** Feathers unequal, the anterior ones hatched-shaped.

† The Lip of a substance like horn. Erotyli.

anteus. Oval, black; the elytra marked with a great many tawney dots. 191. Native of India.

crus. Black; the thorax and elytra of a bright copper colour. 205. Native of New Holland.

† † The Lip membranaceous. Lagrize.

Black; the thorax red and hairy. 221. Native of elongatus; Europe, particularly of England.


208 species of this genus have been described in the last edition of the System of Nature.


Antennae cylindrical; approaching one another at the base, and placed between the eyes. Feelers spindle-shaped. Thorax and elytra frequently prickly.

Body entirely black; antennae spindle-shaped; thorax *atra* and elytra prickly. 4. Native of the south of Europe and north of Africa. To be found at the roots of grasses.

Without prickles; the antennae hairy. 4. Native *mutica*. Of Europe; in rubbish and in museums.

Antennae serrated; thorax red; elytra blue; head *cornice*; furnished with two horns. 15. Native of Britain. fr. Black; the antennae pectinated; the elytra stripped. *flabellifer.*


20 species of this genus have been described in the last edition of the System of Nature.


Antennae filiform. Feelers equal and filiform. Lip pointed.

The elytra black, spotted with white; the anua white, *pist.* with two black spots. 1. Native of North America. It has been lately introduced into Europe, where it commits great havoc in the fields of peas. It is also very destructive to orchards when in bloom.

Gray, somewhat shining; the elytra very little shorter robinia. than the abdomen. 9. Large; and has been introduced into Europe, along with the seeds of the robinia pseudacacia from America.

Black; the elytra red, marked with raised stripes. *scabro-11.* Native of Europe, chiefly on the horse-chestnut. sus. Black; brown, spotted with gray. 13. It feeds on cacao, the seeds of the theobroma.

The elytra gray; spotted with black; legs red; theobrom- scutellum white. 2. Feeds on the seeds of the theo-matus. broma.

Ash coloured; elytra brown; with a black dot at *bipuncta*- the base; surrounded by a yellow circle. 17. Native tas. of Switzerland, on different plants.

Elytra black; speckled with white; the thighs of *granarii*; the hind-legs are marked with a single projection re-as. sembling a little tooth. 5. Native of Europe. Feeds on the seeds of various plants.

Black; the base of the antennae and fore feet reddish *semina* brown; thighs smooth. 6. Native of Europe, on *rusia*; flowers; very small.

25 species of this genus have been described in the last edition of the System of Nature.

22. Pausus.

Antennae consisting of two articulations, elavated. Club solid and hooked.
ENTOMOLOGY.

Coleopta

1. It is a native of North America; entirely black, the head very small, the thorax narrow, with an elevated transverse margin on the fore-part; the elytra terminated abruptly by a transverse line, and a little longer than the abdomen; which is likewise terminated abruptly. It is about the size of the _dermestes luridus._

23. Zygia.


 Oblonga. Oblong, reddish; head and elytra of an obscure blue. 1. Native of the east.


Antennae setaceous. Feelers four, filiform; shorter than the jaw, which is entire. Lip emarginated.

 Yellow; the elytra marked with a black dot in the middle and at the base. 1. Native of Egypt. Black below; the extremity of the abdomen reddish.

Rufus. Reddish; the elytra yellow and black at the tip. 2. Native of the east.

25. Aphiul.

Antennae filiform. Feelers equal; filiform. Jaw horny; furnished with one tooth. Lip membranaceous; terminating abruptly, and entire.

Bimaculatus. Furnished with wings; black, the elytra yellow, marked with a black dot behind; formerly _melol bimaculatus._ Native of the north of Europe; to be seen early in the spring, in sandy places.


Antennae moniliform, advancing beyond the middle of the snout. Mouth furnished with a straight, cylindrical snout, which projects considerably.

* Thighs simple.

27. Curculio, Diamond-beetle.

Antennae elevated, placed upon the snout, which is formed of a horty substance, and prominent. Feelers four, filiform.

This beautiful and numerous genus is divided into five subdivisions; their larvae have a scaly head, and six scaly legs. Those of the long-snouted ones are most destructive in granaries, and to seeds of almost every description. They insinuate themselves into the grain, and consume it gradually, leaving nothing but the skin, in which they lie concealed, and undergo their metamorphosis. Those with the short snout infest artichokes, and the stalks and leaves of plants. The leaves of many trees, particularly the elm, may be seen marked with yellow spots, occasioned by the larvae of this tribe insinuating themselves within the cuticle of the leaf, and forming a bag, in which they lurk, till they come forth a perfect insect.

* Long-snouted.

† Thighs simple.

The thorax and elytra rough. Antennae white at the tips. Native of Japan. Snout cylindrical, long, arched, brown on the fore-part, of an ash-colour behind; thorax round, brown, rough, with raised sharp points; elytra rough, gray, with scattered brown and white dots.

Black; thorax flat and dotted, with a line slightly broken behind; elytra shortened and somewhat striped: the pereis intervals dotted. 553. Native of Europe.

Black; the elytra marked with white dots set in regular rows, and with white interrupted waved bands. 556. Native of Europe.

Scarlet; the elytra marked with ten rows of dots. 538. Native of Europe.

Black; the elytra of a violet colour; the scutellum cyanescent white. 5. Native of Europe, particularly on the willow.

Black above; ash-coloured below, and hunch-back crossed. 6. Native of Europe; feeds on the seeds of the vetch; it is very small.

Gray; the elytra and legs reddish brown. 101. Native of England, on the marrow. The snout and abdomen black.

The snout and thorax red; the elytra of a violet color. 103. Native of Europe, on the oak.

Black; with the abdomen oval. 13. Native of the acaulis north of Europe; frequently to be met with on plants of the class _tetragnanay._

Of a blood-colour. 15. Native of Europe, and very frame destructive to corn which has been long kept. 528. Black; the thorax dotted, and of the same length as the elytra; the elytra marked with two red spots. This species is very destructive to rice kept in granaries.

Wheat or Bond. Black; the thorax dotted, and of the same length with the elytra. 16. This destructive ms. little animal does much mischief in granaries, and in biscuit kept in ware-houses, or on ship-board. Wood, henbane, and elder, are said to drive them away from grain which has been infested by them, and, on that account, is sometimes mixed with the grain.

The elytra of a brick colour, with cloudy bands. 19. Native of Europe; in the bark of the _piaus sylvestris._

Black, sprinkled with green; snout black and bent, cymose; somewhat resembling a keel. 121. Native of Africa, and the south of Europe: on the flowers of the artichoke.

Cylindrical and ash-coloured; the elytra set with sharp tarsi.
ENTOMOLOGY.

34. Native of Europe; on umbelliferous plants, particularly on the phellandrum aquatica; in the stalks of which the larva is frequently lodged, and is supposed to be the cause of the stingers in horses.

bardanae. Cylindrical; covered with a gray down; the fore-legs long. 152. Native of Europe, on the burdock. When old, it loses the gray down, and becomes smooth and black.

bacchus. Of a bright copper colour; snout and feet black. 38. Native of the south of Europe, on the vine and hazel. Somewhat hairy above.

frugilegus Oblong; of a chestnut colour; the elytra equalising the thorax, marked with four red spots. Native of South America and India. It is small, and very destructive to grain.

† † Hind thighs thickened. Saltatorii.

quercus Pale yellow; eyes black. 25. Native of Europe; on the willow, elm, and oak, the leaves of which it frequently covers with blotches, by imitating itself within the cuticle. It is about the size of the pedestatus humerus.

regalis Body black; elytra oblong. 45. Native of Europe; on the ears of corn.

† † † Thighs dentated.

terrimus Black; the elytra shining. 10. Native of Europe; very frequent on plants of different kinds.

cerasi Black; the elytra opaque and oblong. 11. Native of Europe; on the leaves of the cherry and pear-tree, the cuticle of which it eats.

pomorum The thighs of the fore-legs dentated; body gray, clouded. 46. Native of Europe, on the flowers of fruit-trees.

caligino. The streaks of the elytra approaching one another, and dotted. 243. Native of Britain, but rare. Body oblong, entirely black, opaque; thorax round and punctured; elytra with deep approximate stripe in pairs; thighs sharply dentated.

germae Black; the thorax marked with two reddish dots on each side. 8. Native of Europe; very common in Germany. It is amongst the largest of this genus that is to be met with in Europe.

nucum Body gray, of the same length with the snout. 59. Native of Europe; frequently to be found in hazel-nuts.

scrophurica The elytra marked with two black spots situated near the suture. 61. Native of Europe; on the figwort, the capsules of which the larvae consume, and substitute in their place brown follicles.

* * Brevirostres.

† Thighs dentated.

stabilis The body variegated with green and black. 298. Native of New Holland.

co-maestus Black; the thighs faintly dentated; the thorax and elytra smooth, spotted with brown. 301. Native of Europe; large, smooth.

stus The abdomen oval and black; the legs and antennae reddish. 69. Native of Europe; in orchards.

yri Yellowish-brown. 72. Native of Europe. The larva feeds on the leaves of the pear tree; the perfect insect on the flowers of the pear and of the plum. The colour varies; sometimes it is bronzed, red, green.

Sec.; legs reddish; body covered with oblong scales of various colours; elytra striated, punctured.

Downy, brown; the thighs acutely dentated; antennae and legs brownish. 308. Native of Europe; on the apple-tree.

† † Thighs smooth.

The thorax marked with lines; the elytra of an ash-polygoni, colour, marked with little brown lines; the suture brown, dotted with black. 26. Native of Europe; on the polygonum.

Above, brownish-gray; beneath, as-coloured; snout * griscus. grooved. 335. Native of Britain.

Blackish; the elytra gray, marked with two white * trigutt spots, and with a larger one behind, which is common tatus. to both elytra. 336. Native of Britain.

The elytra marked with black elevated stripes, and imperialis, with bright green and gold dotted furrows alternately, swelling out at their base, and drawing to a point at their tips. 349. Native of South America. It is very large, and the most beautiful insect hitherto known; commonly known by the name of the diamond-beetle.

Body green, silky, striped with broad gold bands. regalis.

75. Native of South America. The thighs brown, marked with a golden ring.

Oblong, brown; the back part of the thorax flat. * incanus.

81. Native of Europe; common in fir.

616 species of this genus have been described in the last edition of the System of Nature.

28. RHINOCERAS.

Antennae setaceous, placed upon the snout. Feelers four, thicker towards their exterior side.

Covered with gray down; antennae and legs black. curculio.

1. Native of Italy.

Covered with black hair; antennae and legs reddish. attelaboi.

2. Native of Europe; in pine-forests.

Blue, somewhat hairy; base of the antennae and the cornutus. legs yellow. 3. Native of Europe.

Only three species of this genus have been described.

29. ATTLEABUS.

Head drawn to a point on the hind part, and inclined. Antennae mossiform, the articulations towards the point thicker than the rest.

* Java bifid.

Black; the elytra red and reticulated. 1. Native * coryli. of Europe; on the leaves of the hazel, which it rolls up into cylinders and shuts up at both ends.

Black; legs formed for leaping. 7. Native of * betula. Europe; on the leaves of the birch, which it renders beautifully curled by its gnawing. It leaps very nimbly.

* * Java furnished with one tooth.

† The posterior feelers hatchet-shaped. Cleri.

Black; the elytra marked with three white bands, musilla. and red at the base. 19. Native of Europe.

Black; thorax reddish; elytra red, white at the base. * formica. and risa.
ENTOMOLOGY.

Coleoptera.

The thorax furnished with four small projections on arnetes each side; the elytra rusty-coloured, edged with black; the thighs of the hind-legs marked with a little projection. 4. Native of India; very large.

Thorax furnished with three small projections; the elytra black; the antennae furnished with sharp spines; antennae shorter than the body. 7. Native of Europe; on decayed birch trees. It produces large, oblong, yellowish eggs.

† † Jaw obtuse, furnished with one tooth. Cerambyces.

Thorax prickly; elytra black, marked with black bands; the antennae longer than the body. 29. Native of Europe; in the stems of fir trees, which kills by consuming the inner bark.

Thorax prickly; elytra entire, marked with two small projections on the side; the antennae furnished with two small projections at their tips; antennae of the same length with the body. 106. Native of Europe.

Thorax prickly; elytra whitish at their anterior part, the antennae furnished with two small projections at their tips; antennae of the same length with the body, and rough. 30. Native of Europe.

Green, shining; thorax prickly; antennae blue, and antennae of the same length with the body. 34. Native of Europe; on the willow. The color of the antennae and leg vary from blue to brown. The living insect has a smell of musk, which is said to have a soporific effect. It produces white eggs. The green color of this insect’s body is sometimes tinged with blue, and at other times, it is entirely blue and gold. It is difficult to digest, and is regarded by some to resemble the smell of rose, and is frequently contained in a whole meadow, where the insect happens to be plentiful.

Black; the thorax prickly; the body is red; the elytra narro; somewhat prickly and reddish brown; antennae long. 128. Native of Europe; on the oak.

† † Jaw divided.

* Horns. Lamia.

Thorax prickly; elytra black, with rusty-coloured spots; scutellum yellow; antennae very long. 38. Native of Europe; in woods.

Black; thorax prickly; scutellum bright yellow; antennae without spots; antennae very long. 159. Native of Europe; larger than the preceding species. 6. Native of America. The shanks of the fore-legs, in the male, are very long.

Thorax prickly; elytra black and convex; antennae shorter. 41. Native of Europe; on trunks of trees. 2. Native of America. The elytra are found in the wood of the sumbax. It is a delicacy, and reckoned a delicacy by the natives.

The thorax with three little projections on each side; the jaws expanded, and furnished with one spine on their outside; the antennae short. 3. Native of America. The larva is found in the wood of the sumbax. It is a delicacy, and reckoned a delicacy by the natives.

The thorax with three little projections on each side; the elytra black, with rusty-coloured spots; antennae very long. 38. Native of Europe; in woods.

Black; thorax prickly; scutellum yellow; antennae without spots; antennae very long. 159. Native of Europe; larger than the preceding species. 6. Native of America. The shanks of the fore-legs, in the male, are very long.
Coleoptera.  

**ENTOMOLOGY.**

under the eyes; thorax black, with three impressed green bands; elytra somewhat striated; black, sprinkled with green; abdomen with a white line of tawny dots on each side.

**Membranaceus.** Saperiæ.

**Thorax** smooth, cylindrical; body gray, dotted with black; antennæ of the same length with the body. 52. Native of Europe.

**Cardui.**  
Of a dusky colour; thorax marked with lines, sculpturium yellow; antennæ long. 56. Native of Europe; on thistles, injuring them much in the month of May. Body brown, speckled with yellow; thorax marked with three yellow lines.

**Scolopelus.**  
Thorax without spines, cylindrical, yellow, and marked with lines; elytra marked with four yellow dots; antennæ of the same length with the body. 57. Native of Europe; on the poplar. Body brown; antennæ varied with black and white.

**Cylindricus.** Cylindrical, black; fore-legs yellow. 5. Native of Europe; on the pear and plum-tree.

**Feeters capitatus.** Rhagias.

**Escorpi.** Thorax prickly; elytra obtuse and reddish, marked with a black line, and black along the suture; antennæ of the same length with the body. 45. Native of Europe.

**Anglicus.** Thorax prickly; elytra marked with two oblique yellow bands. 337. Native of Britain.

**Inquinatus.** Black; thorax prickly; elytra coiled with brick-coloured stripes; antennæ shorter than the body. 49. Native of Europe, on the trunks of trees. The larva has six feet, and is naked; white, head and collar horny, brown; back grooved.

**Elatus.** Black; thorax with a spine on each side; elytra brown-striped; their base suture, and a spot on each, are black; they are likewise marked with two yellow bands. 242. Native of Europe.

**Feeters clavatus.** Calidicæ.

**Rusticus.** Thorax naked; body pale; the antennæ tapering, and shorter than the body. 69. Native of Europe; in woods.

**Uranus.** Thorax naked and furnished with knobs, black; the elytra of a brick-colour. 68. Native of Europe; in fir-timber.

**Violaceus.** The thorax somewhat downy; body of a violet colour; antennæ shorter than the body. 70. Native of Europe; chiefly in fir-timber which has been cut down some time, and which has not been stripped of its bark. It bores serpentine cavities between the bark and the wood, which are larger in diameter as the insect increases in size, filling the space it leaves behind with its excrement, which resembles saw-dust. Body dark violet, a little hairy; antennæ hardly as long as the body, hairy; sternum with a small projecting point; elytra linear, round at the tip, turgid at the base. It varies in having the head and thorax, and even the body greyness.

**Borusus.** Thorax hairy, marked with two protuberances; body brown. 76. Native of Europe, on the trunks of trees; in timber, in houses, perforating the joints, particularly those that have been formed of fir-timber.

**Feeters unequal; the anterior pair filiform, the posterior clavated.** Stenocori Fabricii.

Thorax slightly prickly; elytra formed like the roof* meridia* of a house; the anterior part of them reddish brown; the breast shining. 47. Native of Europe. Male of a brick colour; female blackish; larva lies under ground, and has very long legs.

379 species of this genus have been described in the last edition of the System of Nature.

**Calopus.**

**Antennæ** filiform. Feeters four; the anterior ones clavated; the posterior filiform. Thorax turgid. Elytra narrow, and of an equal breadth throughout their whole length.

**Brown; the antennæ compressed.** 1. A native of* serrati-corns. Europe; it is long, and cylindrical.

**Very small; brown; the antennæ serrated and hairy.** Pygmaeus. 3. A native of Europe; about the size of a flea.

There are three species described in the last edition of the System of Nature.

**Leptura.**

**Antennæ setaceous.** Feeters four, filiform. Elytra growing small towards the tip. Thorax somewhat tapering.

**Lig.** entire. **Dentaria.** Fabricii.

Of a golden colour; the thighs of the hind legs clavate* aquatia* ted and notched. 1. A native of Europe; on aquatic plants, on the water-lily, phalanthus aquaticus, at the roots of which the pupa may be found enclosed in brown globes. The thighs of the hind legs are sometimes without notches. Antennæ blackish, the joints pale, reddish at the tip; head with a little down on the middle; thorax grooved; elytra streaked, dotted, and terminating abruptly, with short appendages at each margin; body beneath downy; legs dull, brownish red.

**Of a golden colour; the thighs simple.** 17. A native of Britain; on aquatic plants.

Shining green golden colour; the elytra marked with nitido dotted streaks and with curved wrinkles, likewise with a bright purple and green fillet; the abdomen, antennæ, and legs of a golden colour; the thighs of the hind-legs notched. 88. A native of Europe.

Silvery green; the elytra marked with dotted streaks, vulgaris. curved wrinkles, with a broad green and purple fillet common to both elytra; the head, bottom, and legs, of a golden colour; the thighs of the hind-legs without notches. 89. A native of Europe.

**Lig.** bifid. **Leptura.**

**The Thorax on the fore part somewhat oblong and narrow.**

21. Black; the elytra reddish, with a black dot in the pupa's middle. A native of Europe.

22. Black; elytra red, black at the tips and at the sub-hastate. ture. 23. A native of Europe. The abdomen is reddish in the male, which is smaller than the female.

X 2

Black;
ENTOMOLOGY.

Coleoptera.

35. Lampyris, Fire-Fly.
Antennae filiform. Feelers four. Elytra flexible. Thorax flat, hemispherical, surrounding and concealing the head under it. The sides of the abdomen furnished with folded papillae. The female in most of the species without wings.

* Feelers nearly elevated.

Glow worm. Oblong, brown; shield ash-coloured. * noctuica 1. A native of Europe; in woods and meadows. The female is larger than the male, and emits a beautiful phosphoric light, for the purpose of attracting the male. It is apparent that their shining light depends on a fluid placed near the extremity of the abdomen; the light becomes brighter, and of a finer green colour, when the insect is in motion. The little animal can withdraw the light at pleasure by contracting itself. Though the insect be bruised, the light continues for a considerable time.

Dusky black; the shield marked, on both sides, with corvus; a circular rose-coloured spot. 2. A native of North America.

Oblong, brown; the shield resembling glass at the * tapiro. 3. A native of Europe; in woods. This has only been thought by a variety of the * noctuica; it is peculiarly resplendent in showy weather. The female emits the brighter light, particularly when pregnant.

The shield reddish, and black in the middle; the ptydryis; elytra black, with a white edge; the abdomen white. 4. A native of the south of America.

Yellow; the third segment of the abdomen from the japonica; anus is black. 22. A native of Japan; very plentiful in the months of May and June; diffusing a very strong light from two small bags at its tail, filled with air; eyes, antennae, and wings black.

The elytra brown; the thorax transverse, red. 11. Italic. A native of Italy and Switzerland; on trees; less than the rest of the genus; brown; the last two segments of the abdomen yellow; the breast and legs pale yellow; the female black.

** Feelers nearly filiform.

Black; the sides of the thorax and elytra of a blood sanguineus colour. 17. A native of Europe; in stony ground. Black; the thorax and elytra of a brick colour; an pectinicornis; pencinated. 34. A native of Europe.

Black; the thorax and elytra of a blood colour, and * coecina; without spots. 18. A native of Europe; in hedges; head sometimes reddish, the elytra sometimes striated.

** Feelers with the last joint thicker than the rest, and terminating abruptly. Lyci.

Yellow; elytra with a black marginal spot, and latissima; black behind, the lateral margin very much dilated.

14. A native of Sierra Leone. Mouth cylindrical, prominent; body narrower before, and very wide behind; antennae serrated. Black; thorax orbicular, and with the elytra red, ostra; marked with an impressed black spot on the back. 44. A native of Europe.

Forty-four species.

1. A native of Europe.
2. A native of Europe.
3. A native of Europe.
4. A native of Europe.
5. A native of Europe.
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18. A native of Europe.
19. A native of Europe.
20. A native of Europe.
22. A native of Japan.
23. A native of Europe.
25. A native of Europe.
26. A native of Europe.
27. A native of Europe.
28. A native of Britain.
29. A native of Britain.
30. A native of Britain.
31. A native of Britain.
32. A native of Britain.
33. A native of Britain.
34. A native of Europe.
35. A native of Europe.
36. A native of Europe.
37. A native of Europe.
38. A native of Europe.
39. A native of Europe.
40. A native of Europe.
41. A native of Europe.
42. A native of Europe.
43. A native of Europe.
44. A native of Europe.

100 species of this genus have been described by Gmelin, in the last edition of the System of Nature.
ENTOMOLOGY.

36. HORIA.
Antennæ moniliform. Feelers four, thicker towards their outer side. Lip linear, round at the tip.

setacea. Reddish; antennæ and legs black. 1. A native of Tranquebar; the hind thigh of the male thickened, and grooved beneath, and marked with a little projection.

termesof. Reddish brown; eyes, wings, and breast black. 2. A native of Europe.

There are only two species of this genus described.

37. CUCUJUS.
Antennæ filiform. Feelers four, equal; the last articulation terminating abruptly, and thicker than the rest. Lip short, bifid; the divisions linear, and distant from one another. Body depressed.

vitulus. Thorax unarmed, black, with an impressed dot on each side; elytra striated, brown. 2. A native of Europe; black.

staceus. Of a brick colour; thorax nearly square, unarmed; thighs compressed. 3. A native of Europe, under the bark of the birch tree.

uadratus. Black; the thorax square, notch behind marked with tubercles in the middle, and wrinkled on the external edge, elevated on the anterior part; the antennae brown; the legs and elytra simple and reddish. A native of Europe.

Eleven species of this genus have been described in the last edition of the System of Nature.

38. CANTHARIS.
Antennæ filiform. Thorax (for the most part) margined, and shorter than the head. Elytra flexible. Sides of the abdomen edged with folded papilæ.

* Feelers four, hatchet-shaped.

This is an extremely rapacious genus, preying on other insects, and even on its own tribe; those of the division hygromedon only, both in the grub and perfect state, feed on green wood.

fusca. Thorax red, with a black spot; elytra brown. 2. A native of Europe; in hedges; most rapacious, and devouring its own species.

arginella. Reddish; the abdomen black and margined; the back part of the head, eyes, and breast yellow. 3. A native of Europe.

dia. Brown; the thorax, head, base of the antennæ, the sides and tip of the abdomen, and the legs reddish. 4. A native of Europe.

smatoma. Black; mouth and abdomen red. 5. A native of Europe.

guttata. The middle of the thorax black; the elytra shortened, black and yellow at the tip. 11. A native of Europe; in groves and gardens.

radiata. The thorax somewhat margined; body black; antennæ pectinated; the elytra marked with a blood-coloured dot at the tip. 13. A native of Europe; on the leonurus cardiaca.

striata. Black; the thorax, the base of the antennæ, posterior base of the segments of the abdomen, and legs yellow, with a brown spot on the thorax. 82. A native of Europe.

* * Feelers filiform, the last articulation setaceous. Malachii.

Bright greenish yellow; the upper surface of the *area. elytra red. 7: A native of Europe; on plants. It is furnished with two tentacula at the base of the abdomen, of a blood colour, blunt, and connected at the base; likewise two on the thorax which can be stretched out. There is a smaller variety, with the elytra wholly of a blood colour.

Bright yellowish green; the elytra red at the tips. *bipustulata. 8. A native of Europe.

Black; the thorax and tips of the elytra red. 96. hemericides. A native of Europe.

Thorax red, emarginated; elytra blue and smooth; cryomolobis antennæ and legs black. 63. A native of France; des. when touched under the breast, it contracts its head and body; when set at liberty it runs off very quickly.

* * * The anterior feelers stretched out; the last articulation but one, is enlarged with a large oval split appendix; the last articulation arched and acute. Lynceylon.

Black; the elytra light brown, and black at the tip; proboscis the feelers hooked, and irregular. 69. A native of dea. Europe; in timber.

Brown: the antennæ and shanks of the legs black. barbata. 70. A native of Europe; in timber; covered with glossy down of a changeable hue; antennæ and legs paler.

The thorax somewhat tapering; body yellow; the *navalis. margin and tips of the elytra black. 26. A native of Europe; in the timber of the oak, to which it is very destructive.

Eighty-six species of this genus have been described in the last edition of the System of Nature.

39. SERROFALUS.
Antennæ setaceus. Feelers four, unequal; the anterior one longer than the rest, and deeply serrated; four articulations, the last one very large, terminating abruptly, compressed, and like a plate; the posterior one nearly clavated. Thorax margined, the anterior one receiving the head, with a prominent angle on each side. Head bent down. Legs formed for digging.

Body brown; the elytra striated. A native of the striatus. island of Runseal; found on old wooden buildings in autumn.

Body black; the elytra smooth. 2. A native of lavigatus. Europe.

40. ELATER, Skipper.
Antennæ filiform. Feelers four, hatchet-shaped. Under side of the thorax terminating in an elastic spine, coming out from a cavity of the abdomen; by which means the body, when placed on the back, springs up and recovers its natural posture.

Brown;
ENTOMOLOGY.

Coleoptera.

- Lip divided into three little projections.

This is, in general, a very beautiful genus of insects; they are found in dry sandy places, and prey with the most ravenous ferocity upon all other insects which come in their way, and which they can overcome. The larva is soft, white, long, and has six feet, with a brown scaly head; and lurks in a round perpendicular hole in the ground, with its head at the entrance, to draw in, and devour whatever insects may come near, or fall into it.

Green; the elytra marked with five white dots. 1. *campesi* A native of Europe; in sandy plains. The upper part tris.

of the antennae brown, the under part red; thorax a little angular, rough; elytra irregularly dotted; upper lip white; jaws projecting, sharp; legs red, with a coppery tinge.

Purple; the elytra marked with a white band, and *hybrida* two white circular dots. 2. A native of Europe; in sandy places.

Of a copper colour; the elytra green, marked with a germanicus white spot, like a crescent, at the tip. 4. A native of Europe. It varies in colour, being sometimes blue, green, or black.

Black, above bright brown; the elytra with lateral damns. striae at a good distance from one another. 40. A native of Europe.

Black, on the upper part nearly of the colour of punctata. brass; the elytra striated, marked with four impressed dots; legs a yellowish brown. 41. A native of Europe.

Of a rusty colour; legs, elytra, head, and thorax ferrugineus; the latter green behind; the elytra are marked with a waved green band, and have a green nuture. 49. A native of Europe; in water. Head two-lobed behind; lip white; thorax jagged on the fore part; it has no scutellum; elytra with each 15 punctured striae, and three spots at the base near the anterior margin.


Of a bright greenish yellow; the elytra marked with *riparius* broad concave points. 10. A native of Europe; in moist places.

Of an obscure brass colour; the elytra somewhat *flavipes* cloudy, legs yellow. 11. A native of Europe; on banks. The elytra are sometimes dotted; antennae black, the first joint yellow; thorax rounded, and grooved on the back.

Black; the elytra brown, marked with two pale quadriram spots, the shanks of the legs reddish. 13. A native *calidus* of Europe.

Of a bright brass colour, polished; head striated. *aquatica* 14. A native of Europe; common in water.

48 species of this genus have been described in the last edition of the System of Nature.

42. Buprestis, the Cow-burner.

Antennae filiform, serrated, and of the same length with the thorax. Feelers four, filiform; the last articulation obtuse and terminating abruptly. Head half drawn back within the thorax.

This is a genus remarkable for its rich metallic co-
ENTOMOLOGY.

Coleoptera.

louræ, having frequently the appearance of the most highly polished gold or copper; the larvae are usually found among timber, and in decayed trees.

wittia. The elytra dotted, furnished with two little projections; they are likewise marked with four elevated lines, and with a broad fillet of green and gold. 33. A native of India.

fastivora. The elytra terminating abruptly, furnished with two small projections, green, and marked with dotted stripes; the back is of a bright golden colour. 34. A native of America.

berolinensis. The elytra variegated with green and black, and furnished with two small projections; the anus is furnished with three small projections. 35. A native of Europe.

octoguttata. The elytra formed like the roof of a house, and destitute of projections, marked with four white spots; body blue. 2. A native of Europe; in groves.

maevolosa. The elytra black, striated, furnished with projections, and terminating abruptly, marked with four yellow spots. 50. A native of Europe; of a middle size. Head and abdomen green and gold; the legs and thorax black; the edge of the latter yellow.

mariana. The elytra are serrated, and marked with longitudinal wrinkles, likewise with two impressed spots; the thorax furrowed. 6. A native of Europe.

phrygo-stigma. The elytra are serrated, marked with two golden impressed spots, and longitudinal furrows; the thorax dotted. 7. A native of Europe.

rustica. The elytra formed like the roof of a house, and striated; the thorax dotted. 8. A native of Europe; in groves.

salis. Shining green; the elytra entire, of a golden colour, and green at the base. 85. A native of Europe; on the willow.

120 species of this genus have been described in the last edition of the System of Nature.

43. HYDMOPHILUS.

Anastomos clavatus; the club perforated. Feelers four, filiform. The hind-legs hairy, formed for swimming, and almost destitute of nails or claws.

The insects of this and the next genus, dytiscus, are inhabitants of ponds and stagnant waters, where they swim with much dexterity, turning round with great velocity. They fly abroad by night in search of other waters. The males are distinguished from the females, by having a horny concave flap or shield on the forelegs, near the setting-on of the feet; the hind legs are peculiarly fitted for their aquatic situation, being furnished on the inner side with a series of long and close-set filaments, resembling a pin, by which they are enabled to swim with great ease and celerity. The larvae remain about two years and a half before they change into pupae, forming a convenient cell, and secreting themselves in some bank; they are extremely voracious and destructive to the more tender aquatic insects, worms, and young fish, which they ravenously seize with their forked jaws, and destroy by sucking out their juices.

picus. Water-clock. Black; breast grooved, with a long spine pointing backwards. 1. A native of Europe. The larva appears to have its legs seated on the upper part of the body near the back; but this is occasioned by the peculiar shape and position of the legs; the female spins a flattish circular web, terminated by a long tapering horn, from which the young escape, as soon as they are hatched.

Black, shining; the elytra somewhat striated. 2. A * carbo-ide of Europe.

Black, shining; the edges of the thorax and elytra * scora-yellow. 3. A native of Europe. Feelers filiform. Besides.

Oval, black; the elytra and legs gray. 11. A native of Europe. It makes a buzzing noise in the evening. Thorax is sometimes gray.


Twenty species of this genus have been described in the last edition of the System of Nature.

44. DYTISCUS.

Antennæ setaceous. Feelers six, filiform. The hind-legs hairy, almost entirely destitute of claws or nails, and formed for swimming.

Black; the edges of the elytra dilated, marked with * latissi-ma yellow line. 6. A native of Europe. It is so vorac-ious as even to destroy its own species. The male is smooth, the female grooved.

Black; the whole of the edge of the thorax, and the * margin-outer edge of the elytra, yellow. 7. A native of Europe.

The fore-feet of the male have a hemispherical appendage, with two circular cavities in the middle. The female is semistriated.

Brown; the elytra hairy, marked with ten furrows, * semistriating half their length. 8. A native of Europe. It is furnished with a sharp crooked concealed sword. Its legs are oblong, large, and white.

The elytra marked with ten longitudinal furrows, * sulcatus, and are hairy. 3. A native of Europe and America. The elytra of the male are smooth.

Brown; thorax yellow, marked with four black dots, * notatus. 31. A native of Europe. The thorax is sometimes reddish, sometimes variegated with black dots, or with a short black band.

The thorax of a rusty colour, marked with two black depressus. dots at the base; the elytra brown, spotted with red. 32. A native of Europe.

Brown; the elytra smooth; the legs and belly of a * glaucus. rusty colour. 86. A native of Britain; in stagnant waters.

Bluish, clouded with black; the antennæ and legs of * nubulas. a rusty colour; the belly black, the margin of a light-evebrown colour. 89. A native of Britain; in stagnant waters.

133 species of this genus have been described in the last edition of the System of Nature.

45. CARABUS, Bull-head.

Antennæ filiform. Feelers six; the last articulation obtuse, and terminating abruptly. Thorax heart-shaped; smaller end which terminates abruptly being next the body. Both thorax and elytra are margined.

These insects are exceedingly active and quick in running; they devour the larvae of other insects, and all the weaker animals they can overcome; the legs are long.
**Entomology.**

*Coleoptera.*

* Faeces six; filiform; the fore legs formed for digging, furnished with projections at the extremity like a hand.

The larva of some of the species of this genus live in damp places under ground among rubbish; of others, in flour and different kinds of food, where they perform their metamorphosis. The perfect insects are very troublesome in houses, eating bread, meal, &c.; they precipitately avoid the light; resort to damp cellars, and dark places, where putrefaction alines and nourishes them. They are all of a very dark glossy appearance, from which circumstance they have received their name.

Black; thorax nearly square; the elytra very smooth. 13. A native of Cayenne; large. *Trux.*

Black. 7. A native of Europe; on sand hills, in *fusio*, which it digs holes.

Brown; thorax oblong, marked with five projecting *cursor* angles. 8. A native of Europe; in sand hills.

• Feathers unequal; filiform.

Wholly black, and smooth. 21. A native of Egypt; *stratus*, the elytra joined together, the fore legs furnished with two projections.

• • Feathers four; the anterior ones faintly elevated, the posterior ones filiform.

Black; the thorax nearly square and smooth; the *laminatus* elytra furrowed; the shanks of the fore legs crooked and sharp, terminating in a rusty-coloured plate. 22. A native of India; the largest of the genus.

Black; the elytra striated; thorax smooth. 1. A *gigas*, native of Surinam, about the size of the stag-beetle; the antennae are somewhat elevated.

Wholly black; the thighs of the fore legs thicker. 30. *molitor*, than those of the rest. 2. A native of Europe; among flour, in bake-houses, mills, dry bread, &c. The larva is white, soft, and smooth, composed of thirteen segments; it is eagerly sought after by the nightingales.

Of a rusty colour; the elytra striated, the shield *culinarius* emarginated. A native of Europe; in loose sand, in rubbish, and in granaries.

Black above; beneath of a deeper and brighter *pomona* black; the elytra marked with five elevated stripes on each side. 45. A native of Europe, in orchards; the larva, covered with a loose net, by twos or threes lurk in the folded leaves.

The thorax marked with two cavities; the elytra of *ignarius*, a violet colour or reddish; the antennae and legs of a rusty colour. 57. A native of Europe. The larva is to be met with in the trunks of pine trees that have been cut down, the inner bark of which they consume; the insect is, when full grown, about half an inch long.

64 species of this genus have been described in the last edition of the System of Nature.

46. **Tenebrio.**

Antennae moniliform; the last articulation roundish; Thorax flat on one side, and convex on the other, and margined. Head projecting. Elytra somewhat rigid.

Black; ovate; without wings; the elytra connected and marked with dots which run into one another, and somewhat wrinkled. 1. A native of Europe; in woods.

One of the largest species in Europe; head and thorax irregularly dotted; body beneath shining.

Without wings, and blackish; the elytra of the colour of brass, striated, and marked with elevated dots, placed between the striae. 2. A native of Europe; in fields.

Without wings; black, the elytra smooth, marked with a triple row of bright yellow depressed dots, and with a blue edge. 3. A native of Europe; in gardens and woods. The dots on the elytra are sometimes of the same colour with the elytra.

Without wings, and of a blackish copper colour; the elytra striated, and marked with a triple row of concave dots. 42. A native of Europe.

Without wings; the elytra dark green, with longitudinal raised lines, the edge golden; legs black. 6. A native of Europe; in woods.

Without wings; the elytra girt, and marked with elevated ridges and smooth furrows. 7. A native of Europe; in close confined places in woods.

*violaceus.*

Winged; the elytra somewhat smooth, black, with a girt edge; the thorax of a violet colour. 8. A native of Europe; very common in woods.

*Euryphanta.*

Shining golden colour; the thorax blue; the elytra marked with stripes of green and gold. 12. A native of Europe. This is the largest of this genus that is to be met with in Europe; the larva is black; it attacks caterpillars by night, and devours them.

Without wings; above of an obscure greenish yellow; beneath black; the elytra marked with four rows of concave spots, and with furrows. 82. A native of Europe; in woods, under ground. The elytra are sometimes black.

* • Minores.*

*Sabulosus.*

Pale; the head black, and a black spot on the elytra. 96. A native of Europe; in sandy grounds.

*Euforonia.*

Black; the elytra smooth, and furrowed; the antennae and legs reddish. 97. A native of Europe; in woods frequently.

*Neocoris.*

The thorax roundish; the elytra striated, and marked with impressed dots; the antennae hairy. 104. A native of Britain. It is sometimes black; sometimes, of a bright yellow.

*Spinibarbis.*

Blue; the thorax spherical; mouth, antennae, and shanks of the legs reddish. 105. A native of England.

*Corbitana.*

The thorax, head, and legs, of a rusty colour; the elytra black. 13. A native of Europe; in groves. It pursues the larger beetles, driving them away by the noise made by its belly.

280 species of this genus have been described in the last edition of the System of Nature.

47. **Pimelia.**

Antennae filiform. Feathers four. Thorax flat on one side, and convex on the other and margined. Head projecting,
Coleoptera.

Entomology.

Hunch-backed, black; the elytra marked with three gibbus dotted lines. 2. A native of Africa; in loose sand, and very common in Egypt.

Black; the elytra marked with one elevated line, pl. 367. 3. A native of Egypt.

Black; the elytra very smooth. 4. A native of Asia, minutus.

Only four species of this genus have been described.

50. Lytta.


Green; the antennae black. 1. A native of Euro-sticatarope; on the privet, the ash, the elder, the lilac both rufa common and Persian, the poplar, and on the Tartarian woodbine.

This insect is used in pharmacy, chiefly for the purpose of raising blisters. It multiplies greatly, and has a nauseous smell, not much unlike that of mice; which helps to conduct those who go in quest of them. The odorous particles exhaled from them are extremely corrosive. They were formerly ranked among the canthari-des; more recently in the genus meloi. More accurate observation has placed them in the genus lytta.

Green and gold; the elytra reddish brown. 2. A. mitidula. native of England.

Black, smooth; breast downy; the elytra grayish quadrimaculata. yellow, marked with two black and almost square spots, galeata. 14. A native of the north of Asia. A pleasant smelling oil exudes from its legs.

Smooth, pale reddish brown; thorax depressed; the fenestrella. elytra gray, and black at the tips, and marked with two square glazed spots. 15. A native of the north of Asia, among flowers; of a middle size. A pleasant smelling oil is likewise exuded from its legs.

Brown; the fore part of the elytra, and the thorax, formica which are elongated, are red. 29. A native of Eur-ia. rope.

29 species of this genus have been described in the last edition of the System of Nature.

51. Meloe, the Blossom-eater.


The larva as well as the perfect insect, both of this and the preceding genus, feed on leaves.

* No Wings; Elytra shortened.

Body of a violet colour. 1. A native of Europe. prosera. It is to be met with, particularly in the spring, in sandy barns. plains. They feed on the ranunculus and veratrum; its eggs have a pleasant smell; when touched, a very thin yellowish oil exudes from the joints of its legs. It is recommended as a remedy in the hydrophobia. The female is thrice as large as the male.

The segments of the abdomen red. 2. A native of majalis, the south of Europe.

* Furnished with Wings; the Elytra covering the Wings.

A. Jaw bifid.

Black; the elytra yellow, marked with three black cichorei bands.
ENTOMOLOGY.

bands. 5. A native of Asia, and the east of Europe. It is used in medicine among the Chinese. The antennae are sometimes yellow at the tips.

decem- 
punctatus. dota. 6. A native of Italy. The last articulation of the antennae is elevet.

B. Jow entire.

schafferi. Green; the antennae and legs yellow. 12. A native of Europe.

schreberi. Green; the antennae, legs, and three segments of the abdomen yellow.

32 species of this genus have been described in the last edition of the System of Nature.

52. MORDELLA, the Nibbler.

Antennae moniliform or pectinat. Feelers four; the anterior pair elevated, the posterior filiform. Head bent down under the neck. Elytra bent downwards towards the tip. Before the thighs, and at the base of the abdomen, there is a broad plate.

* Antennae pectinat.

paradoxa. The sides of the thorax, and the elytra, a brick colour. 1. A native of Europe; on umbelliferous plants.

flabellata. Rosy brown; mouth, breast, and upper part of the abdomen black. 10. A native of Europe.

** Antennae moniliform.

bimacule

ta. Of a rusty colour; breast black; elytra reddish, marked with a black spot. 13. A native of Europe. Large.

*** Antennae moniliform.

decem. Black; the ams terminating in a spine. 2. A native of Europe; on umbelliferous, and a variety of other plants.

abdomina. Black; the thorax and abdomen tawney; the anus terminating in a spine. 19. A native of Europe.

* humeri. Black; the mouth, sides of the thorax, and legs yellow. 3. A native of Europe; on flowers.

* bicolor. Black; the elytra reddish, black at the tip, and marked with a black band in the middle. 25. A native of Britain; very common on the flowers of the hawthorn, of the dock, and of some kinds of umbelliforous plants. Very small.

*** Antennae cuneatus.

* claviform. Wholly black. 23. A native of Europe; on the rhubarb.

28 species of this genus have been described in the last edition of the System of Nature.

53. STAPHYLINEUS, Rove-beetle.

Antennae moniliform. Feelers four. Elytra half the length of the body. Wings covered. Tail furnished with pincers.

The larva of the forsculae run very quickly. This insect is very common, and very well known; the pincers at its tail, from whence it has received its Latin name forscula, afford a very good distinguishing mark.

The elytra at the tip; the antennae have four or fifteen articulations. 1. A native of Europe; common in fruit. It is accused of creeping into the ears of people while sleeping, whence it has received its name, earwig.

Pale above, variegated with black; the anus furnished with two projections; the pincers projecting considerably, and each furnished with one projection. 3. A native of Europe. Very large.

The elytra reddish, without spots; the antennae have nine joints. 2. A native of Europe. The tips of the antennae are whitish. It is rare.

Black; the hind part of the head and legs reddish; beneath back of the elytra marked with a white spot. 4. A native of Europe. The antennae have eleven joints.

11 species of this genus have been described in the last edition of the System of Nature.

II. HEMIPTERA.
II. HEMIPTERA.

The mouth and antennae bent inwards, towards the breast. Wings covered with hemelytra. The upper wings, composed of a semicrustaceous substance, do not form a straight suture when shut, but the inferior edge of the one passes over the superior edge of the other.

55. Blatta, Cockroach.

Head bent inwards. Antennae setaceous. Feelers unequal, filiform. Elytra and wings smooth, and somewhat resembling leather. Thorax flatish, circular, and margined. Feet formed for running. Two small horns are situated at the tail in most of the species.

These insects, with their larvae, wander about by night, and secrete themselves by day. They are food of warmists, and haunt about houses, devouring meal, and whatever provisions they can get at. They run with great celerity; and are destroyed by the fumes of charcoal or sulphur, also by the root of the *symphytum officinale* boiled in milk.

Livid; the shield of the thorax marked with a square chestnut-coloured spot. 2. A native of Asia and America. It is the largest of this genus, being nearly the size of a hen’s egg.

Brown; the thorax and elytra livid, and variegated with brown. 3. A native of the island of Madeira; a little smaller than the last species.

Of a rusty colour; the shield of the thorax whitish behind. 4. A native of America; it has been introduced into Europe along with sugar.

Of a rusty colour; the thorax black, marked with a white ring; the elytra marked at the base with a small white hue. 5. Found in ships returning from the South seas.

Of a rusty brown colour, without spots; the elytra short, marked with an oblong furrow. 7. A native of America, and has been introduced into Europe for almost two hundred years. Frequent in many countries of Europe, in meat and bread, and other provisions; likewise in shoes, which it destroys. It abounds the light, and runs very quickly. It is much harassed by the large *hemiptera curculio*. The female is without wings; she produces a cylindrical egg, half the size of the abdomen.

Yellowish; the elytra spotted with black. 9. A native of Europe; consuming provisions. In the moist woods however of the east of Europe it is less noxious.

Livid; body yellowish; the thorax marked with two black parallel lines. 9. A native of Europe.

Thorax black, with a whitish edge; the elytra pale, marked with a large black spot near the tip. 25. A native of Europe; in pine forests and heaths.

43 species of this genus have been described in the last edition of the System of Nature.

56. Pneumora.


The whole of this genus seem to consist of a mere hollow inflated membrane; by rubbing their legs against their bodies, they make a shrill noise in the twilight; and during the night, they are attracted by a bright light.

Elytra without spots. 1. A native of the Cape of Good Hope. Head green; eyes white; between the ta. eyes are three red stigmata, and above these two short projections; antennae short, green; thorax rough, with a short tooth before and an impressed wrinkle in the middle; the elytra ash-coloured, reticulated with green, sometimes marked with very small black dots; they are very rarely yellowish or reddish; the insect is about twice the size of the house-cricket.

Three species of this genus have been described in the last edition of the System of Nature.

57. Mantis, Spotted Plan.

Head nodding; furnished with jaws. Feelers filiform.

Antennae setaceous. Wings four, membranaceous, rolled up. Fore-legs compressed, notched underneath, furnished with one hook, and with a lateral setaceous jointed finger; the hind-legs smooth, and formed for walking. Thorax linear, long, and narrow.

The thorax somewhat tapering and rough; the elytra gigas. very short; the legs prickly. 1. A native of Asia; wings very large.

Thorax margined, and marked with small projections; the elytra variegated with green and white; doted with white along the edge. 17. A native of Alexandria.

The thorax smooth; the elytra green; the wings *oratoria* reddish at the anterior part, marked with a black spot. 5. A native of Europe. This insect rests sometimes on its four hind-legs, stretches the fore-legs out to the right or left, and for this reason has been supposed to point out the way to strangers, when asked.

The thorax somewhat fringed; the elytra greenish, *procera*. marked with a rusty-coloured ocellus. 8. A native of America and Africa; the half of the ocellus on the elytra is white, sometimes entirely white. This is supposed to be the idol of the Hottentots.

Linear, ash-coloured, spotted with black. 30. A *mamula* native of the Cape of Good Hope. This is the tutelary deity of the Hottentots.

52 species of this genus have been described in the last edition of the System of Nature.

58. Gryllus, Cricket.

Head bent inwards; furnished with jaws. Feelers filiform. Antennae either setaceous or filiform. Wings four, either deflected or twisted; the under wings folded. Hind-legs formed for leaping.

The whole of this genus feed on vegetables, except those contained in the first division, oridea, which devour other insects; the *ochetra* destroy the roots of plants; the *tectogonia* and *decuster*, the leaves or tender shoots, in some countries laying waste whole districts; the larvae and pupae resemble the perfect insects, reside chiefly under ground, and are six-footed, voracious and active: some of this tribe are used as an article of food by the natives of Africa and India; many of them produce sound by the friction of some parts of their body.
**Antennae setaceous. Feelers unequal. Tail of the female armed with a projection like a sword. Tetigonios.**

The thorax round, and somewhat warty; wings very aquilinus. broad; with 15 nerves. 27. A native of South America and India; large; the elytra of the shape of a lance; the shanks of the legs set with four rows of prickles.

Brown; the thorax roundish and keel-shaped be-grisceus. bind, furnished with a black crooked spine resembling a sword, the base of which is pale on each side. 108. A native of Europe; the antennae yellow, and of the same length with the body; legs greenish; the elytra variegated with brown and ash colour.

The thorax round; the wings green and without viridissipla; the antennae very long. 31. A native of Eu-mus. 30. A native of Europe; on trees, in pasture grounds, in barley fields. It makes a noise in the night time in warm weather about the time of the dog days.

Thorax nearly square and smooth; the wings green, corruci-spotted with brown; the antennae setaceous, about the corus. same length as the body. 34. A native of Europe, and is collected by the common people of Sweden for the purpose of destroying warts in the hand; which it said to perform by biting off the exsiccujesces, and discharging on the wound a fluid which causes them to decay.

**Antennae filiform. Feelers simple; Tail unarmed. Locusta.**

The thorax entirely keel-shaped; body without wings. elephas. 35. A native of Africa; this is the largest and heaviest of the Locusta; green, the thighs smooth, the rudiments of two wings.

The thorax faintly carinated, composed of one seg-migrum-ment; head obtuse; jaws black. 41. A native of taurus. Tarty, and migrates in incredible swarms into various parts of Europe. The mischief these voracious creatures do, when they appear in vast swarms, far exceeds that done by any other tribe of animals. By suddenly destroying all vegetation, they change the most fertile countries into barren deserts, leaving behind them desolation and famine. They have occasionally appeared in small flocks in England, but have perished in a short time. This was probably the species that constituted one of the plagues of Egypt. They are eaten by the inhabitants of different countries, particularly by the Egyptians, who roast them alive and eat their bodies, after having removed their wings and legs.

The thorax marked with an elevated ridge like a stridu-leel, the wings red and black at the tips. 47. A nu-lus Class of Europe; in dry sandy situations, chirping all day long, till late at night. Either black or variegated with black and yellow.

240 species of this genus have been described.

59. Fulgora, Lantern-fly.
Emiptera.

Entomology.

Globular. The snout, long and bent inwards, is a sheath consisting of five articulations. Legs formed for walking.

Antenna elongate. The forehead extended, forming a straight beak; wings bluish, the under wings marked with ocelli. 1. A native of South America. It emits a very bright light from the prominent part on its forehead. Travelers are said to avail themselves of the light they emit; two or three of them, fixed on the end of a stick, affording light sufficient to let them see in the dark.

Acemia. The forehead set with tapering points, and extended into a beak, divided at the tip into three; wings black, spotted with red. 2. A native of India.

Nelaria. The forehead extended into a clavated beak; the elytra green, spotted with yellow; the wings yellow with black tips. 3. A native of China.

Raspheba. The forehead raised into a tapering beak; body grayish yellow. 4. A native of South America.

Polpina. The forehead conic and unequal; wings transparent, marked with a black streak. 17. A native of Bengal.

20 species of this genus have been described in the last edition of the System of Nature.

60. Cicada, Frog-hopper.

Snout bent inwards. Antennae setaceous. Wings four; membranaceous and deflected. Legs (in the most of the species) are formed for leaping.

The insects of this genus feed on the juice of plants; the larva is without wings; the pupa has only the rudiments of wings, but they have both six legs; they very much resemble the perfect insect, and are very active; the perfect insect chirps as well as those of the preceding genus.

Antenna tapering at the point, and placed on the forehead. Membracidae.

A. Thorax compressed, membranaceous, and larger than the body. Foliacae.

B. The thorax inflated, light brown and reticulated. 52. A native of Cayenne.

A. The thorax brown; lengthened out behind, the abdomen being half the length of the thorax. 56. A native of England; on the genus tinctoria.

Ornata. The thorax furnished with two horns; black, tapering to a point, and of the same length with the abdomen. 57. A native of America, on plants.

B. The thorax furnished with a horn on each side. Cruciate.

Ornata. The thorax furnished with two horns; black, tapering to a point, and of the same length with the abdomen; wings brown. 6. A native of Europe; on thistles and willows.

Legs not formed for leaping. Manifera.

Belia. The tip of the scutellum marked with two small projections; the elytra marked with four anastomoses, and six lines of a rusty colour. 15. A native of Europe and Africa, very large. Of this insect Virgil says, et cantu querusque rumpent arbusta cicade, and sole ubi ardente resonant arbusta cicada.

Black, spotted with yellow; the elytra are surrounded with a thin edge, with six brown connected dots; the wings are white, marked with two black spots, and yellow at the base. 16. A native of Europe; the larva is edible.

Antenna filiform, situated under the eyes.

A. The sheath of the snout stretched out, obtuse, and grooved above. Ceropides.

Yellowish; the elytra brown, marked with two bifasciata white bands. 11. A native of Europe; on plants of different kinds.

Brown; the elytra are marked on the sides with spyma two white spots, and with a double interrupted whitish band. 24. A native of Europe; on various plants, frequently on the rose, on grass and osier; the larva and pupa of this, and some others of the genus, discharge a frothy matter from numerous pores about the tail, within which they are completely enclosed; this is frequently found in summer on various plants, very much resembling a quantity of saliva, and is commonly known by the name of cuckoo spit; the perfect insect will frequently leap two or three yards to escape from any one who attempts to catch it.

Brown; the fore part of the thorax marked with im-punctulata pressed dots, the elytra marked on the sides with two white spots. 212. A native of Europe.

† † The sheath of the snout very short, membranaceous, cylindrical, obtuse.

Legs formed for leaping. Ramatre.

Brown; wings transparent, spotted with brown, and nervose, marked with dotted ribs. 25. A native of Europe; on plants.

Yellow; the elytra gilt and brown. 123. A native of Britain; on plants.

‡ ‡ The wings deflected, covering the sides. Deflexae.

Yellow; the elytra marked with brown, with four aurata black spots, and gilt behind. 48. A native of Europe.

Yellowish; the elytra marked with blood-coloured quercus spots, and brown at the tips. 173. A native of Europe; on the oak.

240 species of this genus have been described in the last edition of the System of Nature.


Snout bent inwards. Antennae shorter than the thorax. Wings four, folded cross-wise, the upper ones coriaceous. Hind legs hairy, formed for swimming.

The insects of this and the next genus, Nepa, live in stagnant waters, and prey on aquatic animals; the larva and pupa are six-footed, active, and swim readily, and very much resemble the perfect insect; the larva is destitute of wings, the pupae have only the rudiments of wings.

Lip long.

The elytra gray, dotted with brown along the edge; glauca, and divided at the tip. 1. A native of Europe; in waters, very troublesome to fish. It swims on its back, for which reason it has been called by the Greek name of notonecta. The hind legs, which are longer than the rest, serve it as oars. When caught, it must be cautiously handled, as the point of its snout is very sharp, and its puncture very painful.

No.
ENTOMOLOGY.

Hemiptera.

inhabitant of most houses in large towns; crawling about in the night to suck the blood of such as are asleep, and hiding itself by day in the most retired holes and crevices.

† † The Elytra almost totally coriaceus. Coleoptera.

Black; without wings; the elytra oval, with yellow gryioidea, edges, and shorter than the abdomen. 33. A native of Europe. The thorax resembling the gryioeus.

† † † Membranaceous and very flat.

The thorax divided into three wings; the scutellum * pyri. resembling a leaf; the elytra reticulated and swelling out at the base. 157. A native of Europe; on the under surface of the leaves of the pear tree, which become spotted with its punctures.

B. Lip long, tapering to a point at the extremity.

† The Scutellum of the same length with the Abdomen.

Scutellati.

Black; the thorax marked with five, and the scutal-biocularum with three orange-coloured lines; the abdomen yellow, dotted with black. 6. There is a variety of this species.

(*) Red; the thorax marked with five, and the scutal migra-
tellum with three black lines; the abdomen yellow, neotae,
dotted with black. A native of Europe; on the flowers of the apple and elder.

† † † The Thorax armed with a spine on each side. Spinosi.

The thorax armed with blunt prickles; the elytra burke-
gray, marked with a brown spot, the shield emargi-
nated. 150. A native of England; in thickets.

† † † Thorax without spines.

A. Rotundati, such are round or oval.

Somewhat tawny, the edge of the abdomen spotted with brown. 45. A native of Europe; on berries. 455.

Blue, with a metallic luster; the thorax marked with a small line; the tip of the scutellum, and dots on the use.

eelytra, all of a red or white colour. 53. A native of Europe; on tetradyomous plants. It is very destructive to cabbages and to turnip fields.

B. Such as have the Thorax cingled.

† Antennae terminating in small hairs.


† † Antennae cactiaded.

Brown; head and thorax reddish. 679. A native of Europe.

C. Antennae filiform.

† Legs smooth.

Yellowish; elytra green. 36. A native of Europe; on pasture lawns.

† † Legs —
Entomology.

Hemiptera.

† † Legs notched or prickly.

calcaratus. Brown; the upper part of the abdomen of a blood colour; the thighs of the hind legs furnished with six sharp projections. 114. A native of Europe.

D. Antenna setaceous.

† † Legs notched.

abietis. Spotted, with tawny coloured spots; legs reddish; thighs thick. 115. A native of Europe; on the fir tree.

† † † Legs without prickles.

patulinus. Green, without spots; wings transparent. 82. A native of Europe; in meadows.

§ § § Linear; Body oblong and narrow.

|| Antenna setaceous.

secta. Variegated, with brown and yellow; the thighs of the hind legs long and notched. 124. A native of India.

|| || Antenna filiform.

stagnorum. Black and tapering; the thorax marked in the centre with two globular dots. 113. A native of England; very common in lakes.

|| || || Antenna clavated.

riepinorum. Greenish brown; the antennae long, with three erect prickles on the back. 124. A native of Surinam.

|| || || || Antenna double clavated.

vesicus. Ash-coloured; the thighs clavated. 542. A native of Europe.

|| || || || || Antenna with two terminations.

pul sinister. Whitish; all the legs very long; the thighs clavated. 120. A native of Europe; in meadows.

* * The Antenna placed above the Eyes; the Senses archet. Reduvii.

crumatus. The antennae resembling hairs at the tips; body somewhat hairy and brown. 67. A native of Europe; in rubbish. The larva is rough, and destroys the houses.

ridulces. Smooth, black; the elytra brown, spotted with black, and with a red edge. 557. A native of Europe. It is small, and moves about with great agility early in the spring; it keeps its antennae in constant motion, and makes a shrill noise by rubbing them against the thorax.

592 species of this genus have been described in the last edition of the System of Nature.

64. Macrophalus.

Snout bent inwards. Sheath of one valve, and consisting of three articulations, and furnished with three bristles, destined of jaws, feelers, and lip. Antennae stretched forwards, very short, elevated, and nearly oblong. Head oblong, cylindrical above. Scutellum of the length of the abdomen, flat and membranaceous.

A grayish-reddish colour; the scutellum of an ab-rimicoides colour; a yellow spot on the elytra; the wings of a purplish violet colour; the thighs of the fore legs thickened. 1. A native of America.

Only one species of this genus has been described in the last edition of the System of Nature.

65. Aphis, Plant-insect or Vine-fetter.

Snout bent inwards; a sheath of five joints, furnished with one bristle. Antenna setaceous, and longer than the thorax. Wings four, erect in none. Legs formed for walking. Abdomen frequently terminating in two horns.

The minute animals which compose this singular genus, infest various plants, generally in large societies, hindering their growth, and consuming their juices. A peculiarity in the mode of their propagation attracted the attention of naturalists a good deal towards the beginning and about the middle of last century. Reaumur, from some observations of his own, and from the opinions of some preceding observers, was led to believe, that they propagated without sexual connection. Bonnet adopted the same opinion, and thought he had established it beyond controversy by some very accurate experiments and observations of his own, which he communicated to the Royal Academy of Sciences. He shot up a young aphid, at the instant of its birth, in the most perfect solitude, which nevertheless brought forth 93 young ones in his sight. The same experiment being repeated on one of this family, it multiplied like its parent; and one of this third generation, brought up in solitude, proved no less fruitful than the others. Repeated experiments, in this respect, as far as the fifth or sixth generation, all uniformly afforded the same result. A suspicion entertained by Mr. Trembley induced Mr. Bonnet to repeat his experiments with still more accuracy, and to continue them longer. He reared to the amount of the tenth generation of solitary aphides, and had the patience to keep an account of the days and hours of the births of each generation: he discovered, that they are really distinguished by sexes; that the males are produced only in the tenth generation, and are but few in number; that these soon arrive at their full growth, and copulate with the females; that the virtue of this copulation serves for ten generations; he likewise found that they were viviparous during spring and summer; and that they were oviparous only in the tenth generation; that from these eggs the aphides of the following year were hatched early in the spring. His observations have been repeated by other naturalists, particularly by Dr. Richardson of Ripon, who has given a very minute account of his observations, in a paper published in the Philosophical Transactions, vol. xi. art. 22. These little animals discharge from their sauc a sweet fluid, commonly called honey-dose, which attracts the bees and ants. The species are very difficultly distinguished; it is still more difficult to describe them; different species are sometimes found on the same plant.
ENTOMOLOGY.

176  

*longiros-tris.* Of an ash-colour; the snout three times the length of the body. 34. A native of Europe; under the barks of trees; feeds on the larvæ of the ants.

*vitis.* 35. A native of Europe; on the vine. This destructive little insect cuts through the peduncles, or stems which support the clusters of grapes, in their very early stage, causing them to wither and drop off soon after the fruit is formed.

*pistacia.* Black; wings whitish; shanks of the legs very long; the thorax wartly. 33. A native of Europe and Asia; on the pistachia: the antennæ moniliform; eyes blackish; the abdomen without bristles, covered with white down, mixed with small balls; the wings sometimes erect. It is lodged in a follicle arising from the base of the leaf, swelling out in the middle, and tapering toward each end, of more than an inch in thickness, at first green, after the insects have left it becoming flesh-coloured.

77 species of this genus have been described in the last edition of the System of Nature.

66. CHERMES.

The snout is a sheath placed in the breast, furnished with three bristles, bent inwards. Antennæ cylindrical, longer than the thorax. Wings four, deflected. Thorax turgid on the upper side. Legs formed for leaping.

These insects inhabit various trees and plants, and produce by their punctures, protuberances and excrecences of various shapes and sizes, in which are frequently enclosed the eggs, and insects in several states; the larva is six-footed and apterous; the pupa is distinguishable by two protuberances on the thorax, which are the rudiments of future wings.

*graminis.* 1. A native of Europe; on grasses, particularly the atra flexuosa.

*castanea.* Brown; the antennæ setaceous and smooth; the wings very much ribbed. 21. A native of Europe; on different plants.

Twenty-six species of this genus have been described in the last edition of the System of Nature.

67. COCCUS, Cochineal.

The snout furnished with bristles, situated in the breast. Antennæ filiform. The anus furnished with bristles. Male with two erect wings; female without wings.

These are extremely fertile; and very troublesome in hothouses and greenhouses; the male is very active, with an oblong body, and ovate abdomen; the tail is furnished with a style and two long bristles; the female has a body nearly globular, and is inactive and fixed to different parts of plants.

*hesperi-dum.* Oval, oblong. 1. A native of Europe: on evergreen plants, in greenhouses, e.g. the orange, the laurel, &c.

*adonidum.* Reddish, dusted over with powder, and hairy. 4. A native of America and Africa, lately in the warmer parts of Europe; on trees. Body oval and whitish; antennæ and legs brown, marked on the back with an elevated line, and with a raised dot on each of its segments, with the edges of the side acute, furnished with fourteen prominent segments and raised dots; its surface sprinkled with as many dots set longitudinally between the clavated line on the back and the edge; the tail divided; the perfect insect constructs a follicle in which it conceals itself and its yellow eggs.

Body oblong, ovate; purple or chestnut. 17. On polonicus. The roots of the seleranthus perennis.—This insect without outpropriety may be called the cochineal of the northern part of the world. It prefers cold climates, and is commonly called cocca tinctoria polonicus, or the scarlet grain of Poland. It calls the plant on which it feeds the polyanthus cocceus; but it is not confined to one kind of vegetable, for it is found on the mouse-ear, pimpernel, and pellitory, as well as on the seleranthus perennis. It is a native of some other northern countries as well as Poland; though formerly the greatest quantity of it used to be collected there. Towards the end of June the cocca is in a fit state for gathering. Every one of these creatures is then nearly of a spherical form, and of a fine violet colour. Some of them, however, are not larger than poppy seeds, and others of the size of a pepper corn. The males are produced from the small grains, the females from the larger ones; each of them is lodged in a sort of cup like that of an acorn. These cups cover more than one half of the body of the animal. They are rough and of a blackish brown on the outside, and smooth and shining on the inside. At the roots of some of the plants only one or two grains are to be found, at the root of others more than forty are to be met with.

Those who collect the grains have a short spade, with which they raise the plants from the ground; after the insects have been collected they replace the plants; the grains are then separated from the earth, which may have adhered to them, by means of a sieve, and sprinkled with very cold water or vinegar to prevent them from hatching.

After this they are dried in the sun, or by gentle artificial warmth; but this must be managed with caution, as too hasty drying might injure their colour. Sometimes the grains are separated from their covers, and made up into balls.

According to Bernard de Bémath, the Turks and Armenians make use of these grains not only for dyeing silk and wool, but likewise the manes and tails of their horses. The Turkish women use it for tingling the tips of their fingers. The Dutch formerly mixed it with the true cochineal. The colouring matter extracted from this insect, by means of a solution of alum with the addition of a little chalk, is said to form a lake equal in beauty to that of Florence. The great superiority of the Mexican cochineal, has caused the scarlet grains of Poland to be neglected in all the countries of Europe where dyeing is best understood, as they contain not a fifth part of the colouring matter which may be extracted from the real cochineal.

Body depressed, downy, and transversely wrinkled; cocti. abdomen purplish; legs short and black; antennæ subulated, the third part of the length of the body. 22. A native of South America, on the coccus coccinellifer. The male is very small; its body is long, of a deep red colour; two long diverging threads proceed from the extremity of the abdomen; its wings are large, white, and incumbent; its legs are pretty long; the antennæ are nearly the length of the body.

The female is more than double the size of the male, when
when at its full growth, it is almost as large as a pea, of a dark brown colour, and covered with a white powder; the antennae are short; the body flat beneath, and convex above, and edged with annular segments distinctly marked; the legs are short.

The female of this insect is the real cochineal, so highly valued in every part of the world, for the incomparable beauty of the red colour which it affords, which forms so considerable a branch of commerce between the new and old continents. In the year 1736, there was imported into Europe 700,000 pounds weight, worth upwards of 700,000l. sterling. It was a long while made use of before its nature was ascertained: for a considerable time it was thought to be the fruit of some vegetable. The same opinion prevailed with regard to another species of coccus, which was much used as a dye before the introduction of the Mexican cochineal, and which, under the name of kermes, is collected in Spain, Sardinia, Africa, and Asia Minor. America is still the only quarter from which the true cochineal is to be obtained. The principal countries, where the cochineal insects are bred, are Oaxaca, Tizoc, Chulula, Nueva Galicia, and Chiapa, in the kingdom of New Spain; and Hambula, Loa, and Tacumian in Peru; but it is only in Oaxaca that they are gathered in great quantities, and form a branch of commerce; the cultivation of these little creatures being there the chief employment of the Indians. It is imported into Europe, in the form of small irregular grains, flat on the one side, and convex on the other: the best is of a slate grey colour, mixed with red, and covered with a white powder. There are two kinds of cochineal: First, the fine, called by different names, according to the places from whence it comes, viz. Mostique, Compsacana, and Tetracole; of these the last is reckoned the best. The second is called sylvoaster, from its being commonly collected from a species of cactus, which grows without culture; this is much inferior to the other, both in price and in the quantity of the colouring matter which it affords; it is likewise smaller, and generally believed to be a different species of coccus. The plant on which they rear the best cochineal is called nopal by the Indians, (cactus coccidentes) Linneas. The colour of the cochineal is by some supposed to be derived from the juice of this plant. Its flowers and the juice of its fruit are of a beautiful red colour. The natives of those countries where the cochineal is reared, form plantations of the nopal in small gardens near their houses; the plant is propagated by cuttings, which grow freely. In about eighteen months after the plantations have been formed they are fit for the reception of the insects. These plantations must be renewed every six years, as the insects succeed best on young vigorous plants.

The nopal will grow on almost any soil, and needs no other culture but to be kept clear of weeds, and protected from the north-wind. The insects are placed upon the nopal about the middle of October, the period at which good weather commonly commences in Mexico after the rains. Those who rear the insects, take care to preserve a sufficient number of females for this purpose, either by protecting them during the rainy season with a covering of mats, or by removing some branches of the nopal loaded with them into their own houses. Eight or ten of these females are put into a small nest formed of a tuft of threads collected from a species of palm, or of any other cottony matter, which is attached to the spines of the nopal, on that side of the plant exposed to the rising sun, the rays of which promote the batching of the young insects, which soon proceed in great numbers from the nest, as each female produces upwards of a thousand. The larvae spread over the plant, and soon fix themselves by means of their trunk; after this, should they by any accident be displaced, they inevitably perish, as their trunks are broken. In some districts the females are preserved during the rainy season in boxes carefully shut up. The males live for little more than one month; the females about double that time. Both of them remain in the state of larvae for about ten days; they remain fifteen days longer in the state of pupae. The males when they pass from the state of pupa get wings; but till that time they are not distinguishable from the females, except that they are only about half the size. After they acquire wings, they impregnate the female, and die. The female, in going through her different changes, does not change her form, but only casts her skin. After she has been impregnated she lives for about a month, and increases considerably in bulk; then lays her eggs, and dies. According to M. Thierry, there are six generations of these little animals in the year. They might be collected during the whole year, did not the rainy season check their progress, and almost entirely destroy them. According to all the writers on the subject, there are three collections made of them yearly. The first takes place about the middle of December, and the last in the month of May. When they make the first collection, they take away the nests, and pick out the dead females, which had been placed on the nopal the preceding October. The second collection is made when the insects again begin to produce young. The insects are detached from the plant with a knife, the edge and point of which have been blunted, to prevent the nopal from being injured. The insects are received in a vessel as they are separated from the plant, put to death, and dried. The Indians have several ways of killing these insects; which they are anxious to accomplish as soon as possible, because the females may live for some time after they are detached, and produce their young, which might escape and diminish the quantity of cochineal collected. Some natives put the cochineal in a basket, and dip them in boiling water; afterwards they expose them to the sun to dry.

Others put them in a hot oven, or on heated plates of iron. But it appears that the best cochineal is obtained by following the first mode. The different colours imported into Europe depend entirely on the mode of killing the insects. That which has been killed by dipping in boiling water, loses part of the white powder, with which they were covered, and acquires a brownish red colour; this kind is called remigris. That which is killed in an oven retains the white powder, and remains of a gray colour; this is called forbesia. That which is killed by plates of heated iron becomes blackish, and is called negro.

The dead females, which are taken from the nests which had been put on the nopal, lose more of their weight in drying than the insects which are taken off alive and full of young; the first losing three-fourths, and the last two-thirds in drying. After it has been dried...
i may be kept for any length of time without losing either weight or colour.

It requires much care and attention to preserve these insects from their numerous enemies. The principal enemies which infest the cochineal are, the larvae of a species of coccinella, which suck them, and leave nothing but the skin. A caterpillar of about an inch long, and of the thickness of a crow quill, is their most destructive enemy, which would soon destroy the whole mass were they allowed to carry on their depredations without molestation. The larvae of a species of ptinus feeds on them likewise. There is a species of insect which lives on the nopal in great numbers, and does as much injury to the plant as the cochineal insects themselves do; which pinches their body, prevents them from taking nourishment, and causes them to drop from the plant. A small mouse which always prefers the fine cochineal to the sylvester, because the cottony matter with which the sylvester is more abundantly covered entangles its teeth, also preys on them. Many birds, too, are fond of them, and would destroy great numbers of them, were they not driven away by the owners of the plantations.

The sylvester is smaller than the true cochineal; their bodies are covered with a white cottony matter, and edged all round with hairs. About eight days after they are fixed, the cottony matter and the hairs increase in length, and become so closely attached to the plant, that part of them is commonly left adhering after the insect has been removed. Though these insects commonly feed on a small species of cactus, which grows wild, the Indians frequently rear them on the nopal, because they are collected from it with much more facility than from the uncultivated species: for the most dexterous workman cannot collect more of the insects in one day than will produce two ounces of cochineal when dry; whereas he can collect from the cactus coccinellifer as many as will yield three pounds when dry. There is another advantage obtained from rearing the sylvester on the nopal which they cultivate in their gardens; the insects become almost as large as the true cochineal, and lose more and more of their cotton covering in proportion to the frequency of their reproduction. The sylvester has been lately introduced into the British settlements in India. The following account of its introduction and comparative value has been published by Mr Nicholas Fontana, who resided for many years in that part of the world.

The introduction of cochineal into Bengal, which our neighbours had endeavoured to naturalize in their West India possessions, deserves particularly to be marked, as being likely, under proper management, to become not only a new era in the progressive resources of the company, but an accession of opulence to the British empire: an era the more remarkable, as notwithstanding the attempts of government, the design was not accomplished but through accident, the great parent of discovery, which, with never-ceasing influence, operates in many ways for the good of mankind.

"After a large plantation of the various species of opuntia had been reared at Madras, waiting only the arrival of the insect to make it serviceable, which a long correspondence of thirteen years could not obtain, Dr Anderson's solicitations about it had almost been for-gotten; yet though his laborious industry and zeal for his country's interest, had no other reward, the introduction of the cochineal insect into India is entirely owing to his publications on the subject, which fortunately fell into the hands of Captain Nelson, who was then stationed at Madras with the 52d regiment. On the captain's return to India in 1795, the fleet in which he sailed, repaired for refreshment to the port of Rio de Janeiro. In his perambulations a little way out of this town, he was attended as usual by the centinel, when he saw a plantation of opuntia with the insect upon it. This circumstance immediately brought to his recollection the ardent wish for the importation of the insect expressed in the letters he had read at Madras; and he conceived the hope of being able to gratify Dr Anderson's desire, by carrying some to India with him.

"A day or two previous to his embarkation, he took another walk to the place where he had seen the opuntia or nopal. He made bold to ask the cultivators for some of the plant, being curious, he said, in matters of natural history. Having collected several other plants, he wished to have this also. The good people being the less suspicious as he was in his regimentals, granted his request. They gave him several plants with insects on them, which he carefully carried aboard. Many of these, during the passage to Bengal, which was remarkably long and tedious for such delicate passengers, died. A few insects only remained alive on the last plant, several of the leaves having withered.

"Captain Nelson, on his arrival at Calcutta, sent the survivors to the botanic garden, where they were distributed on the different species of the opuntia. This well nigh frustrated the whole labour. On the Chia and Manilla species, they were found to die fast. It fortunately occurred to make trial on the indigenous opuntia of Bengal, which is also abundant in many parts of India. On this the insects thrived amazingly; insomuch, that from these few, in the course of four or five months, a quantity had been collected sufficient for distribution among all who wished to try the rearing of them, and several plants upon which the insects were feeding were sent to Madras.

"The novelty and importance of the object promising so speedy and plentiful a harvest of fortune, engaged a multitude of individuals to undertake the business; and this, no doubt, the more readily, as the cultivation of this field of wealth required but very little capital. Many golden dreams were enjoyed by the new planters. All who had a mind were provided with insects; and undertook plantations of opuntia.

"The anxiety and impatience natural to all, who, indulging in ardent expectations, undertook new enterprises, induced some of the planters of nopal to put the insect upon it when the plant had just emerged from the ground. Others, through inattention, kept their insects in places too near to where the opuntia was growing young, which in that tender and premature state was devoured by these creatures when hard pressed by hunger. The unskilful mode of drying was likewise adopted; and some of those persons whose opinions led the multitude, declared in the most decided and positive manner, that the cochineal would never answer, as it would not be found worth the trouble and expense attending the cultivation of it. All these considerations damped in a great measure the ardour of the enterprise. Many
Hemiptera.

Many abandoned the pursuit, and left the insects to provide for themselves, after the plants destined for their use were destroyed, wherever they could find nourishment. They were seen flying about indiscriminately on various other plants, and thus perishing; while others rooted out the plantations, and employed the ground for other purposes.

"Besides the discouraging circumstances already mentioned, it was urged that the species imported into India was the grama eelhostriz, and that the first specimens sent home had been of no value. They had grown lumpy and musty for want of being properly dried, or thoroughly divested of the cottony matter with which the insect is covered. But supposing, it was added, that a proper mode of drying and preparing it could be found out, and the cultivation of it brought to the greatest perfection, it would soon stock the market, as there is a certain quantity only, and that not very great, which is required for Europe. This would soon be supplied, and loss instead of gain would accrue to the planters. This excess, however, it was farther urged, was to be presumed only in the case of the country being able to supply plants sufficient for the food of the insect, which was very doubtful on account of its quick reproduction, as it sends forth a new generation every forty days. These, with other objections of less force, may easily be refuted by any impartial observer acquainted with the nature of the climate and soil of India, even without any kind of knowledge of agriculture. In such a vast extent of territory as that of the East Indies Company, and lying under such a variety of climates, it is not surely impossible, or very difficult to find a climate and soil fitted for the naturalization and rearing the cochineal insect, and where the plants will grow to proper size for affording it food, in the same manner as in the districts of Mexico, where the people who take most pains, have them growing to such a height as to require ladders to gather the insects. Such a state of the plant would check the too rapid reproduction of the insect, and at the same time improve its quality; for it is a fact, that the sylvestre cochineal, when bred upon a well grown nopal, loses part of its tenacity, and grows to a double the size of that gathered on gummy plants, and is less covered with the cottony substance.

"The cultivation of cochineal, would in all probability be greatly favoured by the vicinity of a hilly country; such as the Boglepore, Rajahmali, and Purna. It can be ascertained by good authority, that there are already in the Chittagong district, plantations of large oponias, which have been growing for two years past. Whenever the insect shall be placed on these plants, we shall see cochineal of a very good quality. The nature and habits of the natives seem entirely calculated for the employment of gathering the insect; work that may be done by men, women, or boys.

"As to the drying the insects, there is no country where the sun has such influence as in Bengal. The method of drying in the sun, after scaling the insect in hot water, is that practised in Mexico and Brazil: the insects collected in wooden bowls are thereby spread from them on a hot dish of earthen ware, and placed alive on a charcoal fire, where they are slowly roasted, till the downy covering disappears, and the aqueous juices of the animal are wholly evaporated. During this operation, the insects are constantly stirred about with a tin ladle, and sometimes water is sprinkled upon them, to prevent absolute torrefaction, which would destroy the colour; but a little practice will teach them to remove them from the fire, though surely its barbarity ought to prevent its adoption.

"By an estimate, made on a large scale, of the necessary expense that would attend the cultivation of one hundred bighas of opuntia, it appeared, that after making every possible allowance for ground rent, ryots gathering, and an European overseer, and interest on disbursements at twelve per cent. the quantity produced of grama eelhostriz, during nine months of the year, reckoning it at four sicas rupees per seer of thirty-two ounces, would more than treble the capital employed. But if this calculation be just in the vicinity of Calcutta, and there is no reason to suppose it otherwise, where labour and ground rent is dear; how much would the whole expense of cultivation and preparation be, if transferred to a greater distance, and to the other provinces!

"When the insect has been well dried, it should be packed immediately, as it might otherwise be affected by the damp air of Bengal. In this business the method used in Mexico should be followed; which is to put it first into a linen bag, covered with a compact net; and then over the whole an ox's hide sewed so closely as to render it impervious to water.

"For some of the cochineal which I wanted for the purpose of making experiments, collected at Entally, two miles from Calcutta, I paid in 1796 sixteen rupees per seer; for the same quantity raised by another planter the following year eight rupees; and in 1799, I might have bought a great quantity, part of which came one hundred miles from Calcutta, at five rupees per seer.

"The improbability of the grama eelhostriz, by attention, will be ascertained more clearly by the following fact, than by a thousand arguments. Some merchants, at my recommendation, bought about two hundred pounds of cochineal made at Rassapugil, five miles from Calcutta, at five rupees per seer. The same house paid for seven muns, or 280 seers, to Mr. Stephens at Keerpay, seven rupees per seer; and I can say, that it was the best of the sort that had yet been seen in the town, both for its size, cleaning, and drying.

"Let us now suppose for a moment, such cochineal as that made at Keerpay, to be the best that can ever be obtained at Bengal, and that the above may be within a rupee, more or less the average price. The grama fins that is brought to Bengal by way of Manilla, sells, when abundant, at sixteen rupees per seer, but often at nineteen and twenty. The Bengal sylvestre contains only from 36s to 2s parts of the colouring matter contained in the other; but say only half, so that the manufacturer will be obliged to use two seers instead of one, the quality of the colour to be the same; even at this rate, the silk manufactories at Bengal might be supplied with it, with a yearly saving. After admitting that fact, if the quantity be increased, there will be a demand for it in the China and English markets, though only of the sylvestre kind. Supposing it for ever to remain such, by leaving it to the indolent natives only, even this would be a great acquisition, considering the various ways in which it can be employed by the dyers. Besides, if the prices were immediately to fall, so as not to indemnify the present freight and insurance to the private adventurers, how easy would it be to reduce the in-
ENTOMOLOGY.

Hemiptera.

sect to a much smaller bulk, by making a lake, and producing carmine no less valuable than the grana fina.

"The overstocking of the market, however, with a drug so important, and of such extensive use, is not a thing very likely to happen. The manufacturer, wherever he could get it at a low price, would use it generally, and substitute it in the room of other materials for reds, such as madder, red-wood, and others, used for woollens, and silks; besides the great varieties of shades from scarlet and crimson, down to all those various tints to be obtained by modifications of re-agents from cochineal, with a brilliancy, and stability, that would soon repay the small additional expense that might be incurred by the substitution.

"It is a thing greatly to be wished, by every citizen and patriot, that the Bengal cochineal may soon be brought to such a degree of perfection, and produced in such plenty, as may admit of a reduction of its price sufficient to induce the calico printers in Europe to use it more commonly than hitherto, in the dyeing of cotton; which would open a much wider field for its consumption. As to the shyness of cotton to the admission of this animal colour, it is not an obstacle that ought by any means to be considered as insurmountable in the present state of chemistry, advancing so rapidly to further improvements, and particularly applying with vast success many of its operations to the art of dyeing. The few unsuccessful attempts made by manufacturers and chemists to fix this colour on cotton, have been defeated more by the deadness of the drug, than by any impracticability of the design. This exhausted at once the purse and patience, both of the artist and chemist; and precluded that continuation, repetition, and diversification of experiment, which is necessary to the completion of new inventions.

"It was upon cotton that the Spaniards first saw the cochineal used in Mexico; but for want of preparation it produced but a dull crimson. When some of the dried Bengal insect was shewed to the vaeelo of the rajah of Napaui, residing as minister to our government at Calcutta, he soon knew it, and declared that it was always used in dyeing his country robes and turbans. The opportunity arising from the management of a chintz manufactury, induced me to make some trials of cochineal in cotton cloth and thread. By these it was ascertained, that the quantity of colouring matter contained in the Bengal cochineal of 1796, compared with the grana fina, was from nine or eleven to sixteen. I then repeated, as far as the chemical reagents to be obtained in India would permit, various experiments of the kind mentioned by Dr. Bancroft, in his first volume of the Philosophy of Fast Colours; and nearly with the same success, in variety of shades, and degrees of permanency. From these experiments, there resulted two considerable benefits to that manufactury: the first was, that I was induced to make an addition of a certain quantity of powdered cochineal to the morinda root, for the fine cloths and muslins that were to undergo the boiling process in the vat. The second, I was led to mix with the basis for printing red (alum), a decoction of cochineal, instead of the turmeric or red wood, formerly used by printers in tracing their designs. This last substitute was only boiled in simple morinda, and the other with the addition of cochineal. By this process, deep and brilliant reds were obtained, such as had not hitherto been seen in Bengal."

The cultivation, therefore, of the cochineal insect, is an object worthy of all the countenance and care of government. The attempts towards its naturalization ought not by any means to be abandoned; but continued with all persevering industry, and unwearied attention to every circumstance that may promote so important a branch of commerce. For this article we send annually immense sums to the Spaniards. Not only might this expense be saved to Britain; but, in due time, the rest of the world might be supplied from the Bengal produce of this valuable commodity. It is in the recollection of most people conversant with India affairs, how the first specimens of indigo sent home from Bengal were depreciated and rejected. Hence the cultivation of it was obstructed for some years. But when it began to be attended to in 1780 and 1782, by people who were acquainted with the best modes of manufacturing it, it was improved with such rapidity that in 1790, some of the Bengal indigo was judged to be equal to the Guatimala, and bore the same price. The quantity sent home in the years 1795 and 1796, was far beyond what had ever been imported into the port of London from all the world, and more than is required for the annual consumption of Europe. The use of indigo in the dye-house is very circumscribed, and confined chiefly to the colours of blue and green. It gives also a few finer blacks, with line grounds; but it cannot, like cochineal, be applied to the various principal colours, as crimson, scarlet, purple, and all the intermediate shades.

Body red; antennæ branched; tail furnished with fiese.

two bristles. 23. A native of India; on the fiese re-
ligiosa and indica. This is the insect which produces
the gum lac.

In the months of November and December, they first appear, and traverse the branches of the trees on which they are produced for some time, and then fix themselves on the extremities of the young branches. The middles of January, they are all fixed in their proper situations, when they appear as plump as before, but show no other signs of life. The legs, antennæ, and setæ, are no longer to be seen. Around their edges they are environed with a subpellicular liquid which seems to glue them to the branch; it is the gradual accumulation of this liquid which forms a complete cell for each insect, and is what is called gum lacca. About the middle of March the cells are completely formed, and the insect is in appearance an oval smooth red bag without life, about the size of a small cochineal insect, margined at the obtuse end, full of a beautiful red liquid. In October and November, we fine about twenty or thirty oval eggs, or rather larvae, within the red fluid of the mother. When this fluid is all expended, the young insects pierce a hole through the back of their mother, and walk off one by one, leaving their exuvia behind, which is that white membranous substance found in the empty cells of the stick lace.

These insects feed on some other trees besides the fiese religiosa and indica of Linnaeus, viz. on the rhom-
us japonica (Linn.) and on the plano, (Hort. Malabar.). The insects generally fix themselves close together, and in such numbers, that scarcely one in six can complete her cell; the others die, and are eaten by various insects.
Hemiptera: ENTOMOLOGY.

The extreme branches appear as if they were covered with a red dust, and their sap is so much exhausted that they wither and produce no fruit; the leaves drop off or turn to a dirty black colour. These insects are transported from one tree to another by birds. It is worth observing that these fig-trees exude, when wounded, a milky juice, which instantly coagulates into a viscous,ropy substance, and when dry resembles the gum lac.

A resin is procured by incising the placa, so similar to the gum lacca, that it may readily be taken for the same substance. Hence, it is probable, these animals have but little trouble in preparing the sap of the trees for the construction of their cells.

The gum lacca is rarely seen on the rhamnus Jujuba, and is inferior to what is found upon the other trees. This gum, in Bengal, is principally found on the uncultivated mountains on both sides the Ganges, where it is produced in such abundance, that the markets might be readily supplied, were the consumpt ten times greater than it is.

The only trouble in collecting it is in breaking down the branches. The best lac is of a deep red colour: if it be pale and pierced at top, the value diminishes, because, the insects having escaped, it cannot be useful as a dye, though it may answer better as a varnish.

These insects and their cells have been variously denominated: viz. gum lacca, lock, lacitra, and in Bengal lacscha. By the English, lac is divided into four kinds: viz. stick lac, gum lac, seed lac, and shell lac; for which, and their varieties, see the article Lac.

The following account of the lac insect by Dr William Roxburgh, is published in the Asiatic Researches, vol. ii.

Some pieces of very fresh looking lac, adhering to small branches of the mimosa cinereus, were brought me from the mountains on the 20th of last month. I kept them carefully; and to day, the 4th December, fourteen days from the time they came from the hills, myriads of exceedingly minute animals were observed creeping about the lac and branches it adhered to, and more still issuing from small holes over the surface of the cells: other small and perforated excrescences were observed with a glass among the perforations; from which the minute insects issued, regularly two to each hole, and crowned with some very fine white hairs. When the hairs were rubbed off, two white spots appeared. The animals, when single, ran about pretty briskly; but in general they were so numerous, as to be crowded over one another. The body is oblong, tapering most towards the tail, below plain, above convex, with a double or flat margin; laterally on the back part of the thorax are two small tubercles, which may be the eyes; the body behind the thorax is crossed with 12 rings; legs six; feelers (antennae) half the length of the body, jointed, hairy, each ending in two hairs as long as the antennae; rump, a white point between two terminal hairs, which are as long as the body of the animal; the mouth I could not see.

On opening the cells, the substance that they were formed of cannot be better described, with respect to appearance, than by saying it is like the transparent amber that beads are made of: the external covering of the cells may be about half a line thick, is remarkably strong, and able to resist injuries: the partitions are much thinner; the cells are in general irregular squares, pentagons, and hexagons, about an eighth of an inch in diameter, and a fourth deep; they have no communication with each other; all those I opened during the time the animals were issuing, contained in one half a small bag filled with a thick red jelly-like liquor, replacing what I take to be eggs; these bags, or utriculi, adhered to the bottom of the cells, and each had two necks, which pass through perforations in the external coat of the cells, forming the fore-mentioned excrescences, and ending in some very fine hairs. The other half of the cells have a distinct opening, and contain a white substance, like some few filaments of cotton rolled together, and numbers of the insects themselves ready to make their exit. Several of the same insects I observed to have drawn up their legs, and to lie flat; they did not move on being touched, nor did they show any signs of life, with the greatest irritation.

December 5th. The same minute hexapodes continue issuing from their cells in numbers; they are more lively, of a deepened red colour, and fewer of the motionless sort. To day I saw the mouth; it is a flattened point, about the middle of the breast, which the little animal projects on being compressed.

December 6th. The male insects I have found today. A few of them are constantly running amongst the females most actively; as yet they are scarce more, I imagine, than one to 5000 females, but twice their size. The head is obtuse; eyes black, very small; antennae clefted, feathered, about two-thirds the length of the body; below the middle an articulation, such as those in the legs; colour between the eyes, a beautiful shining green; neck very short; body oval, brown; abdomen oblong, the length of the body and head; legs six; wings membranaceus, four, longer than the body, fixed to the sides of the thorax, narrow at their insertions, growing broader for two-thirds of their length, then rounded; the anterior pair is twice the size of the posterior; a strong fibre runs along their anterior margins; they lie flat, like wings of a common fly, when it walks or rests; no hairs from the rump; it springs most actively to a considerable distance on being touched; mou h in the under part of the head; maxillae transverse.

To-day the female insects continue issuing in great numbers, and move about as on the fourth.

December 7th. The small red insects still more numerous, and move about as before; winged insects, still very few, continue active. There have been fresh leaves and bits of the branches of both mimosa cinereus and corisae put into the wide-mouthed bottle with them; they walk over them indifferently, without showing any preference, nor inclination to work nor copulate.

I opened a cell whence I thought the winged flies had come, and found several, seven or ten, more in it, struggling to shake off their encumbrances; they were in one of these utriculi mentioned on the 4th, which ends in two mouths, shut up with fine white hairs, but one of them was open for the exit of the flies; the other would no doubt have opened in due time; this utriculus I found now perfectly dry, and divided into cells by exceeding thin partitions. I imagine, before any of the flies made their escape, it might have contained about twenty. In those minute cells with the living
ENTOMOLOGY. Lepidoptera.

flies, or whence they had made their escape, were small, dry, dark-coloured, compressed grains, which may be the dried excrements of the flies.

Shining brown, covered with white down. 6. This insect is commonly called kermeis grynaeus, and inhabits the quercus coccifera of the southern parts of Europe. Mr. Heliot of the French Academy of Sciences, in his Art of Dying, chapter 12, says it is found in the woods of Vauvert, Vaudemus, and Narbonne; but more abundantly in Spain, towards Alicant and Valencia; but also in Murcia, Jaen, Cordova, Seville, Estremadura, la Mancha, Serranias de Cuenca, and other places. In Xixona, and Tierra de Belloc, there is a district called de la Gran, where the people of Valencia first began to gather it, whose example was followed all over Spain. It has some years produced 5000l. to the inhabitants of Xixona. Both the ancients and moderns seem to have had very confused notions concerning the origin and nature of the kermeis; some considering it as a fruit: this opinion was entertained by Pliny, and by most of the ancient naturalists; others taking it for an excrescence formed by the punctures of a particular fly, like the common gall observed upon the oak. Tournefort was of this number. Count Marsigli, and Dr. Nisoli, a physician of Montpelier, made observations and experiments, with a view of discovering its nature, but did not perfectly succeed. Two other physicians at Aix in Provence, Dr. Emeric and Dr. Garidel, applied themselves about the same time with greater success; they discovered the kermeis to be nothing else than the body of an insect. About the beginning of March they are perceived on the branches of the quercus coccifera, very small; they soon fix themselves and become immoveable, after which they increase rapidly in size. In April they arrive at their full growth, and are nearly about the size of a pea. About the end of May, sooner or later, according to the warmth of the climate, the husk appears replete with small eggs, less than poppy seed. These are properly ranged under the belly of the insect, progressively placed in the nest of down that covers their bodies. After this it soon dies, though it still adheres to its position, rendering a further service to its progeny, and shielding them from the inclemency of the weather, or the hostile attacks of an enemy. In a good season they multiply exceedingly, producing from 1800 to 2000 eggs. In Languedoc and Provence the poor are employed to gather the kermeis; the women letting their nails grow for that purpose, in order to pick them off with greater facility.

The custom of lopping off the boughs is very injurious, as by this means they destroy the next year's harvest. Some women will gather two or three pounds a-day; the great point being to know the places where they are most likely to be found in any quantity, and to gather them early with the morning dew, as the leaves are more pliable and tender at that time, than after they have been parched by the rays of the sun: strong dews will occasionally make them fall from the trees sooner than usual; when the proper season passes, they fall off themselves, and become food for birds, particularly doves. Sometimes there is a second collection; but the insects are commonly smaller, and do not afford so much colouring matter. The insects which are produced in the spring, are generally found adhering to the bark;

those of the second crop are commonly attached to the leaves.

Those who buy up the kermeis for exportation, spread it on linen, taking care to sprinkle it with vinegar, to kill the insects, which causes a red dust to separate from them; in Spain, this is carefully collected, and kept apart by itself. After it has been dried, they pass it through a saccara and put it up into bags. In the middle of each, its proportion of red dust is put into a leather bag, which likewise belongs to the buyer. The people of Hinojos, Bonarea, Villalba, and of some other parts in Spain, dry it on mats in the sun, stirring it about, and separating the red dust, which is the finest part; which they sprinkle with vinegar, and call postill. The kermeis is much in request on the coast of Barbary, particularly that which comes from Spain. The people of Tunis mix it with what is brought from Tetuan, for dyeing those scarlet caps so much used in the Levant.

43 species of this genus have been described in the last edition of the System of Nature.

68. THIRPS.

Soot concealed within the mouth. Antennae filiform, of the same length with the thorax. Body linear. Abdomen capable of being bent upwards. Wings four, straight, incumbent, narrower than the body, and nearly forming a cross.

The insects of this genus leap about very actively on flowers; their feet are vesicular; the larvae are equally active with the perfect insect; commonly red.

The elytra yellowish; body black. 2. A native of Europe; on compound flowers. It shuts up the flowers of the lotus corniculatus, and causes them to swell out; it is very destructive to wheat and rye, frequently rendering the ears quite empty.

Eleven species of this genus have been described in the last edition of the System of Nature.

III. LEPIDOPTERA.

Wings four, covered with small scales laid over one another, like tiles on the roof of a house. The mouth furnished with a spiral tongue. Body hairy.

69. Papilio, the Butterfly.

Antennae thicker towards the points. Most frequently they are both elevated and furnished with a knob at the extremity. Their wings, when at rest, are for the most part erect. They fly about in the day-time.

The butterfly feeds on the nectarious juice of flowers, or on the saccharine juice which exudes from the leaves of vegetables. Their larvae are active, and run about a good deal. They are furnished with tentacula and 16 feet; some are naked, others covered with prickles, and feed on the leaves of plants. The pupa is naked, and remains torpid for a longer or shorter period; frequently adhering to different substances, by means of threads attached to its middle or head. The perfect insect is furnished with two feelers, but wants jaws, and has
Lepidoptera.

ENTOMOLOGY.

has four or six feet. Their names are frequently taken from the plants on which they feed.

These butterflies which belong to the family of knights are, for the most part, furnished with filiform antennae; and with a tail or long appendix to the wings; the larvae are commonly variegated, and few of them are natives of Europe.

Lianzeus has arranged the genus of butterfly into six divisions, and these again into many subdivisions.

1. EQUITES. Alis primo-

ribus ab angulo posterior-

re ad apicem longioribus

quasi ad basin; his sepe

antennas filiformes.

A. Troes. Species nigri. A. Trojans. Those equi-

tes that are generally black, and marked on the

breast with spots of a blood-red colour.


b. Alis fasciatis. b. Wings marked with

bands.

2. HELICONII. Alis an-

gustis integerrimis, sepe

denudatis; primoribus

oblongis, posterioribus

brevissimis.

B. Achivi. Pectora non

cruenta, ocello ad angu-

lam ani.


b. Alis fasciatis. b. Wings marked with

bands.

2. HELICONII. Those which

have narrow and perfectly entire wings, frequently

bare, the upper ones oblong, the under very

short.

3. PARNASSII. Alis in-

tegerrimis rotundatis.

A. Parnassii. Those with

wings perfectly entire, the upper pair being round.

4. DAMAII. Alis integ-

errimis.


B. Festivi. Alis variegas.

B. Festivi. Wings varie-

gated.

5. NYMPHALES. Alis den-

ticulatis.

A. Gemmatis. Alis oc-

elatas.

a. In alis omnibus.

b. primoribus.

c. posterioribus.

B. Phaleratis. Alis abaque

ocellis.

6. Plebeii. Parvi, larva

sepius contracta.

A. Rurales. Alis macu-

lis obscurioribus.

B. Urbicola. Alis macu-

lis sepius pellucidus.

1. EQUITES.

A. Troes.

† Wings furnished with a tail.

Wings of the same colour, both on their upper and hector.

under surfaces, black; the upper ones marked with a white band, the under with red spots. A native of India; on the aristolochia. The white band on the upper wings is composed of eight white half-divided spots. The scarlet spots on the under wings are round and form a double arch.

Wings black, both above and below marked with a smacianus.

white band, common to both wings; that on the lower clouded with red. A native of Brazil. It resembles the tinctoria; body black, breast marked with blood-coloured spots.

Wings of the same colour, both on their upper and androcer.

under surfaces, black spotted with white; the under ones marked with circular red spots along their edges. A native of India. Head red; antennae and thorax black; abdomen white, with red bands; wings marked with numerous white spots, the lower part greenish in the middle, with a red circular spot at the angle of the tail.

Wings nearly of the same colour on both upper and glicans.

under surfaces, clouded; the upper wings marked with a yellow spot, the under with a tawney one near the tail. A native of America. The under surface of the lower wings are marked with red and yellow spots.

Wings black, sprinkled with green and gold dots; palinurus.

and marked with a bluish green band. A native of Tranquebar. Body covered with green and gold specks. Wings black, speckled with white on their under surface. The upper ones ash-coloured at the tip, the under marked with tawney spots along their edges.

Wings black, the under ones of a shining green, thephilon.

under surface marked with seven red spots somewhat resembling eyes. A native of America. Body black; abdomen speckled with white; margin of the upper wings variegated with white and black; under ones with a few white specks; the margin variegated with white and black, marked with a white dot at the base on the under surface; the tip greenish, with seven round tawney dots surrounded with a black ring, and marked with a small white lateral dot.

Wings black, with a white band; the under surface assius.

of the lower wings marked at the base and at the tip with red. A native of America. Thorax marked with an ash-coloured lateral line; breast with an ash-coloured dot on each side; abdomen with an ash-coloured lateral line beneath; upper wings with both surfaces alike; under ones black above, with three scarlet circular spots at the angle of the tail, and five white ones at the margin, brown beneath, marked with red spots at the base, a red line at the inner margin, and three circular spots at the angle of the tail, with four white circular spots on the outer margin.

†† Wings notched.

Wings notched, and silvery, the upper ones green on priamus.

their superior surface, marked with a black spot, the under with six black spots. A native of Amboyna. This.
This is the most remarkable species of this genus, both for its size and beauty. Head and legs black; abdomen bright yellow, and the sides of the thorax varie- gated with scarlet lines.

Wings of the same colour on both their upper and under surfaces, black; the under wings marked with seven oval scarlet spots. A native of America; on the orange tree. The larva is prickly, brown marked with white circular stripes, and furnished with tentacles. They are gregarious. Pupa: brown, marked with four projections on its anterior part.

B. Achivi.

† Wings furnished with a double tail.

pyrrhus. Wings brown, each of them marked with a white band, the band on the upper wings as it were halved. A native of South America and India.

strecites. Wings of a dusky blue, marked on both sides with a white band, the edges of the under one green. A native of Africa.

† † Wings furnished with two notched tails.

tricidates. Wings black on their upper surface, spotted with blue, and marked with a dotted white edge. A native of Ambonya.

dollus. Wings brown; marked with a yellow band on their upper surface, and on their under surface with a white band and white spots. A native of Africa.

† † † Wings furnished with two very slight tails.

-socles. Wings striped with white and yellow, with a white band in the middle; the lower wings marked on their under surfaces with a strip of dots resembling little eyes. A native of Siam. Of a middle size, and very tender.

† † † † Wings notched and furnished with a tail.

polycoen. Wings black, marked with a yellow band; the under surface of the lower wings marked with tawny blue and yellow circular spots. A native of Surinam; feeds on some species of the oliscaea.

siphers. Wings black, the upper spotted with white, the under ones marked with a yellow band. A native of Africa.

† † † † Wings furnished with a tail.

ulysses. Wings black, with a blue radiant centre; the under surface of the lower ones adorned with seven ocelli. A native of Asia.

agamemnon. Wings black, spotted with green; the under surface of the lower ones adorned with an ocellus, and with red spots. A native of Asia.

* machaon. Wings of the same colour in both surfaces, yellow with a brown edge, marked with yellow circular spots, and with a tawney one at the angle of the tail. A native of Europe; on umbelliferous plants, and on rue. The larvae are seldom found in numbers together, are smooth and marked with annular stripes of green and blacked, dotted with red; their tentacula are short and yellow. They emit a very disagreeable smell, by which they keep off the ichneumon. Their pupa is black and yellow. The under wings are adorned with an eye of a yellowish-red colour, encircled with blue, which is situated at the edge nearest the extremity of the abdo- men. This is the largest and one of the most beau- tiful butterflies which Britain produces. It changes in- to the pupa in July, assumes the winged state in August, and frequents meadows. Sometimes it appears in May.

Wings nearly of the same colour both on their upper podophor and under surfaces, marked with brown bands set in us. pairs; the under surface of the lower wings marked with a blood-coloured line. A native of Europe and the northern parts of Asia and Africa. It feeds on different species of the brassica: Larva solitary, yellowish dotted with brown; head pale green; pupa yellowish dotted with brown, marked with two slight projections towards the anterior extremity.

Wings white, the upper ones marked with black alcibiades bands along the edges, the under ones marked on their superior surface with red near the tip. A native of Tranquebar. Head tawny, with a broad black line in the middle; thorax downy and asb-coloured, marked with two tawney spots; abdomen whitish, marked on the sides with a line of black blotches; upper wings greenish at the base; under ones marked with a black spot near the tail, and marginal circular spots; tail long, black tipped with white, streaked with black beneath.

† † † † † † Wings terminating in a slight projection faintly resembling a tail.

Wings brown, marked on their under surfaces with philiops. white bands, adorned with two eyes, and with a double eye at the tail. A native of India. The female much larger than the male.

Wings brown, black at the tip, spotted with white; aurora the under wings on their lower surfaces adorned with two eyes. A native of India.

Wings, upper surfaces brown; under wings with a Jason band marked with six green blotches. A native of South America and India.

Wings brown: the under wings marked with twofilobates blue ocelli, with black pupils, and three white dots. A native of South America and India. The female has a tuft of long diverging hairs at the end of the upper wings.

Wings black, marked with a plain green band; the nervus under surfaces of the wings are blackish. A native of South America and India.

† † † † † † † Wings notch.

Upper surfaces of the wings of a bright blue, the menetes, under spotted with brown. A native of South America. The larva prickly and yellow, marked with rose- coloured stripes; head brown and feet red. Pupa pale, and has a cylindrical inflected tail.

Upper surfaces of the wings brown, spotted with nector. white, and blue in the centre; their under surfaces adorned with three or four eyes. A native of America.

Wings brown; the upper surfaces of both have a telamachus large radiated disk, the under surface of each marked with six eyes. A native of South America.

Wings pale blue, and black at the tips, spotted with persona. red. A native of Surinam.

Upper surfaces of the wings black marked with achilles blue band; the under ones are brown, adorned with three or five eyes. A native of America.

Under
ENTOMOLOGY.

Lepidoptera.

Argyria. Under surfaces of all the wings of blue and silver; the upper wings black on their superior surfaces, marked with two silver bands, and with two brown ones on the under surface; the under wings marked on their superior surface with a broad silver band, and with seven spots of blue and silver. 378. A native of Asia.

Idoneus. Wings faintly notched.

Dromon. Wings nearly crenated, and of a dusky blue colour; the under surfaces clouded, and adorned with two ocelli. 45. A native of South America. The larva is reddish, with feathery protuberances set round it in a ring. The pupa is dentated, and furnished with two crooked horns at the head.

2. Heliconia.

Epeis. Upper wings yellow; under wings of a deeper yellow than the upper, sprinkled with black spots. 55. A native of Asia.

Aliso. Wings yellow; the upper marked with three black streaks, and the under with three black bands. 56. A native of South America and India. Tips of the upper wings speckled with white.

Timias. Wings pale yellow; the upper ones marked with a bright yellow band, the under with three black bands. 58. A native of South America. Larvae yellowish and prickly.

Lata. Wings tawny, dotted with black, and the under ones have a black edge dotted with white. 359. A native of Italy; on the violet and borragine.

Cini. Wings brown; the upper wings marked on both sides with two white bands. 63. A native of America; on the ricinus palmis christi; the base of the under wing in the male marked with purple, in the female with blue; the larva green, covered with white hairs.

3. Parnassia.

Ollo. Wings white, spotted with black; the under wings are red at the base, and adorned with four ocelli on their upper, and six on their under surfaces. 50. A native of Europe, and feeds on the sedum telephium, and the saxifraga cotyleion; flies about slowly; the larva solitary, silky, black, and furnished with two tentacles at the back part of its head; all its segments are marked on each side with two red dots. The pupa covered with a slight follicle; oval, bluish, and marked on each side with red dots on the anterior part.

Verno. Wings white, with black veins; the upper ones marked with two black spots near their edges. 51. A native of Europe.

Sagasti. Wings white, with black veins. 72. A native of Europe; on fruit trees. It is very destructive in gardens and orchards, and emits a fluid of a reddish colour, which has frequently given rise to the reports of showers of blood which are said to have fallen in different places. Larva gregarious; hairy and yellow, green beneath; head black; body marked with three black lines; pupa greenish, with black spots and dots.

Soma. Wings of the same colour, both on their upper and under surfaces; the upper ones dusky and naked, the under yellow. 382. A native of New Holland. Head black; feelers yellow; thorax black, with a yellow dot on each side; breast spotted with yellow; posterior margin of the lower wings black, marked with seven yellowish dots.

4. Danae.

A. Candidi.

Wings black at the tips, marked with two black *brassica* spots. 75. A native of Europe; on some species of brassica. The upper wings in the male are without black spots, and the same happens in the two following species. The larva solitary, dotted with black, and marked with three sulphur-coloured lines; the tail black; pupa pale green, marked with three yellow lines, and three of its segments globular; eggs set in clusters.

Smaller than the preceding species; wings white, *rapa* upper ones terti with brown; the female has three brown spots on the upper, and one on the lower pair. 76. A native of Europe; on the turpin and other species of brassica; also on the tropaelum. Larva green; marked with a bright yellow line on the back, and bright yellow on the sides; pupa greenish, marked with three sulphur-coloured lines.

Wings marked on their under surfaces with broad *rapa* greenish veins. 77. A native of Europe; on several species of brassica.

Wings roundish; of a dusky colour at the tips. 79. *sinapis*. A native of Europe; on the mustard.

Wings white above; the upper ones on their superior discors surface, black at the edge and tip, which is marked with four white dots; inferior surfaces black, marked at the tips with four yellow spots and a yellow base; the inferior surface of the under wings scarlet, marked with black veins. 88.

Wings roundish, brown at the edges; their under *dopl uçuş* surfaces of a grayish yellow spotted with white. 81. A dicra native of Europe; on different kinds of reseda and brassica; larva covered with bluish hairs, marked with black spots and yellow streaks.

Wings round; the centre of the upper ones tawney; *carda* the inferior surface of the under ones clouded with mines. green. 83. A native of Europe; on the cardamine, brassica, and thlaspi. Larva solitary; greenish above and whitish beneath. Pupa green, with a white line on each side; thorax conical, ascending.

Wings yellow, with black tips, and a brown mar-polemo gin; the inferior surface of the under ones marked with a silver dot. 90. A native of Europe; on the coronilla; wings sometimes whitish. Larva somewhat hairy; green marked with yellow lines and black dots.

Wings angular and yellow; each marked with a rusty-*ramami* coloured spot. 106. A native of Europe; on the buckthorn. Commonly flies about in August, though frequently it lies dormant all winter, and appears early in the spring. The male is very often of a sulphur colour; the female white. Larva smooth; and green with a dark line on the back. Pupa in the anterior part turgescent, and drawn to a point.

B. Festivii.

Wings almost entire, brown, with a rusty-coloured cassis. band divided at the point. The lower surface of the under wings ash-coloured, and adorned with two ocelli. The larva green, streaked with red, with two prickles.
black dots on its back; tail divided. It remains under
ground till it has undergone its metamorphosis.

B. Phalerata.

Wings notched, of a dusky colour, marked with
white dots and bands; their inferior surfaces yellow,
marked with white bands and black spots. 162. A
native of Europe; on the populus tremula. The female
marked with a broader white band than the male.
Larva prickly, and variegated; head and tail tawny.
Pupa yellowish, dotted with black.

Wings angular, black, with a whitish circumanference.
165. A native both of Europe and America; on the
birk and willow. When it appears in spring, the
edges on the wings are white, and in the summer they
become yellow. Larva gregarious, prickly, black, mark-
ed with square rusty-coloured spots on the back. Pupa
black, marked with small projections and tawney dots.

Wings angular, tawny, spotted with black; the upper ones marked on their superior surface with four
black dots. 166. A native of Europe; on fruit trees.
Larva gregarious, prickly, blackish, marked with a
yellow line on the sides. Pupa of a flesh colour.

Wings angular, tawny, spotted with black; the upper superior surface of the upper wings marked with three
black dots. 167. A native of Europe; very common
on the nettle; supposed, though often falsely, to be a
forerunner of spring. Larva gregarious, prickly, brown,
variegated with green; the head black. Pupa brown,
marked with small projections, and golden spots on the
neck, and sometimes entirely of a golden colour. This
insect, and many others of the same genus, p. alantia,
polychloros, jo, &c. soon after their enlargement from
the chrysalis state, discharge a few drops of a reddish-
 coloured fluid; which in places where they have ap-
peared in great numbers, has had the appearance of a
shower of blood, and been marked by writers as a
prodigy foreboding some extraordinary event.

Wings angular, tawny, spotted with black; the lower ones marked on their inferior surface with a white C. 168. A native of Europe; on the nettle,
willow, and gooseberry. Larva solitary, prickly, and
tawny; the back yellow on the fore part, and white
behind. Pupa of a flesh colour, contracted in the
middle, dotted with gold.

Wings notched, yellow, variegated with black, and hys-
 radiated at the tips; the under ones marked with seven
red dots. 607. A native of Europe; on the aristot-
chidch clematis. Larva yellow, marked with black,
variegated with black, with prickles set round in a circle; red, with
black tips.

Wings black, spotted with white; the upper ones
marked with a purple band on both sides, the under
with a purple band along the edge. 175. A native of
Europe and America; on the nettle. Larva solitary,
prickly, green, marked with yellow lines on the sides.
Pupa marked with small projections; blackish above,
and ash-coloured below, dotted with gold.

Wings angularly notched, brown, marked with taw-
celly spots and a single white one; the under wings gray
on their inferior surfaces. 639. A native of the south of
Europe. Larva green, marked with white lines, spotted
with black. Pupa green, marked with white lines.

Wings slightly notched, variegated, and reticulated,less
on
on their inferior surface; the upper ones marked on their superior surface with some white spots. 201. A native of Europe; on the common thistle. Larva gregarious, prickly, and black; legs red; head marked with two prickles; pupa furnished with small brown projections; thorax yellow below.

**adippe.**

Wings notched, brown, spotted with black, adorned on the inferior surface with twenty-three silvery spots. 212. A native of Europe; on the *vicia odorata* and *tricolor*; the silver spots sometimes, though rarely, change into ye. Larva yellow, furnished with brown, covered with many reddish prickles, and marked on the back with a black line, rising out of a white one; pupa brown, marked with silver dots.

6. **Plebeii.**

A. **Rurales.**

**rupido.**

Under wings terminating in six small projections, white on their inferior surface, marked with silver spots. 217. A native of America; on the cotton. Larva white, dotted with black.

**betuler.**

Wings furnished with a slight tail, the under ones marked with two white streaks, 220. A native of Europe; on the birch and sallow. Wings of the male marked with tawney spots; larva thick, green marked with two obliquely transverse white lines, and two small furrows on the back; pupa smooth, of a rusty colour.

**pruni.**

Wings slightly tailed, brown, above, with a red spot at the tip of the lower ones; lower wings beneath with a tawney marginal band, dotted with black. 221. A native of Europe; on the plum-tree. Larva thick, green, with a pale lateral line; pupa brown, with a white head.

**quercus.**

Wings slightly tailed, bluish, beneath ash-coloured, with a white streak and double tawney dot near the tail. 222. A native of Europe; on the oak. Larva thick above, of a rose colour; with three lines of green dots. Pupa smooth, of a rusty colour; with three lines of brown dots on the back.

**cerasi.**

Wings tailed, brown, without spots; the inferior surfaces marked with a white streak, and tawney circular spots; the under wings marked with a black dot. 710. A native of Europe; on the cherry tree.

**sedi.**

Wings furnished with a tail, blue, with a white spotted edge, white on their inferior surfaces, marked with black square spots, and a reddish band. 743. A native of Europe; on the *sedum telephium*. Larva green, marked with a red line on the back. Pupa obtuse; green on the anterior, and brown on the posterior part.

**cyllariv.**

Wings entire, and blue with a black edge; beneath of a brownish colour, adorned with a streak of dots resembling ocelli; the under wings on their inferior surface blue at the base. 750. A native of Europe; on the flower of the *astragalus* and *melilot*. Larva pale; marked with a red streak on the back, and on the sides with oblique green lines; head black. Pupa brown, spotted with black.

B. **Urbica.**

**omma.**

Wings perfectly entire, spreading so as to form an obtuse angle, tawney, marked with a small white line and with white dots beneath. 256. A native of Europe; the line wanting in the female. Larva of a shining red; head black, with a white strip on the collar. Pupa long, cylindrical, and brown.

Wings perfectly entire, spreading so as to form an obtuse angle; tawney, with a black margin. 817. A native of Europe; upper wings in the male marked with a small black line on the middle. Larva solitary and green. Pupa green; with a very thin covering.

Wings notched and spreading so as to form an obtuse angle; brown, waved with ash colour; the upper wings marked with transparent dots; the under ones with white dots. 267. A native of Europe; on the *melis. Side of the body yellowish. Larva grey; head black; neck marked with four sulphur-coloured spots. It draws together the leaves on which it feeds, by threads which it spins. Pupa husk-backed and bivitd.

876 species of the butterfly have been described in the last edition of the System of Nature published by Gmelin; but a great many more are to be met with in the collections of the curious, which have not yet been described by any author.

**Sphinx, Hawk-moth.**

Antennae nearly prismatic, thickest in the middle. Tongue (in most species) projecting. Feelers two, bent back. Wings deflected.


† Wings angular.

The under wings reddish, adorned with a blue eye. *ocellete.* 1. Native of Europe and America; on the *spirae. Willow, and fruit trees; the thorax marked with a rusty-coloured spot, the tongue very short. The larva solitary, rough, green, and furnished with a tail marked with obtuse white streaks, and dotted with yellow ocelli. The pupa is brown, with a black back.

Wings angularly notched, yellowish, marked on the *ocellete.* under surface with brown bands; the under wings with a red band. 48. Native of Europe, on the oak. The body of the male is ash-coloured; that of the female brown. The larva solitary, furnished with a tail, and green; marked on the sides with oblique white stripes, and with reddish specks. The pupa a light brown, with reddish edges.

Wings dentated, reversed and gray; the under wings *populi.* of a rusty colour at the base; the upper ones marked with a white dot. 2. Native of Europe; on the poplar and willow. The larva solitary, rough, green, furnished with a tail; it is marked on each side with a white line, and with white oblique cross stripes. The pupa a dusky gray, and of a rusty colour behind.

Wings marked with greenish bands, and clouded *tiliae.* with dark green; the superior surface of the upper wings of a yellowish brick-colour. 13. Native of Europe; on the lime-tree. The larva solitary, rough, green, furnished with a tail. It grows smaller towards the head, and is marked on the sides with oblique blood-coloured and yellow stripes. The pupa of a dusky brown.

Wings irregularly notched, and greenish, marked *aeothor. with a dark green band; the under wings tawney, and black at the tips. 54. Native of Europe; on the *aeother.* The larva solitary, brown, and without a tail; marked with blood-coloured specks, and with a black ocellus, the pupil of which is white, on the last
ENTOMOLOGY.

Lepidoptera.

- Scim. The wings entire; the Tail furnished with a band; the Tongue projecting, and terminating abruptly; the Antenna cylindrical.

The sides of the abdomen variegated with black and *stellata*-white; the under wings of a rusty colour. 27. Na-rum. Native of Europe; on the madder, and on the rest of these plants which form the natural order called *stellatae.* The larva is spotted with white, and is furnished with a blue tapering tail, of a rusty colour at the tip. The pupa brown.

The abdomen black, marked with a yellow band; *fusciformis* the wings transparent, with a black edge. 28. Na-mis. Native of Europe; on the woodbine, and on the scabious. The larva is green, marked on the sides with a yellow line, furnished with a reddish horn. The pupa black, marked on the fore part of the body with yellow streaks, and enclosed in a follicle.

The wings transparent; the abdomen yellow, with *apiformis* black incisures; the thorax black, marked with two mis. yellow spots. 29. Native of Europe; on flowers. The larva on the trunk of the poplar-tree.

The upper wings brown, the under wings transpa-sessia-ent; the abdomen black, marked with three yellow belts. 102. Native of Europe.

The wings transparent, with a black edge and black *vespariformis* band; the abdomen black; the second and last segments marked with a yellow margin. 31. Native of Europe.

The wings transparent, with a black edge and black *tipuliformis* band; the abdomen black; the incisures are alternately formis. marked with a yellow margin. 32. Native of Europe.

Feeds on the pit of the common red currant.

- *Zygynae Fabricii, s. Adcittae. The Tongue projecting, and setaceous; the Antennae thicker in the middle.*

The upper wings blue, marked with six red dots; the *filipendula* under wings red with a blue edge. 34. Native of *dulce-*

Europe; on the *spirium filipendula.* There is a variety of this species (*p. pseuderam*) distinguished by a red belt on the abdomen, which feeds on the *pseuderam.*

The larva is thick, of a sulphur-colour; marked with four rows of black dots, and furnished with a tail. The pupa is brown, of a sulphur-colour in the middle, and marked with brown specks.

Black; the upper wings green, marked with three *pythia* oblong blood-coloured spots, placed near one another; the under ones red. 106. Native of Europe. The larva hairy and white; the head marked with two lines of black dots; the fore legs are black; the hind legs yellow.

Blue; the upper wings green, marked with five red *fulvius* spots; the under ones of a blood colour, and without spots. 107. Native of Europe; on the *lotus corniculatus.*

Greenish-black; the wings marked with transparent *phagea* dots, six on the upper, and two on the under wings; the abdomen marked with a yellow belt. 35. Native of Europe; on the oak, &c. The larva brown, with reddish head and legs; with tufts of whitish feathers on the back.

Blue; the upper wings marked with six red dots; the *aphis* under ones with one red dot; the abdomen gilt with a red belt. 36. Native of the south of Europe; on the *medicago*
ENTOMOLOGY.

77. Phalena, Moth.

Antennæ growing gradually smaller from their base to their tip. Tongue spiral. Jaws none. Shield (in most species) short, and of a hornv substance.

Moths fly about at night, have their antennæ composed of many articulations, and commonly pectinated in one or both sexes. They feed chiefly on the nectarous juice of flowers. The larva is active, commonly smooth, and more or less cylindrical, and feeds on the leaves of plants. The pupa remains torpid, is generally cylindrical, sometimes pointed before, sometimes at both ends, and in most instances covered with a folicle.

Phalena divinator in, Moths are divided into,

1. Bombyces. Larva 16-poda, scapitus pilosus, sub-cylindrica; pupa spice acuminata; antennæ filiformibus, spice acutis; palpis duobus, compressis, reflexis, squilibus, pilosis, obtusis; lingua spirali, brevi, membranae, vix exserta, filiformi, obtusa, bifida.

a. Attacoc, alis patulis.
b. Bombyces, alis non patulis.

2. Geometrae. Larva octo vel decem-poda, pedibus pectoralibus 6, caudalibus 2, et interdum subcaudalibus 2; hirudinem instar inoidae, dum quiescit erecta, glabra; pupa spice acuminata; antennæ filiformibus, articulis obsoleteis; palpis duobus squilibus, reflexis, membranae, cylindrícis; lingua porrecta, membranae.

3. Tortricæ. Alis obtusissimis, fere retusis, margine exterioire curvo; antennæ filiformibus; palpis duobus squilibus, nudaeculis, basi cylindricis, medio dilatato-ovatis, apices setaceæ; lingua porrecta, membranae, setaceæ, bifida; larva 16-poda, folia, quæ vortæ, et intra quæ se recipit, filis contorquentia, et connectente.

a. Alis angulatis, antennis oblongis, ut pluriium pec- tinitis.
b. integris.
c. rotundatis.

4. Pyralides. Alis convexitibus, in figuram dealtoideam forficatam; antennæ filiformibus, articulis obsoleteis; palpis duobus squilibus, reflexis, membranae, cylindrícis; lingua porrecta, membranae, setaceæ, bifida; larva 14—16-poda.

5. Nocturnæ. Larva 16-poda, epipla glabra, spica acuminata, antennæ setaceÆ, palpis duobus compressis, pilosis, spica cylindricís, nudis; lingua porrecta, cornis, setaceæ, bifida.

a. Alis branacceæ, et cylindricæ; lingua membrandaceous, setaceæ, dividit ad extremity, and projecting; the wings, when at rest, spreading horizontally.
ENTOMOLOGY.

8. HAPIALI. Larva 16-poda, subcylindrica, simpus gibra, radicibus plantarum visititante; pupa folliculata, cylindrica, apice acuminata; antennæ brevibus, membranaceis, reflexis; lingueque bifidas inter hos rudimenta.

Lepidoptera.

Wings curved, of the same colour, both on their upper surfaces, variegated with yellow, marked with a transparent spot; the upper wings have a small transparent spot joined to the other. 1. Native of Asia and America; on the orange tree. Each articulation of the antennæ has two projections proceeding from them in opposite directions. The larva has hairy tubercles set round it in circles. It spins a large ball of silk, which is unravelled with very great difficulty.

Wings of a dark carnation colour; the under ones nictitans, marked with a rusty-coloured eye, the pupil of which is transparent. 469. Native of Africa. Female larger than the male.

Wings round, clouded with gray, and faintly marked pavo-sonius, with bands, adorned with a long semi-transparent ocellus.

7. Native of Europe; on heath, bramble, the rose, the elm, the willow, and fruit trees. There are three varieties of this species, minor, media, and major. The antennæ in the male are more distinctly pectinated than in the female. The larva is gregarious, and green, having red and yellow hairy tubercles set round it in circles. The pupa is blackish, with a hole at the top of the follicle, which is elastic, and acting like a valve.

Wings of a brick colour, adorned with an eye of a tawny violet colour; with a white spear-shaped pupil. 8. Native of Europe; on the birch. The larva green, marked on the sides with oblique white streaks, the back covered with knots. The pupa light-brown and hairy.

† † Bombyces. Wings not spreading.

4. Wings reversed.

Wings of a brick colour, notched, and marked with populus, a great many brown spots like crescents. 485. Native of Europe; on the white poplar.

Wings notched, and of a rusty colour; the mouth querci- and shanks of the legs black. 18. Native of Europe; on grass, the sloe, pear tree, apple, and willow. The larva is hairy, of a rusty colour, with a blue neck, and furnished with a slight tail. The pupa brown, marked with red bands.

Wings fawn-coloured, marked with two whitish rubi. streaks on their upper surface. 21. Native of Europe; on the bramble and willow. The larva is hairy, black on the under side, and of a rusty colour, marked with black rings on the upper side. When young it is covered with a veil of black silk. The pupa blackish, marked with three yellow rings, and enclosed in a covering of silk.

Wings notched, yellow, and marked with two brown pruni. streaks and a white dot. 22. Native of Europe; on the plum. The larva is smooth, of an ash colour, marked with blue lines, and furnished with tufts of hair on the neck and along the sides; the hind-legs are stretched out, and at a distance from one another. The pupa black on the fore part of the body, and of a light brown behind.

Wings faintly notched, and yellow, marked with potato-broad tawney stripe, and with two white dots. 23. Native of Europe; on grass. It produces oblong eggs of a leaden colour, marked at each end with a green ring, and with a green dot in the middle. The larva has a tail...
ENTOMOLOGY

Lepidoptera.

*guercus.* Wings of a rusty colour, marked with a yellow streak; the upper wings with a white dot. 25. Native of Europe; on heath, the sloe, the birch, the willow and oak. The colour of the female is paler than that of the male. The larva is hairy, gray, marked with black rings, and spotted with white. The pupa is enclosed in a thick covering of silk, is green, and brown on the fore part.

Wings of a rusty colour, marked with a white streak; the upper wings are white at the base, and marked with a white dot. 28. Native of Europe; on the lime tree, the sloe, and the willow. It produces eggs covered with ash-coloured wool. The larva is hairy and black; each of its segments is marked with three white dots between two red tufted spots. It is gregarious, and lives in habitations which it forms for itself composed of many cells; going out in quest of food, it returns through parallel holes. The pupa is of a sulphur colour.

*vivula.* Wings nearly reversed, waved and streaked with brown; body white, dotted with black. 29. A native of Europe; on the willow and poplar. Larva solitary, green, and brown on the back, on which there is situated a turgid prominence; the tail is furnished with two bristles; it discharges an acid fluid from a chink under its head.

Silenia. Wings pale, marked with three faint brown streaks, and a brown circular spot. 33. Native of China and Persia; on the mulberry. It was introduced into Europe by Justinian. It varies a little in size and colour; the wings being sometimes yellowish, sometimes whitish. The larva is furnished with a tail, is naked, and whitish. The pupa light brown, enclosed in a thick silky covering, from which silk is manufactured. The pupa is a person who unravelled the cocoons of the silk-worm, and manufactured them into silk, was Pamphilus, a woman of Coos, the daughter of Latonas, (Vide Plin. xi. 22.); seu potius Platus fiius; (Aristot. Anim. v. 19.)

*populi.* Brown and whitish on the fore-part; the wings brownish, marked with a whitish spreading stripe, with a small one placed close by it. 34. Native of Europe; on the poplar, and on fruit trees. The larva hairy, and of an ash-coloured, darker on the back; each segment is marked with two pairs of red dots. The pupa is brown on the fore part, and reddish behind.

Asteria. Wings yellow (in the female brown), marked with a white dot, and becoming paler towards the tip. 499. Native of Europe; on the sloe, &c. It deposits rough eggs in clusters. The larva gregarious, hairy, and light-brown. The divisions between the segments black, and marked on the sides with blue spots and sulphur-coloured dots. The pupa yellowish.

*castrensis.* Wings dark-coloured, marked with two pale bands. 36. Native of Europe; feeds on the pilosella, jacca, milefolium, alchemilla, and euphorbia. It deposits its eggs in circles round branches. The larva is gregarious, consuming a great variety of vegetables; it feeds under a web, and frequently shifts its quarters: it is hairy, blue, and marked with red lines dotted with black. The pupa is dark-coloured.

*procustion.* Wings of a brownish ash-colour: the female marked with one dark stripe; the male with three. 37. Native of Europe; on the oak. Of a middle size. The larva gregarious, hairy, of a brownish ash-colour, black on the back, and marked with yellow warts: they move in sets, differing in number. The skin which they cast excites inflammation when touched.

Wings deflected.

† Tongue short.

|| Back smooth.

Wings whitish, marked on the back with a brown rufa spot, and with six brown spots like crescents on the lower wings. 508. Native of Europe. The under wings white, with a brown edge: the antennae pectinated and brown; the legs brown.

Wings black, with white veins; the under wings planta-yellow, with a black edge, and dotted with black. 489. Native of Europe; on the plantane, elm, and hawthorn. The under wings in the male are scarlet; but in the north of Europe, frequently white, with a black edge and black spots: when caught it emits a yellow drop from its collar. Larva hairy, black, with the back brown.

Wings white, waved with black, marked with blood-monacha coloured rings between the segments of the abdomen. 43. Native of Europe; on the bramble, the willow, the apple, the oak, the larix, and other species of pine.

To these last it is particularly destructive. Larva brownish ash-coloured, with red tufts on the back; the second segment of its body is marked with a black spot of a heart-shape. Pupa black.

Wings marked with spots clouded with gray and dispar brown: the wings of the female whitish, with black spots. 44. Native of Europe; on the oak, the lime, and fruit trees; the pest of orchards. The female twice the size of the male, covers her eggs with balls of dust.

The larva feeds on a variety of vegetables, are hairy, marked with white lines, dotted with blue on the fore part of the body, and with red behind. When touched they excite an itching in the hands. The pupa is marked on the fore part of the body with four black dots; when touched, it rolls itself up in a circle.

Wings of a snow-white, a beard of a rusty colour chryse at the anus. 45. Native of Europe; on the oak and rhocia fruit-trees. There is a smaller variety of this species with brownish wings in India. The female produces yellow eggs, and covers them with a large quantity of tawny-coloured wool. The larva is blackish, hairy, gregarious; not confined to one kind of food; marked with two red lines on the back, tufted with white on the sides. The pupa blackish.

|| Back furnished with a Crest.

Wings of an ash-colour, marked with three brown pudibunweaved streaks. 54. There is a variety of this species, da. scopularis B. Antennæ pectinated, wings whitish, marked with three dark-coloured bands; the under wings white. It is a native of Europe; on the oak, beech, and fruit-trees. The larva is yellow, hairy; the tuft on the tail longer than the rest, and red; four tufts on the back, white; the head is pale yellow. The pupa is black in the lower part of the body, and a light brown behind, spotted with yellow.

Wings clouded; the posterior part of the thorax costatus, marked with a black band; antennæ lamellated. 63.
A native of Europe; in decayed wood. The larva somewhat hairy, of a carnation colour; the head black, and back of a blood-colour. It was reckoned a delicacy by the Romans, who fattened it with flour. (Plin. xviit. 24.) The pupa of a light brown on the fore part of the body, and yellow behind.

Wings yellowish, marked with black bands. 1305. A native of Chili; on a kind of commia. The larva is naked, and red; while it undergoes its metamorphosis, it rolls itself up in a kind of wax, at first white and sweet, and afterwards yellow and bitter, which the natives gather in the autumn and put into cakes.

† † Tongue long.

a. Back smooth.

*aulica. The upper wings gray, and dotted with yellow; the under ones tawny spotted with black. 68. A native of Europe; on the angelica, nettle, and grass. The larva solitary, black, marked with white warts; on the upper part of the body it is covered with whitish hairs, and underneath with hairs of a rusty colour.

matronula. Wings brown; the upper wings gray, spotted with yellow on their superior surface; the under ones yellow marked with black bands. 92. A native of Europe; on the artemisia vulgaris.

b. Back furnished with a Crest.

Wings of an ash-colour, streaked with a light brown, and marked with 00. 81. A native of Europe; on the oak. Larva naked, of a violet-colour, marked with white lines, and dots.

esculi. Of a snow-white colour; wings marked with a great number of bluish-black dots; the thorax with six. 33. A native of Europe; in the wood of the pear and horse-chestnut. Larva yellow, dotted with black; head and tail black.

y. Wings incumbent.

*graminis. Wings gray; marked with a white line dividing into three branches, and a white dot. 73. A native of Europe; on grass. It varies in size, and is very destructive to pasture grounds. The larva consumes all kinds of grass except the alopecurus. It is smooth, dusky, with a lateral and dorsal yellow stripe. It is destroyed by rooks and hogs. The pupa remains torpid for fourteen days only.

*fuliginea. Wings dark-coloured, tinged with red, marked with a double black dot; abdomen red; and black on the back. 95. A native of Europe; on the turnip, mustard, grass, and birch-tree. The larva is hairy, of a rusty colour, with black head and fore-legs; wanders over the snow in winter in Norway; and is said to forbode a cold summer and scarcity where it appears in considerable numbers. Pupa black, marked with yellow bands behind.

*varicella. Wings transparent and gray; antennae brown. 591. A native of Europe; on the riccia sylvatica. The female deposits her eggs while in the pupa state, and never becomes a perfect insect.

2. Wings convoluted.

histrionic. Wings tawny, marked with numerous white spots, surrounded with blue. 593. A native of the island of Tobago. Feelers white at the base, and tined with black; thorax bluish black with white dots, and two tawny spots; abdomen beneath white, with black rings; anus tawny; upper wings blue at the tip, with white dots; lower wings, and all beneath, black; the hind margin a little whitish.

§ § Feelers cylindrical. Geometra.

a. Wings angular.

Wings green, and faintly notched, marked with a thymia, faint waved whitish streak; a smaller line of the same description being placed contiguous to it. 199. A native of Europe; on thyme. Larva dark-coloured, marked with carnation-coloured spots on the back; the head and collar furnished with two little projections. Pupa light brown, marked with a black line, sharp-pointed before, and divided behind, and covered with a very thin follicle.

Wings ash-coloured, and marked with a rusty-co-punctaria, coloured streak, and transverse row of black dots. 200. A native of Europe; on the oak. Larva ash-coloured, marked with yellow spots on the sides. Pupa of a pale carnation colour above, beneath yellow; and is attached to a leaf.

b. Wings entire.

Wings green, somewhat waved, marked with a papilionosa, waved streak, and smaller streak of the same description ria, contiguous to it. 225. A native of Europe; on birch-trees. Larva green, with ten crooked reddish prickles on the back. Pupa green, varied with yellow; remains torpid for 14 days.

Wing pale, marked with a pale fillet. 634. A villata. native of Europe.

c. Wings round.

All the wings yellowish, marked with brown streaks, *atomoria and very small dots. 214. A native of Europe; on the centaura. Larva gray, and smooth, marked with a number of interrupted lines of rusty colour, having two tubercles on the posterior part of the body.

Wings white, marked with a striated yellow band; *pantaria the abdomen yellow dotted with black. 213. A native of Europe; on the elm and pine-tree. Larva green, marked with black lines; head and tail black. Pupa bluish.

Wings variegated with green and ash-colour, marked lichenaria with two black streaks; the anterior one curved, the posterior one waved. 633. A native of Europe; on lichens. Small. Larva rough, varying in colour according to the colour of the lichen on which it feeds, green, ash-coloured, or yellow, spotted with black on the sides; the fore-legs marked with a black spot, and a green dot.

§ § Feelers almost naked, and cylindrical at the base; denated in the middle, and oval tapering at the tips. Tortrices.

The upper wings green, marked with two oblique frutinaria yellow streaks; the under wings white. 235. A native of Europe; on the alder and oak. Larva and pupa green: the former is marked along the side with a yellow line, and has the second segment of the back marked with tubercles; the latter marked on the back with a black line.

Wings
ENTOMOLOGY.

pomonae. Wings elbowed, the under ones marked with a reddish golden spot. 401. A native of Europe; on the apple. Larva naked, and red; with a black head. Pupa light brown.

resinae. Wings brown, marked with a brown spot at the base, common to both wings, and with a triangular rusty spot at the tip. 406. A native of Europe. It takes up its habit in the ball of rosin, which exudes from a wound made in the branches of the pine. Larva naked, and yellowish; head light brown. Pupa brown.

§ § § Wings shutting closely, with the under edge of one over the upper edge of the other. Pyralides.

farinalis. Feelers bent backwards; wings yellowish and polished, marked with white waved streaks, yellowish at the base and tip. 327. A native of Europe; in flour and meal. It walks with its tail erect.

* pinguisinalis. Feelers bent backwards; wings ash-coloured, thicker at the edges, faintly marked with black bands. 336. A native of Europe; on butter, bacon, &c. Very common in houses and kitchens, sometimes in the human stomach; the most pernicious of all the animals that live within the bodies of others. The larva smooth, brown, shining. Pupa naked, of a light brown.

secalis. Wings gray, streaked with brown, and marked with a kidney-shaped spot, on which there is inscribed a Roman A. 338. A native of Europe; within the stalks of rye, which it consumes within the sheath, going from one to another; this is the cause of the ears becoming white and empty. Larva green, marked with three longitudinal green lines; head light brown.

* * The Antennae setaceous.

§ Tongue projecting and horny. Noctuæ.

a. Wings spreading.

odorae. Wings notched, brown, and waved with black; the upper wings are adorned with a black eye, and marked with a blue spot like a crescent, and with a white spotted streak. 11. A native of Surinam.

striata. Wings of the same colour, both on the upper and under surface, reticulated and clouded with black and white. 82. A native of South America. Larva naked, black, and marked on the sides with a greenish line, and with green rings.

macropa. Wings indented; brown, waved with black; upper pair adorned with a large light brown eye. 968. A native of China. In some specimens, probably the females, the outer margin of the lower wings is reflected, forming a pouch which contains a great quantity of fine silk.

b. Wings incipient.

c. Thorax smooth.

litidae. Wings shining black; under wings of a rusty colour, edged with dark brown. 999. A native of Europe. Larva growing smaller towards each end, naked, greenish, variegated with yellow and shining red, marked with a dark-coloured line on the back, and with a very slender pale one on the sides; the head of a pale colour.

Vol. VIII. Part I.
ENTOMOLOGY.

172. A native of Europe; on the pea and broom, consuming their pods. Larva naked, and of a russet colour, marked with four yellow lines; head of a carnation colour. Pupa dark brown; the divisions between the segments of a blood colour.

tritici.

Of an ash-colour; the wings marked with two pale-coloured spots, and with a single blackish one. 179. A native of Europe; on the ears of wheat and oats. Larva naked and yellow; marked with three white lines.

flavicorns

Upper wings of an ash-colour, marked with three black streaks; antennae yellow. 182. A native of Europe; on fruit trees. Larva naked, greenish, marked on the sides with white dots; head of a carnation colour.

§ § Tongue prominent and membranaceous. Times.

a. Wings four, unequal.

cerella.

Wings gray, emarginated behind; back of a dark brown, and furrowed. 282. A native of Europe; in bee-hives, feeding on the wax.

padilla.

The upper wings of a livid colour, and marked with 20 black dots; the under ones brown. 331. A native of Europe; on apple trees. The larva gregarious; living in swarms, under a common covering: it is naked, and gray, marked with a black dot on each side of its segments. Pupa yellowish.

* yellioncel. Wings gray, marked in the middle with a black dot. 372. It is to be met with everywhere in woollen stuffs, which it destroys, lying concealed within a covering. Larva whitish, marked with a red line on the back. Pupa yellowish.

* tapenella

Wings black, under ones whitish; head pure white. 371. A native of Europe; on tapestry, furs, and skins, into which it gnaws holes.

* fascitella

Wings of an ash-colour; thorax marked on each side with a white dot. 373. A native of Europe; in cloths and furs, which it destroys. It lies concealed under a covering.

* melinella

Wings whitish, growing purple towards their exterior part, marked with a white streak; the scutellum black, and white at the tip. 375. A native of Europe; in bee-hives, where it penetrates the honey-combs. Larva is naked, and gray, with a light brown head. Pupa light brown.

* prolestel.

Wings whitish, marked with two dark brown dots; tongue bent inwards. 379. A native of Europe; on different species of cabbage; on the horned poppy; and on the oak. An individual, in the space of a year, may produce many millions, as they propagate every month, each depositing a great number of eggs.

b. Feelers divided the length of the middle, two in number.

* granella

Wings variegated with black and white; head very white. 377. A native of Europe; in grammaries, where it destroys the grain and collects it into knots; it climbs up the walls of houses in winter.

§ § Wings divided into many divisions. Alcita.

* bidactyla

Wings spreading and brown, marked with white streaks; the superior wings bifid; the posterior ones divided into three divisions. 454. A native of Europe; on the genist rivale, and on the cunonobius. Larva green, covered with tufts of hair. Pupa long; with two lines of tubercles on the back, each furnished with four prickles.

* * * Antennae moniliform and short. Hapialia.

Wings yellow, with tawny streaks; the wings of the * auritula, male of a snow-white colour. 84. A native of Europe; at the roots of the hop: the hop-planters manure with hops dung, as a remedy against this troublesome insect; it deposits a very great number of eggs.

1520 species of this genus have been described in the last edition of the System of Nature.

IV. NEUROPTERA.

Wings four; naked; their veins forming a net-work. Tail unarmed.

72. Libellula, Dragon-fly.

Mouth furnished with jaws. Jaws numerous. Lip divided into three. Antennae shorter than the thorax; very slender and filiform. Wings extended. Tail of the male furnished with a hooked forceps.

* Wings spreading when the insect is at rest.

A. The central division of the Lip very minute.

The under wings marked at the base with a blackish * quadri- spot; and all the wings marked on the middle of their * maculata, upper surface with a blackish spot; the abdomen fimbriate and downy. 1. A native of Europe; in waters.

The under wings becoming black at the base; the * rubixus, body quadrangular. 4. A native of Europe; in fresh, cold waters. The one sex is waved on the back with red, and the other with yellow.

All the wings black at the base; the abdomen de-* depressa, pressed; the sides yellowish. 5. A native of Europe; in fresh water. The abdomen of the male bluish, marked on the sides, near the base, with yellow spots; the abdomen of the female brown, and yellow on the sides.


Abdomen yellow, marked with two black lines; the minuta, under wings yellow, marked with two black spots. 42. A native of China. Small; head yellow; eyes brown; thorax with yellow lines beneath; abdomen with two black lines above, and one beneath; upper one black at the base, with a yellow spot.

Thorax black; marked with various yellow oblong- * forcipora, ters; tail furnished with crooked hooks. 11. A native of Europe.

* * * Wings erect when the insect is at rest; the Eyes distant from one another; the exterior division of the Lip slightly divided. * Agria.

Wings coloured.

* virgo.

- c. Body shining, greenish blue; wings bluish in the middle, the base, and tip whitish, the margin without spots.

- d. Body silky; wings bluish green, the tip brown, the margin without spots.

- c. Silky,
Neuroptera. E N T O M O L O G Y.

* Tail furnished with three bristles.

Wings reticulated and spotted with brown; body * vulgata. brown. 1. A native of Europe; in fresh waters. In the month of June, they are to be seen in the evenings fluttering about under trees in innumerable swarms. In the neighbourhood of Laz in Carniola, they abound so much, that the country people collect them for manure; the peasant who has not collected to the amount of twenty cart loads, thinks himself unfortunate.

Wings white, the outer margin brown; body black. * marginata.

3. A native of Europe.

Wings black, the under ones whitish. 4. A native* vesper-ina. of Europe; in fresh waters.

* Tail composed of the two bristles.

Wings white, and reticulated; the head marked with * biocula- two yellow tubercles. 5. A native of Europe; in ta. fresh waters. The bristles of the tail white dotted with brown, and longer than the body.

Wings white, the edges blackish and thicker than * horaria. the rest of the wing. 9. A native of Europe; in fresh waters.

18 species of this genus have been described in the last edition of the System of Nature.

73. Ephemeræ, Day-fly.

Mouth without jaws. Feelers four, very short, and filiform. The resemblance of a jaw, membranaceous, cylindrical, and connected with the lip. Antenna short, and tapering towards the tip. Two large stemata above the eyes. Wings erect, under ones very small. Tail bristly.

These short-lived animals are found everywhere about waters in the summer, and in their perfect state seldom live above a day, during which time they perform all the functions of life. They remain in the state of larvæ and pupæ for one, two, or three years. The larvæ live under water, and is eagerly sought after by fish, particularly by trout, for which it forms an excellent bait. They are furnished with six feet, a tail, and six fins which serve them as oars. The pupa resembles the larva, except in having the rudiments of future wings. They scoop out holes for themselves in the banks of rivers, formed like siphons; the one leg serving as an entrance, the other as an outlet. The banks of some rivers are often perforated with them. When the waters decrease, they form fresh holes lower down. The ephemera on the Rhine appear two hours before sunset; they come forth almost all at the same time, and in immense numbers. Those on the Marne and Seine, in France, do not begin to fly till two hours after sunset. The females, by the help of the threads of the tail, and the flapping of their wings, support themselves on the surface of the water, and, in almost an upright position, drop their eggs in clusters. A female will drop seven or eight hundred eggs, which sink to the bottom.

74. Phryganea.

Mouth furnished with a horny mandible, short, arched and sharp, without teeth. Jaw membranaceous. Feelers four. Stemmata three. Antenna setaceous, and longer than the thorax. Wings incipient, the under ones folded.

These insects are seen in a summer evening floating in the air in great numbers, and are eagerly devoured by swallows; they are easily distinguished from the smaller moths, by their wanting the spiral tongue. The larvæ is six-footed, found at the bottom of shallow waters enclosed in a tube, constructed of sand, straws, or small chips of wood, and is known to fishers by the name of caddye, or caddie, who use it as a bait for trout, after they have taken off the tube with which it is covered. When about to become a pupa, it shuts up the mouth of its tube with a few loose threads of silk, of the same nature with that by which it connects the straws and chips that compose its tube. The larvæ of the species which compose the first division have one or three tails, which serve them for fins; the pupæ have six feet, and prominent horny jaws. The larvæ of the other species are somewhat hairy, furnished with two hooks at the tail, and with three tentacular one on the fourth segment. The pupa very much resembles the perfect insect.

* Jaw divided. Tail formed of two bristles, and terminating abruptly. Sembia.

Wings marked with many veins, forming a net-work. * biocula- x. A native of Europe; in fresh waters; carrying * about its eggs in a mass underneath its belly; body greenish.

Body black; wings white, spotted with black. 3 phalenei. A native of Europe. B b 2

* * Tail
ENTOMOLOGY.

Neuroptera.

31 species of this genus have been described in the last edition of the System of Nature.

76. MYRMEOCHION, Linn.-ant, or Ant-eater.

Mouth with a sharp horny jaw, and mandible. Lip projecting. Feelers six. No stigmata. Antennae thicker towards their outer edge. Wings deflected. Tail of the male armed with a pair of pincers, composed of two filaments nearly straight.

A. The posterior feelers much longer than the rest; jaw furnished with one tooth; lip membranaceous and square, terminating abruptly, and emarginated.

The insects of this family prey with the most savage ferocity upon ants, and lesser insects; and for the purpose of ensnaring them sink themselves into the sand, and form a kind of funnel or pit in which they lie buried, the head only appearing above the sand: into this hollow such insects as wander near it are sure to fall; and not being able to crawl up the sides of loose sand, are seized and devoured by the hon-ant. But if the sides of the pit do not give way, or the unlucky insect appears to be able to make its escape, its enemy, by throwing up with its head repeated showers of sand, forces it down till it comes within its reach. Larva is six-footed, oval and hairy, with exerted toothed jaws. Pupa enclosed in a ball composed of aggregated sand or earth.

Wings clouded with brown, marked with a white formica-spot on their posterior margin. 3. A native of Eu-rius. The larva goes backwards; frequents sandy places, where it digs pits to ensnare other insects.

B. Feelers nearly equal, and filiform; the jaw fringed; lip horny, round and entire.

The upper wings transparent, marked at the base longico- with a double yellow spot; the under wings are yellow; and black at the base. 2. A native of Europe. Head black and hairy.

Wings white, marked with a black spot at the edge; australis. Body variegated. 14. A native of Europe. Variegated with brown and yellow; the antenna of the same length with the body, and black; club ovoid.

15 species of this genus have been described in the last edition of the System of Nature.

77. PANORPA, Scorpion-fly.

Mouth stretched out into a cylindrical snout, composed of a horny substance. Mandible, without teeth. Jaw divided at the point. Lip very long, covering the whole mouth, and like it formed of a horny substance. Feelers four, nearly equal. Antennae filiform, and longer than the thorax. Tail of the male notched, of the female unarmed.

Wings equal, spotted with black. 1. A native of common Europe; lives chiefly on dipterous insects.

Wings tapering towards the point, somewhat curved inermatis, and fringed; female without wings. 3. A native of Europe.
Hymenoptera.

Europe. It is common when winter disappears. It is of a brownish yellow colour above.

10 species of this genus have been described in the last edition of the System of Nature.

78. Raphidia.

Mouth furnished with an archet mandible set with teeth. Jaw cylindrical and obtuse; lip round and entire; all of them formed of a horny substance. Feelers four, very short, nearly equal and filiform. Stemmata three. Wings deflected. Antenna filiform, the same length of the thorax, which is lengthened out at the anterior part, and cylindrical. Tail of the female furnished with a loose curved bristle.

*ophisquis. Wings without spots. 1. A native of Europe; in pine forests; feeding on other insects. Larva has six feet. The pupa active, very like the perfect insect in every point, except that it wants wings.

*notata. Wings marked on the edge with a brown spot. 2. A native of Britain. Black; a reddish brown spot on the head and legs, and furnished with a projecting sting of the same length with the abdomen.

V. HYMENOPTERA.

Wings four, membranaceous for the most part. Tail of the female furnished with a sting.

79. Cynips, Gall-fly.

Mouth with a short jaw, furnished with one tooth, and membranaceous. The mandible arched, cleft at the tip, and with a short, cylindrical, and entire lip, all composed of a horny substance. Feelers four, short, unequal and capitated. Antenna moniliform. Sting spiral, and for the most concealed.

The numerous excrescences or galls, found on the roots, branches, and leaves of various trees, are produced by the phlegmas of these insects. The larva without feelers, soft, cylindrical, and inhabits within the gall, feeding on the juices of the tree. The pupa resembles the perfect insect, except in having only the rudiments of wings.

adescens - dens. Of a brazen colour; the abdomen conical, ascending and joined to the trunk by a very narrow connection.
20. A native of Europe. Large; legs of a pale colour; the thighs black at the base.

*rose. Body black; the abdomen of a rusty colour, and black behind; the legs of a rusty colour. 1. A native of Bedeguar; on the rose.

*quercus. Black; base of the antennae and legs yellowish. 4. borearum. A native of Europe. Forms roundish and transparent galls, about the size of a pea, on the under surface of the leaves of the oak; and comes out about the middle of summer.

*quercus. Black; thorax marked with lines; legs gray; thighs beneath black. 5. A native of Europe. Forms galls about the size of a hazel nut, on the under surface of the leaves of the oak.

*quercus. foli. Black; antennae and legs pale. 6. A native of Europe. Forms globular, opaque, red galls, about the size of a hazel nut, on the under surface of the leaves of the oak.

Black; legs white; thighs brown. 7. A native of *quercus Europae. Forms hollow galls, convex at each end, on peduncle. the footstalks of the leaves of the oak.

Gray; wings marked with a linear cross. 8. A *quercus native of Europe. Forms granulated connected galls, pedunculi, on the male flowers of the oak.

In galls on the bark of the oak. 9. A native of *quercus Europe. Forms a cup-shaped gall, the disk convex and corticis. surrounded with about twenty concave dots, sunk into the bark of the oak.

Pale; abdomen and eyes black. 10. A native of *quercus Europe. Forms white woolly galls on the small ramuli. branches of the oak.

In the terminal bud of the *quercus robur. 11. A *quercus native of Europe. Found in the large imbricated galls gemmae. on the terminal buds of the *quercus robur. This fly is of a very dark green, slightly gilded. Its antennae and feet are of a dun-colour, rather deep. It deposits its eggs in the oak buds, which produce one of the finest galls, leaved like a rose-bud beginning to bloom. When the gall is small, the leaves are compressed, and lie over one another like the tiles on the roof of a house. In the centre of the gall there is a kind of hard nucleus, in the middle of which is a cavity, and in that is found the little larva, which feeds there, takes its growth, undergoes its metamorphosis, and breaks through the closure in order to get out. The whole gall is often near an inch in diameter, sometimes more when dried and displayed, and is attached to the branch by a footstalk. (Barbut, Insect. p. 233.)

On the calyx of the oak and agiopoe. 18. A native quercus of Europe. Forms galls on the calyx of the *quercus calicis. robur, sometimes used by tanners. They were called by the Romans cervo.


Forms galls of the shape of a pear, on the upper surface of the leaves of the common beech.

Body brown. 22. Forms tenacious globular galls, *rosmarini. about the size of a hazel nut, filled with clear oil, on the branches of the *rosmarinus chilensis.

Body black; the base of the antennae and legs of a phragmites brick colour; the abdomen lengthened out into a broad tail. 25. It is lodged at the top of the stalk of the *mallow fragmites, which becomes dilated, and grows no higher.

28 species of this genus have been described in the last edition of the System of Nature.

80. Tenthredo, Saw-fly.

Mouth furnished with an archet mandible, formed of a horny substance, and notched in the inside. Jaw straight and blunt at the tip. Lip cylindrical and divided into three. Feelers four, unequal, and filiform. Wings plain and swelling out. Sting composed of two serrated laminae, slightly projecting. Scutellum marked with two grains placed on its surface, at a distance from one another.

The male and female of many of the species of this genus vary in colour. They feed on the leaves of various plants; the female uses her sting in the manner of a saw, and cuts out spaces in the twigs or buds of trees; for the purpose of depositing her eggs; larva cylindrical, soft, with sixteen or twenty-eight feet; feeds on the leaves.
ENTOMOLOGY.

Hymenoptera.

Larva of an ash-colour; marked with triangular light brown dots on the back.

Greenish yellow; legs tawney; the thighs of the cymipifer bind-legs of a brass colour. 69. A native of Europe; mist. in the pods of the vetch; about the size of a black ant; the thorax lengthened very much, resembling a cymipa. Female bluish green, with a metallic lustre.

Body variegated. 21. A native of Europe; on salicis.

The poplar and willow. Larva feeding in parallel troops; flat, rough, yellow, and marked on each side with two rows of black dots; head black.

Body black; head and thorax red. 29. A native of alni.

Europe; on the leaves of the alder. When looked at, it attempts to conceal itself. The antennae are black; the abdomen black, with a violet gloss; the fore legs reddish brown.

Body black; belly, legs, and scutellum whitish. 35. ripae.

A native of Europe; on the leaves of the turnip. Small; whitish beneath; the edges of the wings black; the edges of the segments of the abdomen faint yellow; head and thorax variegated with white.

Body yellow; head and upper part of the thorax and abdomen black; wings marked with a yellow dot. 55. A native of Europe; on the willow and cosinith. The larva yearly destroys the gooseberry and red corinith, but does not injure the black corinith; blue; the three first and three last segments tawney, marked with nine lines of dots.

Body black; the shanks and apophyses of the thighs rubiis. of the bind-legs are white on their exterior sides. 88. A native of Europe; on the red corinith. The larva destroys the edges of the leaves of the red corinith; it is green; the head edged with black; the body wrinkled; six feet situated on the breast, are furnished with books; six on the abdomen are set close together, and two near the tail resemble papillae.

Antennae setaceous, composed of many articulations.

Body blue; head red. 40. A native of Europe; on erythro the common pine. Male black; the mouth and shanks cephalo.

of the fore-legs pale yellow.

Black, with a tinge of blue; mouth, feelers, and populi. shanks of the legs yellow. 44. A native of Europe; on the poplar; wings brownish; the breast variegated with pale yellow on each side, edged with bright yellow; the abdomen pale yellow; spotted on the back with black.

The following species, and other five, seem doubtful.

Black; legs yellow; antennae slightly elevated. 50. intercus.

A native of Europe; on the leaves of the burdock, the nightshade, and the euhorbia; it is lodged under the cuticle of the leaf; the antennae shorter than the body, transparent and deeply articulated; the abdomen oval and pointed.

140 species of this genus have been described by Gmelin, in his last edition of the System of Nature.

87. Sirex, Tailed Wasp.

Mouth furnished with a thick mandible, composed of a horny substance, terminating abruptly at the tip; the
Hymenoptera.

Body black; the abdomen yellow at the base and at the extremity. 1. A native of Europe; on fir trees.

Abdomen black; thorax hairy, with a pale yellow mark before the wings. 3. A native of Europe; in decayed timber, particularly fir wood.

Abdomen yellow above, marked with black rings; head and legs pale yellow. 12. A native of Europe; mouth, thorax, and under part of the abdomen black.

18 species of this genus have been described in the last edition of the System of Nature.

32. ICHNEUMON.

Mouth furnished with a jaw, straight, membraneous, roundish at the tip, divided, expanded, and fringed; the mandible arched, sharp, and smooth; and with a lip cylindrical, membranous at the tip, and margined. Feelers four, unequal, and filiform; situated in the middle of the lip. Antenna-setaceous, furnished with upwards of 30 articulations. Sting prominent, furnished with a sheath composed of two valves.

The whole of this singular genus are parasitical; deriving their nourishment from other insects. The fly feeds on the nectar of flowers; and when about to lay her eggs perforates the body of some other insect or its caterpillar, with its sting or instrument at the end of the abdomen, and there deposits them; these, after being transformed into larvae, prey upon the intestines of their foster parents till they are metamorphosed into pupae. The larva is without feet, soft, and cylindrical; its sometimes naked, sometimes covered with a follicle. It is a species of this genus which produces the animal cotton, of which M. Baudy of Loizires gives an account (Vide Second Voyage à la Louisiana, par Baudy des Loizires). A worm of considerable size, which Baudry calls fly-carrier, (well known to platers as the manioc or indigo worm) is at one period of the year attacked by swarms of the ichneumon fly, which deposit their eggs in every pore of the worm. The insects are produced all nearly at the same time, and spin each of them a minute covering for itself. The manioc worm is now covered with a white case, which he with considerable difficulty shakes off, and, in a few days, the insects are again hatched from it, but in the form of flies, leaving the animal cotton behind them. This production is very abundant, as M. Baudy could collect several bushels of it in a short time. In his opinion, it possesses many advantages over the vegetable cotton.

A. Scutellum whitish; the Antennae marked with white rings.

Scutellum white; the thorax without spots; the second, third, and fourth segments of the abdomen pale; the rest white at the tip. 2. A native of Europe; the thighs of the four hind-legs black.

Black; the scutellum, the extremity of the abdomen, and a notched band on the anterior part of the abdomen yellow; the legs, and connection between the abdomen and trunk likewise yellow. 221. A native of Italy. It forms cells composed of cemented clay, in chimneys and windows, arranged commonly in parallel rows, forming a cylindrical nest, each containing a brown, lactic follicle, in which the larva is lodged, together with the body of a spider in which the egg had been originally deposited. The upper wings are dark-coloured towards the tip.

B. Scutellum whitish; Antennae totally black.

Black; the scutellum whitish; the divisions between equitale, the segments black; the second, third, and fourth segments, as well as the legs, are yellow. 90. A native of Europe. In the pupa of the phasmea piniperae.

Black; the scutellum yellowish; the under part of the antennae reddish; the thorax armed on each side with a prickle; the abdomen black, marked with yellow belts; aqua yellow. 168. A native of Britain.

Scutellum white; the thorax spotted; abdomen black; the base of the second segment, the third and fourth segments yellow. 93. A native of Britain.

C. The Scutellum and Thorax of the same colour; Antennae marked with rings.

Black; the abdomen of a rusty colour, and black at migrator, the extremity. 116. A native of Europe.

Black; legs reddish; the feet of the hind-legs white at the tips. 199. A native of Britain. It smells of to.

D. The Scutellum and Thorax of the same colour; Antennae black.

Body and wings black, marked with a transparent desiguror spot like a crescent; abdomen scarlet. 28. A native of Britain; in gardens.

Black; legs reddish; the shanks of the hind-legs turionielle, black, marked with white wings. 40. A native of Europe. In the larvae of moths, particularly in the phasmea turionielle. Antennae of the same length with the body; the wing shorter than the abdomen.

Black; mouth and legs reddish; the abdomen joined to the trunk by a stalk, or narrow connection. 33. A native of Europe. In the parts of some species of butterflies.

Black; the abdomen curved like a scythe, reddish jocula, in the middle; the thighs of the hind-legs clavated; tor, white at the base and at the extremity. 58. A native of Europe; in the larvae of the bee and of the aphid.
and having discovered it, it flies away, and returns and places its egg on it.

E. **Antennæ pale yellow.**

**venosus.** Entirely yellow, except some black between the stems mata; wings white, with yellow veins. 354. A native of Europe.

**cinctis.** Black; antennæ and legs of a rusty colour; wings transparent, marked with a black speck. 60. A native of Europe; in gardens.

F. **Minute, with the Abdomen closely attached to the Thorax.**

**gregarius.** Black; the legs and side of the abdomen of a rusty colour. 204. A native of Europe; in the larvae of butterflies; gregarious, and very frequent in the spring. Soon after they are hatched they spin each of them a white follicle for themselves, which are connected together in a cluster, from which they come forth perfect insects.

**bedega- ris.** Shining green; abdomen golden-coloured. 69. A native of Europe; in the larvae of the cynips, which produces the gall on the rose and the oak. The sting has the same length with the body.

**gallar- rum.** Of a bronze colour; abdomen black; shanks of the legs whitish. 64. A native of Europe; in the larvae of the cynips, which produces the gall on the branches of the oak.

**puparum.** Body blue and gold; abdomen shining green; and legs pale. 66. A native of Europe; in the larvae of butterflies.

**cynips.** Green and gold; the abdomen brown, marked with a pale-coloured belt at the base; legs yellowish. 68. A native of Europe; on the larvae of the cynips, and on the pupae of butterflies.

**globatus.** Black; legs of a rusty colour. 74. A native of Europe; in stalks of grain, within a roundish follicle, composed of white silk, common to a number of the insects.

**glomera- tus.** Black; legs yellow. 75. A native of Europe; in the larvae of butterflies. Soon after they are hatched, they spin each of them a yellow follicle for themselves; they deposit their eggs on the pupae of butterflies, soon after they have changed from larvae.

418 species of this genus have been described in the last edition of the System of Nature.

83. **Sphex.**

Mouth furnished with an entire jaw; the mandible curved, notched, and formed of a substance like horn. Lip horny, and membranaceous at the tip. Feelers four. The antennæ in some species have upwards of 10 articulations. Wings in each sex incumbent and not folded. Sting pungent and concealed within the abdomen.

The insects of this genus are the most savage and rapacious of this class of animals; they attack whatever insects come in their way, and by means of their poison scent, sting overcome and devour such as far exceed themselves in size; when they attack any insect, they give one stroke, and fall down as if dead, and quietly wait till the poison they have infused through their sting produce its effect. Their prey either serves as food for themselves or their young. Those of the division B. are to be found chiefly on umbelliferous plants; the larva is without feet, soft, and inhabits the body of some other insect, on the juices of which it feeds; the pupa has only the rudiments of wings; the perfect insect deposits her eggs in the bodies of other insects.

A. **Antennæ setaceous; Lip entire; Tongue wanting.**

**Evanize.**

Body black; the abdomen very short, and attached appendi to the back part of the thorax by a foot-stalk. 13. **gaster.** A native of Europe, America, and Africa. Sprinkled with concave dots; the thorax flattened behind; the abdomen oval, compressed and very smooth; wings transparent, short, and deflected.

B. **Antennæ filiform; the Lip emarginated, and furn iished with a bristle on each side; Tongue bent inwards, and divided into three divisions for almost half its length.**

a. Abdomen attached to the trunk by a stalk or narrow communication.

Black, hairy; the attachment of the abdomen to the trunk furnished with two articulations; the second and third segments of the abdomen of a rusty colour. 1. A native of Europe; on sandy ground, where it digs a hole with its fore-feet, like a dog, in which it buries the larva of a moth, on which it deposits an egg, and then shuts up the hole. The abdomen exceeds the wings in length about one half, and in the male is black on the back.

Smooth, black; the lip and the edges of the segments of the abdomen lucid. 11. A native of Europe; in holes of wood, in partitions, which have been formed and abandoned by other insects; these it cleanses by gnawing round them; and placing a piece of moist clay at the bottom, sticks a spider upon it. In the body of this spider it deposits its eggs, and then closes up the entrance with clay. The larva is pale, and very like the larva of a bee. Having consumed the spider, which had been enclosed along with it, it spins a yellowish brown membrane for itself, exactly adapted to its body. One female sphinx forms a great many nests; she spends no more than two days in forming any one.

Body black; fore-head, mouth, scutellum, and twosinus obscure bands on the abdomen, yellow. 98. A native of Italy; breeds in chimneys and in windows, in the same nest with the ichneumon seductor. It is about seven lines long, dotted; the shanks of the legs yellowish; and black at the extremities; wings transparent and dark coloured at the tips.

b. The Abdomen closely attached to the Thorax.

Downy and black; wings brown; the anterior part viscosa, of the abdomen of a rusty colour, marked with black belts. 15. A native of Europe; in sandy ground; it digs holes in the sand, in which it buries the larva of a moth, after it has deposited an egg on it.

Body black; the fore part of the thorax furnished viscosa, with
Hymenoptera.

Entomology.

87. Tiphia.

Mouth furnished with a membranaceous rounded jaw. The mandible arched, and acute. The lip short, furnished with three small projections, and composed of a substance like horn. No tongue. Feelers four, filiform, unequal, projecting, and situated in the middle of the lip. Antennae filiform and arched.

Black; the thighs of the four hind-legs angular and * femora-reddish. 4. A native of England.
Black; thorax spotted; abdomen marked with five * quinque-yellow bands, the second interrupted. 6. A native of * cicuta. Europe, chiefly in England.

17 species of this genus have been described in the last edition of the System of Nature.

88. Chalcis.

Feelers four, and equal. Antennae short, cylindrical, and spindle-shaped; the first articulation a little thicker than the rest.

Shining black; the thighs of the hind-legs thickened-pustules, and marked with a white dot at their extremities. 6. A native of Europe. Feet white.

7 species of this genus have been described in the last edition of the System of Nature.


Mouth composed of a horned substance, and projecting; is furnished with a linear jaw, and with a lip emarginated, and membranaceous at the tip, and much longer than the jaw. No tongue. Feelers four, projecting, unequal, and filiform. Antennae short, and filiform; the first articulation longer than the rest. Body gilt and shining. Abdomen arched beneath, furnished with a scale on each side. The anus (in most of the species) is furnished with small projections. Sting is slightly projecting. Wings plane.

The insects of this genus commonly form their nests in holes made in walls.

Smooth, polished; the thorax green; the abdomen * ignita, of a golden colour, and furnished with four small projections at the extremity. 1. A native of Europe; in walls.
Smooth, shining; the thorax green; the abdomen of * aurata, a golden colour; the anus furnished with two small projections. 4. A native of Europe; in walls.
Smooth, shining; the thorax and abdomen blue; * cyanus, the anus furnished with three small projections. 5. A native of Europe; in walls.
Smooth, shining green; the thorax and superior part viridula, of the two first segments of the abdomen gilt; the anus furnished with four small projections. 6. A native of Europe; in walls of houses.

27 species of this genus have been described in the last edition of the System of Nature.

Vol. VIII. Part I.
ENTOMOLOGY.

Hymenoptera.

VESPA, Wasp.

Mouth composed of a horny substance. Jaw compressed. Feelers four, unequal and filiform. Antennae filiform; the first articulation longer than the rest, and cylindrical. Eyes large and circular. Body smooth. Sting pungent, and concealed within the abdomen. The upper wings are folded in the males, females, and neuters.

These live mostly in numerous societies, constructing curious nests or combs, generally under ground; they prey upon other insects, especially bees and flies, and devour meal, bread, and fruit. The larva is soft, without feet, and feeds on the nectar of flowers and honey; the pupa quiescent, and has the rudiments of wings. Some of them are solitary, others live in swarms.

A. No tongue.

* The Antennae thicker towards their outer edge.

**crabo.** Hornet. The thorax black, marked on the fore part with reddish-spots; there is a double dot contiguous to the divisions between the segments of the abdomen. 3. A native of Europe. It has its nest in hollow trees, in out-houses, or in dry situation; its combs are very neatly constructed, and composed of a substance like coarse paper, or decayed parchment. They prey on other insects, particularly on bees. Their sting is very painful.

**ultraria.** Thorax marked on each side with a small interrupted line; the scutellum marked with four spots; the divisions between the segments of the abdomen dotted with black. 4. A native of Europe, about houses; they prey on flies, and rob bee-hives. They live in swarms composed of males, females, and neuters. The male has a yellow head, and long antennae; an abdomen composed of seven yellow segments, marked with black triangular spots. They are destitute of stings, but are longer and larger than the neuters, though smaller than the females. The female has short antennae; lip yellow; abdomen composed of six segments, marked on the sides with two black dots, and is furnished with a sting. There are frequently between two and three hundred females, and as many males, in a swarm of wasps. A single female in the spring that had been impregnated in the preceding autumn, lays the foundation of a swarm. It makes itself a hole in some dry situation, or fixes on a mole hole, where it hastily builds a few cells, and deposits its eggs; which in the course of about twenty days, pass through their different changes, and become perfect insects. Almost the whole of those produced from the first deposited eggs are neuters. As soon as they are fit to fly about, they commence their labours, enlarge their hole by removing the earth with their mouth, go out in quest of materials for forming new cells, which are composed of small fibres of wood, cemented together by a glutinous substance formed within the body of the animal. They may frequently be seen on rails, posts, &c. on reeds, or stalks of decayed vegetables, gnawing off small particles, which they convey to their nest, and deliver to those occupied in the construction of the work. The external covering of their nest is formed of several layers of thin leaves resembling paper, which are not in immediate contact with one another, and in that way they prevent external moisture from penetrating into the cells, which are arranged in flat combs placed over one another, each story being supported by a number of very neat pillars. The female continues to deposit her eggs, which are oblong and yellowish, during the whole summer, to the amount of many thousands. A few hundreds of those that are last deposited, produce males and females, which are impregnated in the autumn, and which, should they survive the winter, lay the foundation of new swarms in the beginning of winter.

Body black; the thorax is marked with two dots; parietum the scutellum is likewise marked with two dots, the abdomen with five yellow bands; the first of which is at a distance from the rest. 6. A native of Europe; about houses. It forms its nest in holes in wood. Black; thorax marked with two pale yellow spots; parietum the abdomen marked with four yellow bands, the first at a considerable distance from the rest. 8. A native of Europe, in walls; the scutellum without spots; the shanks of the legs yellowish.

First segment of the abdomen funnel-shaped; coecocsecond bent-shaped, and very large. 11. A native of tata. Europe, in gardens. It attaches its nest, which is globular, and constructed of the same materials with that of the common wasp, to the branches of trees; the abdomen black, the segments yellow at the edges; the first and second marked with two dots.

** Antennae filiform. Crabrones.

The abdomen marked with two yellow bands; tridentata anus furnished with three small projections; wings black, white at the edge. 98. A native of Europe. Thorax without spots; the abdomen marked on each side with five yellow spots; legs black. 101. A native of Europe, in sandy situations. Head large, terminating abruptly in the fore part; mouth of a silver colour; the spots on the abdomen uniting so as to form a band.

B. The tongue bent inwards, and divided into three at the point. Bombyes.

The upper lip conical and divided; the abdomen redrata black, marked with waved yellowish bands. 152. A native of Europe, on sand hills. Their nests contain only a single larva.

Black; lip roundish; the abdomen marked with six fasciate yellow bands; the first five of which are interrupted. 157. A native of Europe, covered with ash-coloured down; the thorax spotted with brown, the antennae black, the first articulation yellow below, the last of a rusty colour; lip and legs yellow, the thigh black: the anus furnished with three small productions.

The lip nearly conical; the thorax brown, spotted fuscinis with yellow; abdomen black, marked with six yellow bands; antennae and legs of a rusty colour. 156. A native of Europe; head brown; mouth yellow: the bands on the abdomen broad, the first four interrupted.

166 species of this genus have been described by Gmelin in the last edition of the System of Nature.
Hymenoptera.

ENTOMOLOGY.

91. Arts, Bee.

Mouth formed of a substance resembling horn; the lip and jaw membranaceous at the tip; tongue bent inwards. Feelers four, unequal and biflorm. Wings plane. The females and neutrers have a pungent sting concealed within the abdomen.

The insects of this genus live some of them in large societies, and some are solitary; their food is the nectar of flowers, honey, and ripe fruit; the larva is soft and without feet; the pupa resembles the perfect insect. The larvae of the neutrers are very numerous, and placed in hexagonal cells; the larvae of the males are turgid and obtuse in the fore-part, and tapering behind.

A. The Tongue divided into five at the point; the Feelers very short.

Black; the under part of the abdomen covered with yellow wool. 4. A native of Europe. It forms several nests under ground, very neatly composed of the leaves of roses. There are several species which form similar nests in the trunks of trees or in walls, composed sometimes of the leaves of the rose, at other times of those of the horse chestnut.

Black, covered with ash-coloured hairs; abdomen black; the segments of the abdomen marked on each side with a white dot; the scutellum entire. 59. A native of Britain; on flowers.

Common Honey Bee. Downy; the thorax grayish; abdomen brown; thighs of the hind-legs fringed with hairs; on the inside marked with transverse striae. 22. A native of Europe; in hollow trees; but they are more frequently domesticated, and kept in hives. This well known and busy insect lives in great swarms, composed of females or queens, males or drones, and neutrers or working bees. The female is larger and longer than the rest; the abdomen being about one-third longer than the wings; the antennae have ten articulations; the feet reddish. The males are larger than the neutrers; their wings are longer than the body; their antennae have eleven articulations; the trunk is covered with long hairs, and is of a tawny colour. The neutrers as well as the females are gray on the thorax, and are furnished with a sting, of which the males are destitute; their antennae have fifteen articulations; they are furnished with two stomachs. A swarm consists commonly of one female, from 1000 to 1000 males, and of nearly 20,000 neutrers (vide Bee). They construct regular combs, composed of hexagonal cells, with wax which is formed within the body of the insect. Neutrers and others have supposed, that the wax was formed from the furinus of flowers, which the neutrers collect and carry home on their legs, and their opinions have been implicitly followed. But Mr Huber, member of the Society of Natural Philosophy and Natural History of Geneva, by a set of very accurate experiments and observations, has clearly proven that the wax is formed from honey (vide Journal de Physique, 5e. Planches An. XII.). We shall give here his own account of the experiments he has made. "It has been thought strange that the word wax should seldom occur in a book which treats of bees alone; but nevertheless, as in the course of my observations I had not attended to the products of their industry, I could only have repeated what had been said by Swammerdam and Beaumur, and that did not seem to me to be necessary. I knew that these insects collected abundantly upon the antherae of flowers; that they are acquainted with the method of opening them, of gathering their dust, keeping it in the cavities of their hind legs, and carrying it to their hives. It had been observed that the particles of this dust swell in water, and that when one of them bursts, an oily liquor runs out, which floats on its surface, but did not mix with it. From these experiments, repeated on the dust of a great number of flowers, it was concluded that they contain the principle of wax; but it was admitted that these must undergo a peculiar elaboration in the body of the bee, since, according to the experiments of Beaumur, a flexible wax could not be made from the dust of the antherae. It will be seen here from several passages in my work that I had adopted this opinion; a single observation of Burnsos (the name of Mr Huber's secretary), changed all my ideas. The true origin of wax might have been sooner known, had there been any suspicion that it was not already discovered. I shall now state how I was led to doubt, and what I have done to verify my new conjectures. "I was in Switzerland in 1793; the farmer of the estate on which I resided had many bees; and the greater part of his hives having been stacked in former years, the combs with which they were filled reached to the stands, consequently there was no room to construct new ones. We remarked, however, that the working bees carried in a considerable quantity of this fecundating powder. There was also in the same apiary, some swarms of that year, the hives having only been stocked a day or two; in some of them the combs were only begun; in others they were larger; but in all of them there were vacancies to fill up, and much work to do. We observed with astonishment, that the bees of these swarms did not carry in the pollen; and that, nevertheless, they worked with activity in the construction of new combs, and in lengthening those already commenced. Where, therefore, did they procure materials for their edifices? After these observations, we suspected that it was not from the dust of the stamens, and that they had a very different use for it than that for which it was believed to be intended. We, however, found that it was impossible to explain these extraordinary facts, without abandoning the hypothesis of Beaumur, by supposing that the bees of the old hives stored up so much pollen in their combs for their future wants, while those of the new swarms did not carry it outwardly on their legs, in the infancy of their establishment, because they had no cells in which they could deposit it; it might be sufficient to enable them to construct their combs, if they were at liberty to fly to the flowers, procure their pollen, and return to their hives and having filled their stomachs, where it must be elaborated, and converted into perfect wax. It was to obviate these doubts, that I undertook the following experiments. "First Experiment. On bees in confinement, with honey alone for their nourishment. Must pollen be ate by bees, to be in a state to produce wax? This was the first question which I thought it necessary to investigate: the method of trying the experiment was obvious;
**ENTOMOLOGY.**

Hymenoptera.

it was only required to keep the bees within their hives, and thus prevent them from collecting or eating the fe
cundating powder. On the 24th of May, Burnons lodged a swarm in a straw-hive, with as much honey and water as was necessary for their consumption; and he closed the doors, so that the bees could not get out, and the air be at the same time renewed.

At first the bees were very uneasy, but became calm on removing the hive to a cool dark place; their captivity lasted five days; they were permitted to come out into a room, the windows of which were shut; we then examined the hive more conveniently. We first noticed that there was no honey left in the vessel which had been filled with it, with the sole intention of feeding the confined bees; and were more astonished to see five combs of the most beautiful wax, suspended from the roof of the hive; they were perfectly white, and very brittle. This result was very remarkable; however, before forming a conclusion from it, that the honey with which these bees were fed, had enabled them to produce the wax, it was necessary to inquire, whether it could not also be explained in another manner. The bees which I had employed had doubtless collected the dust while they were at liberty. They might have done so the evening before, or on the very same day of their confinement, and might have enough in their stomachs, and in the cavities of their legs, to extract from it all the wax which we found in their hives. But if it was true that it had been obtained from the fecundating powder, previously obtained, this source was not inexhaustible, and the bees being unable to procure any more, they would soon cease to construct combs, and fall into the most complete inaction. It was necessary, therefore, to repeat the same trial, to render it decisive.

The 28th, Burnons returned this swarm into its hive; after having taken out all the combs, he shut them up as before, with a fresh supply of honey. This experiment was not long, for on the evening of the second day we perceived the prisoners working with new wax. The next day the hive was inspected, and we found five combs, as heavy and as regular as those made during the first captivity. We afterwards repeated this experiment five times successively, with the same bees, and the same precautions: we always found that the honey had disappeared, and that new wax was produced. This result was so invariable during this long seclusion, that we could no longer doubt that the honey alone had supplied them with all the elements of their wax, without the assistance of the fecundating dust.

Second Experiment.—On a hive from which honey was excluded, and in which only pollen and fruits, for the nourishment of the bees, were left, I thought it would not be useless to make the inverse of the preceding experiment; it would show me whether the pollen could not supply the want of honey, when the bees were deprived of it, and enable them to produce wax.

I therefore enclosed a swarm in a bell-glass, in which had been placed a comb, whose cells contained only pollen, and the sole nourishment of the bees was fruit.

These bees did not make combs, nor did they form a single cell during eight days, which was the time of their captivity. I was going to repeat this experiment, when Burnons remarked, that the free bees were, in some measure, in the same state as those we had con-

fined; there being no honey at that time in the flowers, they found only pollen, and did not work in wax.

It may perhaps be asked, how I was satisfied of this: to which I answer, bees wax is white at first, the cells soon become yellow; and in time, this colour grows browner; and in older hives have acquired a blackish tinge. It is, therefore, very easy to distinguish the new cells from those which had been some time formed, and consequently to know whether the bees are really making combs, or whether that work is suspended; it is sufficient to raise the hive, and to notice the lower edge of the combs.

The odour exhaled by the hives, and the shape of the bees, are indications, by which it may always be known whether there is honey in the flowers: if they are combined, there can be no further doubt; and, particularly, if a great number of bees return to the hive, which are remarkable for the bulk and form of their bellies. These which are filled with honey, have the abdomen cylindrical; the name of wax-making bees belongs to them exclusively: the bellies of the labouring bees, which have other functions, always preserve their ovoid form, and their volume is never sensibly augmented; the name of nursing bees is proper for these.

The farmers of the neighbouring villages kept their bees in baskets, or in cases of different forms; and I was able to visit a very great number, without going to any great distance from my habitation.

In 1793, an inconstant spring had retarded the separation of the swarms; there had not been any in the country before the 24th of May; but towards the middle of June there were several in the vicinity of my residence. At that time the fields were covered with flowers, the bees collected much honey, and the new swarms worked at the wax with vigour.

On the 18th, Burnons visited 65 hives; at the entrance of all of them he observed wax-making bees. Those which returned to old hives, not having to construct cells, deposited their honey in the combs, or distributed it among their companions; those belonging to the young swarms converted their honey into wax, and hastened to construct combs for the reception of their young bees.

It was showery on the 25th; the bees went abroad, but brought home only pollen. The weather was cold and rainy until the 27th. We were desirous of knowing if this had prevented their working. On the 28th, all the hives were lifted. Burnons found that the work had been stopped; the combs which he had measured on the 15th, were not at all increased, and were of a citron yellow; nor was there a single white cell in any of these hives.

On the first of July, the obscurants and limes were in blossom; the thermometer indicated the twentieth degree; the wax-making bees re-appeared; they carried away great quantities of honey, which, as he had before observed, was employed in augmenting the provisions of the old hives, and enabling the young swarms to construct new combs. The greatest activity was observable among them; the gathering of honey, and the production of wax continued, until the middle of this month. July 16th, the heat remained the same; the field flowers, as well as those of the obscurant and lime, were completely withered; they yielded no more honey, their pollen alone attracted the working bees, and they collected
collected it abundantly; but there was not any wax produced; the combs were not lengthened; those of the young swarms did not fill more than two-thirds of their hives.

"August 9th. It had not rained for six weeks; the heat was very powerful, nor was there any dew to delay it during the night; the black wheat, which had been in flower for some days, did not offer any honey to the bees; they found only pollen. 2d. On the 9th of August, it rained for several hours; next day, the black wheat had the odour of honey; in fact it might be seen glittering in the expanded flowers. The bees found enough to feed them, but too little to induce them to work at new wax.

"On the 14th, the drought recommenced, and lasted to the end of the month; no more honey appeared upon the flowers; and when we visited the 65 hives for the last time, we found, 1st, That the bees had not produced any wax after the middle of July. 2d, That they had stored up a great quantity of pollen. 3d, That the supply of honey was much lessened in the old hives, and that hardly any remained in the new swarms, that which they had collected in the spring having been employed in the preparation of wax. The pollen, therefore, has not this property, and no farther doubt remained on this head. This year had not been stormy, and I have since ascertained, by a great number of observations, that electricity is singularly favourable to the secretion of honey by the flowers; the bees never collect it in greater abundance than is the preparation of wax ever more active, than when the wind is in the south, the air humid and warm, and a storm gathering.

"Heat too long continued, and the drought which is the consequence of it, cold rains, and principally a north wind, suspend it entirely.

"Third Experiment. On the use which the bees make of the fecundating powder. In the second experiment, the bees did not touch the pollen which I had placed within their reach, and as its quantity was not sensibly diminished during this trial, I was induced to believe it was not an aliment proper for them.

"I also knew that the new swarms were liable to perish from hunger in the middle of summer, and even when the country was covered with flowers, if a particular temperature, which is too uncommon in our climate, did not favour the secretion of honey in their nectaria. What, therefore, is the use of the pollen they collect with such avidity during eight months of the year, and of which they lay up such abundance (a)? This question remained to be investigated.

"I had a hive in divisions, the queen of which was barren; its combs did not contain any pollen, but they had much more honey; the two narrowest sides of this hive were formed of panes of glass, through which the surfaces of the exterior combs might be seen, and the conduct of the bees observed.

"I took away the queen on the 16th of July; but to console the working bees, I removed the first and twelfth combs, in which there was not any thing to interest them; and I supplied their places with two combs, the cells of which were filled with eggs and worms of all ages. I carefully cut away all the cells in which pollen could be perceived, and shut up the hive with a grating. My intention will be guessed; I wished to know whether these insects could support their young without this fecundating powder. The next day nothing extraordinary occurred; the bees sat on their eggs, and seemed to nurse them.

"On the 18th, after sunset, a great noise was heard in the hive. Anxious to see what occasioned it, we opened the shutters, and observed that all was in confusion; the incubation was stopped; the bees ran over the combs in disorder; we saw thousands precipitate themselves on the stand, those which were nearest to the mouth eagerly gnawing the grating; their intention was no longer doubtful, they wished to get out of their confinement.

"I was fearful of destroying them by continuing to prevent them from yielding to their instinct; they were therefore set at liberty. The whole swarm came out, but the hour was unfavourable to their collecting: the bees did not go far from the hive, the darkness and the chillness of the air soon compelled them to return, and probably calmed their agitation; for we saw them quietly reassend their combs, and order appeared, to us, to be re-established. This moment was taken to close the hive again. On the 19th, we saw two royal cells begun on one of the combs of the nursery: the evening of this day, and at the same hour as the day before, we heard a great tumult in the closed hive; it was in a general confusion, and we were again obliged to permit the swarm to come out. The 20th was the fifth day of their captivity. We thought it had been of sufficient duration, and were also very impatient to examine the nursery, and to see what was the cause of this periodical agitation of these bees: Barons therefore opened the first and twelfth windows, and drove the bees from the combs, suffering them to take their flight in a room; the windows of which were shut. He first noticed that the royal cells had not been continued, that they did not contain any worm, and that there was not an atom of the jelly which serves for the nourishment and the cradle of the grave of the queens. He sought in vain for eggs, for worms, and for the liquid in the common cells; all had disappeared. Had these worms died of hunger? Had we, by withdrawing the fecundating powder, deprived the bees of every means of nourishing the larvae?

"To ascertain this, it would be sufficient to restore them their pollen, and observe the issue. The bees were, therefore, again returned to their prison, after having substituted young worms for those which had been suffered to die.

"On the 23d, we found that the bees had fastened these combs, and that they were again in a state of incubation; we then gave them some pieces of combs in which other bees had stored up the fecundating powder; and

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(a) Beaumur was of opinion that the bees of a well-stocked hive, might collect at least a hundred pounds of this substance in the course of a year; but having remarked that the weight of wax, fabricated in the same time, did not exceed two pounds, he concluded that the bees extract only a very small portion of the true wax from this active wax, that the greatest part of it is required for their nourishment, and that the rest is discharged from their bodies in the form of excrement.
ENTOMOLOGY.

Hymenoptera.

and the better to observe what they did with it, we took some of the pollen out of the cells, and laid it exposed on the stand of the hive. In a few minutes, the bees discovered the pollen in the combs, and that which we had taken out; they took it grain by grain in their jaws, and conveyed it into their mouths; those which had eaten most voraciously reascended the combs, and placed themselves, at first, upon the cells of the young worms, which they entered head foremost, and remained there a greater or less length of time. One of the windows of the hive was now opened cautiously, Bunsions powdered the bees which ate the pollen, and watched them for some hours; he observed that the marked bees always reascended the nursery, and immediately entered the cells of the young bees.

The 23d, we found the royal cells begun.

The 24th, we drove the bees from off the young worms; and we remarked,

1st. That all of them had the jelly, as in the common hives.

2d. That the worms had grown larger, and were forwards in the cells.

3d. That others had been shut up again; and,

4th. That the royal cells had been lengthened.

The 25th, we withdrew the pieces of comb which we had placed on the stand, and found that the quantity of pollen was certainly diminished; we afterwards replaced them in the hive with other cells filled with the fecundating powder.

The 26th, the royal cells had been closed during the night, as well as several of the common ones.

The 27th, I restored these bees to liberty. Bunsions examined the cells with the greatest attention, and found jelly in all those which still contained worms, but most of them were shut with a lid of wax: he examined some of the latter, and found the worms employed in spinning cocoons of silk.

All the worms therefore had been tended as in the natural hive. In this second trial we did not perceive any disorder in this hive; there had not been the least agitation: it is true some of the working bees attempted to go out in the course of the day; but finding it impossible, they reascended the combs quietly, which were never left for an instant. The hive being abundantly supplied with honey, and with the pollen necessary for their young, left them nothing to wish for; and they were still more happy when a queen was born, who afterwards became pregnant, and laid a great number of eggs. After these two experiments, there could be no more doubt that the fecundating powder was the aliment proper for the young bees, and that the want of this substance was the cause of their death, and of the evident anguish of their nurses during their first captivity.

Fourth Experiment.—On bees deprived of honey and pollen, and which it was attempted to feed with sugar. I wished to know, if it was the saccharine part of the honey which enabled the bees to produce wax. Bunsions confined a swarm in a glazed hive; one pound of Canary sugar was their sole aliment. He put a second swarm into another hive, and endeavoured to feed them with very coarse raw sugar; and to obtain a term of comparison, a third swarm was shut up in the same manner, and fed with honey. The best of the three swarms produced wax; those fed with the different qualities of sugar produced it sooner than the swarm which had only had honey, and they produced a greater quantity.

A pound of Canary sugar reduced to syrup, and clarified with white of egg, yielded 10 gns. 52 grains, of a wax not so white as that which the bees extract from honey. An equal weight of raw sugar, gave 22 gns of very white wax. Maple sugar produced the same effect. This experiment having been repeated seven times successively, always employing the same bees, we could not doubt that sugar contains the principles of wax; and concluded that it was the saccharine part of the honey which had this property.

Conclusion. These observations shew,

1st. That the wax comes from the honey.

2d. That the honey is also a food of the first necessity to the bees.

3d. That flowers do not always contain honey, and that the secretion of honey depends in a great measure on the state of the atmosphere.

4th. That it is the saccharine part of the honey which enables the bees to produce wax.

5th. That raw sugar yields more wax than honey or refined sugar.

6th. That the dust of the stamens does not contain the principles of wax.

7th. That this dust is not the food of the adult bees, and that they do not collect it for themselves.

8th. That the pollen affords the only aliment which is proper for their young; but that this substance must undergo a peculiar elaboration in the stomachs of the bees, to be converted into an aliment which is always appropriated to their sex, their age, and their wants; since the best microscopes do not shew the particles of pollen, or their coverings in the liquor, prepared by the working bees.

Hairy, black; wings of a violet colour. 38. A ne-vulvaes. native of Europe, and of India. It pierces the trunks of decayed trees, or posts, and forms longitudinal excavations, in which it constructs several nests; having placed one at the bottom of the hole, it deposits an egg in it, fills it with a mixture of honey and pollen of flowers, closes it up, and commences another; it proceeds in this way till the cells occupy the whole length of the perforation; the eggs are so placed in the cells, that the head of the larva points downwards towards the exit.

Humble-bee. Hairy, black; thorax marked with a terrestris. yellow belt; anus white. 41. A native of Europe. It forms a nest at a considerable depth under ground, and collects a good quantity of honey.

Hairy, black; the anus of a tawney colour. 44. A tepidaria. native of Europe; in heaps of stones, or in old walls. It collects a considerable quantity of honey.

Black; slightly covered with reddish hairs; abdomen parsee smooth, marked with three bands, white above, and reddish beneath. 147. A native of Europe. It somewhat resembles A. mellifica, but less. It comes out very early in the spring.

B. The Tongue divided into three at the extremity.

* The Lip furnished on each side with two membrana- ceous bristles. Andreae.

Abdomen brown, marked with five whitish bands; the bidentate. anus furnished with two small projections. 156. A native of America. It forms its nest in walls, of leaves of
Hymenoptera.

Entomology.

of trees neatly folded up; the fore legs are long and yellow; the feet fringed.

dichros. Black; anus of a rusty colour. 137. A native of Europe; in groves.

* * Lip without bristles, compressed, and entire; posterior Feelers tongue-shaped. Nomadne.

sulcata. Covered with sub-coloured hairs; the abdomen smooth and black; the second and third segments of the abdomen of a rusty colour. 200. A native of Europe; in groves.

variegata. The thorax and abdomen variegated with white; the legs of a rusty colour. 24. A native of Europe. It sleeps all night fixed to the flowers of the Geranium phaenum. The scutellum sometimes of a rusty colour, and sometimes white; the first and second segments of the abdomen marked with two white spots; the third, fourth, fifth, and sixth, marked with four.

Very hairy, and black; the jaws broad, and marked on the outside with elevated lines, and rounded at the points; wings of a reddish violet-colour. 214. A native of the south of America. One of the largest of this genus.

52. Formica, Ant, or Emmet.

Feelers four, unequal, with cylindrical articulations, placed at the tip of the lip, which is cylindrical, and nearly membraneous. Antennae filiform. A small erect scale placed between the thorax and abdomen. The females and neuters have a sting concealed within the abdomen. The males and females have wings; the neuters none.

This is a gregarious, and proverbially industrious family, consisting, like bees, of males, females, and neuters. The last are the well known little insects, who construct the nests or ant-hills, who labour with such unceasing assiduity for the support of themselves and the idle males and females, and who guard with such ferocity the larvae, or what are commonly called ant eggs. They wander about all day in search of food or materials for the nest, and assist each other in bringing home what is too cumbersome for some as have attempted it. They every day bring out of the nest, and expose to the warmth of the sun, the new hatched larvae, and feed them till they are able to provide for themselves. In the evening they consume together whatever has been collected during the day, and do not, as is commonly supposed, lay up any store for the winter, but probably become torpid or die. They are peculiarly fond of ophiodes, and are themselves eagerly sought after by the ant-eaters, and various birds. The puncture inflicted by their sting, occasions a hot painful itching sensation. They contain a peculiar acid. See Chemistry Index.

* kerculaeana.

Black; the abdomen oval; legs of a rusty colour. 1. A native of Europe, and America; lodge in the trunks of decayed trees.

viatica. Of a rusty colour; the abdomen oval and black. 23. A native of Europe; runs very quickly; the tip of the jaws black; the abdomen smooth.

* rubra. Black; the thorax compressed; the legs of a rusty colour. 3. A native of Europe; it lodges in sandy hills, in woods; it is large, and has no sting.

black; the mouth, the tip of the thorax, and legs, * fusca. of a rusty colour. 4. A native of Europe; in woods.

Of a brick colour; eyes black; a black dot under * rubra. the abdomen. 7. A native of Europe. It lodges under stones in woods. They inflict a very painful puncture.

Black; two knots on the filament which connects the * campi- abdomen to the trunk; the scutellum furnished with two small projections. II. A native of Europe; in dry meadows, under moss. The males and females, in the month of August, leave their nest about mid-day, when the weather is serene, and fly about in the air. The abdomen oval.

The thorax marked with raised dots; the filament _conspicua_, which joins the abdomen to the thorax is furnished with two knots; the body of a brick colour; the abdomen small. 12. A native of America. It is very destructive to all sorts of provisions. Small. The abdomen brown, covered with white hairs scarcely perceptible.

Black; abdomen oval and hairy. 50. A native of Europe; on decayed trees. It gnaws holes in the wood under the bark, and forms a number of passages for itself.

Black, smooth; the scale placed between the thorax _glabra_ and abdomen, furnished with two small projections; the divisions between the segments of the abdomen whitish; legs reddish. 53. A native of Europe.

55 species of this genus have been described in the last edition of the System of Nature.

93. Mutella.

Mouth formed of a substance like horn; without a tongue. Jaws membraneous at the tip. Lip projecting, resembling an inverted cone; at the extremity of which are placed four unequal feelers, with conical articulations. Antennae filiform. Wings wanting in most species. Body downy. The posterior part of the thorax turned back. The sting is pungent, and concealed within the abdomen.

Scarlet; the abdomen marked with a black belt. 1. accidenta. A native of Europe. The antennae, eyes, legs, and _dis_. under part of the body black; the sting long and filiform.

Black; the base of the abdomen marked with two _diadema_. yellow dots; the middle with an interrupted yellow streak; the extremity with a small white line. 10. A native of South America. Large; the lower part of the head marked with a white band; the thorax marked with two white lines, and with white on the inferior part.

Bluish; the abdomen marked with a large _aurata_. coloured spot. 13. A native of New Holland.

Black; the thorax reddish; the edges of the seg_ * europeae_. ments of the abdomen white. 4. A native of Europe; in woods of maple.

Hairy, black; the thorax reddish; the abdomen _kalennis_. marked with two white dots, and with a white band on the posterior part. 15. A native of Europe; the upper part of the shanks brown.

27 species of this genus have been described in the last edition of the System of Nature, published by Gmelian.
VI. DIPTERA.

Wings two. Feelers clavated; one placed behind each wing under a little scale.

94. OEstrus. God-fly, Breeze.

A sucker drawn back within the lips, which are connected, and furnished with a small pore. Feelers two, of two articulations, orbicular at the tip, and seated in a depression on each side of the mouth.

Antennæ short and setaceous.

The face of this singular genus is broad and depressed, and has some resemblance to the ape. They are extremely troublesome to horses, sheep, and cattle, depositing their eggs in different parts of their bodies, and occasioning painful tumours, and even death. The larva is without feet, thick, short, soft, and composed of several segments; they are sometimes furnished with hooks. They lurk within the bodies, or under the skin, of horses, oxen, &c.; and feed on their juices during the winter. The pupa is without feet, oval, and incapable of motion, covered with a hard light brown crust. The perfect insect lives but for a short time.

Wings brown, without spots: the abdomen black, white at the base, and of a tawny colour at the extremity. 1. A native of Europe. It deposits its eggs on the backs of oxen, and lodges them under the skin. The larva, when young, is smooth, white, and transparent; as it advances in age, it becomes brownish, and when full grown and ready to be changed into a pupa, it acquires a dark-brown colour. It is lodged in a sack formed in the cellular substance immediately under the skin, and occasions a very considerable tumour on the back of the animal. The sack communicates with the air by a very narrow opening, next to which the anus of the animal is placed. Through the anus a yellow purulent matter is discharged; and near the anus are situated two spiracula. There is a small indentation on the opposite extremity of the larva, which is situated at the bottom of the sack, surrounded by two or three papillæ, which forms the mouth. It has a number of dots on its surface, disposed in transverse interrupted lines. Two distinct and different kinds of lines are seen on each segment; the uppermost of them is narrower, and consists of larger dots. Underneath this is a broader line, and the dots considerably smaller. The first are easily seen, by using the lens, to be hooks bent upwards, or towards the tail of the insect. On examining the broader line of small dots, with a tolerably powerful magnifier, they are also found to be hooks, but turned in an opposite direction, that is, downwards in the sack, and towards the head of the insect. These hooks, it is probable, are occasionally erected by the muscles of the skin; and according to the series of them used by the larva, it is raised or depressed in the sack; and by this motion, and consequent irritation, a more or less copious secretion of pus is occasioned for its sustenance.

This singular arrangement of hooks round the body of the larva, in this instance, serves the same purpose as the legs in other larva, enabling them to move about in the sack, and to crawl out of it when about to change into pupae.

They never change their skin like most other larva, the same serving them through their growth; and it at length also serves to form the shell of the pupa. After leaving the sack, and previous to their becoming pupae, they contract themselves, and assume a different figure. They continue in the state of pupae from about the latter end of June until about the middle of August, when the fly appears. Full grown larva are sometimes to be met with on the backs of cows in the month of September, which probably remain in the state of pupae till the ensuing spring. The perfect insect, on leaving the hard crust which surrounds it, forces open a very remarkable, margined, triangular valve, which may be traced in the skin of the larva, and is situated on one side of the smaller end.

The oestrus bovis, in its perfect state, is the largest of the European species of this genus, and is very beautiful.

The pain it inflicts in depositing its eggs is much more severe than any of the other species. When one of the cattle is attacked by this fly, it is easily known by the extreme terror and agitation of the whole herd: the unfortunate object of attack runs bellowing from among them to some distant part of the field, or the nearest water, while the tail, from the severity of the pain, is held, with a tremulous motion, straight from the body, in the direction of the spine; and the head and neck are also stretched out to the utmost. The rest, from fear, generally follow to the water, or disperse to different parts of the field. When the oxen are yoked to the plough, the attack of this fly is attended with real danger, as they become perfectly uncontrollable, and will often run with the plough directly forwards, through the hedges, or whatever obstructs their way. There is provided, on this account, a contrivance in many ploughs, to set them immediately at liberty.

The strongest and healthiest beasts seem constantly to be preferred by it, and commonly have the greatest number of bots, worms, or warbles, on their backs; dealers are frequently guided in their choice of cattle by this circumstance. The female fly is very quick in performing the operation of depositing her eggs: she does not appear to remain on the back of the animal more than a few seconds.

Gray, marked with a white band, and dotted with buccatus black. 6. A native of Carolina.

Black, hairy; wings of a sooty colour; their outer trompe, edge bright black; head, thorax, scutellum, and anus, grayish-yellow. 7. A native of Lapland. The larva occupy the frontal sinus of the rein-deer; the animal sometimes in the spring, forces out great clusters of larva by sneezing. This is the largest species of the genus.

Wings without spots; the thorax yellow, marked tarandi with a black band; the abdomen tawny, and bright yellow at the extremity. 2. A native of Lapland. It deposits its eggs on the back of the rein-deer. Such is their dread of it, that they every year leave the woods, and take refuge in the mountains. A very great proportion of them fall victims to this insect, before they are three years old. Those who escape with life are very much emaciated, and have their skins spoiled.

Bots.
Diptera.  

Botts. Wings whitish, marked with a black band in the middle, and two black dots. A native of Europe. (Vide Transactions of the Linnæan Society, vol. iii. p. 326.) The forehead white and downy; top of the head brown; the eyes black, and distant from one another; thorax brown, with a dark-coloured centre; the abdomen yellowish brown, the divisions between the segments of the abdomen marked with black spots and dots; the scutellum furnished with two tufts of hair; wings marked near the base with a very small black dot, in the middle with a black band, and towards the extremity with two black spots. The male is distinguished by a brighter yellow; the female by a deeper brown, and by the extremity of the abdomen, which is long, bent inwards, and black, terminating in a bifid style. It deposit its eggs on the hairs of the knees or sides of horses, when the animal licks itself, are conveyed by the tongue into the stomach. The body of the larva is composed of eleven segments, all of which, except the two last, are surmounted with a double row of rusty bristles directed towards the truncated end, and are of a reddish colour except the points, which are black. These larva attach themselves to every part of the stomach, but are generally most numerous about the pylorus; and are sometimes, though much less frequently, found in the rectum. Their numbers in the stomach, are very various, often not more than a dozen; at other times more than a hundred; and if some accounts might be relied on, even a much greater number than this. They hang most commonly in clusters, being fixed by the small end to the inner membrane of the stomach, to which they adhere by means of two small hooks or tentacula. When they are removed from the stomach they will attach themselves to any loose membrane, and even to the skin of the hand. For this purpose they seethe or draw back the hooks almost entirely within the skin, till the two points come close to each other; they then present them to the membrane; and keeping them parallel till it is pierced through, they expand them in a lateral direction, and afterwards, by bringing the points downwards towards themselves, they include a sufficient piece of the membrane, and remain firmly fixed for any length of time. These hooks, the better to adapt them to this purpose, appear to have a joint near their base.

The larva attain their full growth about the latter end of May, when they quit their hold of the internal membrane of the stomach, and pass along with the food through the intestinal canal. From the end of May till the beginning of July they may be seen in the dungh which drops from the horse; when they reach the ground they seek out some convenient situation, and become pupal, and remain in that state for about six or seven weeks. The mode pursued by the perfect insect to obtain for its young a situation in the stomach of the horse, is truly singular, and is effected in the following manner.—When the female has been impregnated, and the eggs are sufficiently matured, she seeks among the horses a subject for her purpose; approaching it on the wing, she holds her body nearly upright in the air, and her tail, which is lengthened for the purpose, curved inwards and upwards: in this way she approaches the part where she designs to deposit the egg; and suspending herself for a few seconds before it, suddenly darts upon it, and leaves the egg adhering to the hair; she hardly appears to settle, but merely touches the hair with the egg held out on the projected point of the abdomen. The egg is made to adhere by means of a glutinous liquor secreted with it. She then leaves the horse at a small distance, and prepares a second egg, and poising herself before the part, deposits it in the same way. The liquor dries, and the egg becomes firmly glued to the hair: this is repeated by various flies till 400 or 500 eggs are placed sometimes on one horse.

The inside of the knee, or those parts of the body of the animal that are liable to be licked, are chosen by the fly from instinct, as the proper places for depositing its eggs. The well-known disease in horses called the bottes, which frequently proves fatal, is supposed to be occasioned by the larvae of this insect.

Wings without spots; the thorax of a rusty colour; nasalis, abdomen black, covered with yellow hairs. 3. A native of Europe. This insect is said to deposit its eggs in the nostrils of horses, mules, asses, and of goats; and the larva occupy the fauces. Body black; thorax destitute of furrows; the head and abdomen covered with yellow hairs, except the first segment, which is covered with white ones.

The larva yellow, marked with a black band; wings horridalis, white, marked with black bands. 4. A native of Eucereisopia. It deposits its eggs on the lips of horses, occasioning a stinging, which causes the animal, when attacked by it, to move his head about violently, and gallop about with every appearance of distress. The larva of this insect needs not to be particularly described, as it resembles in almost every respect that of the eur mystax.

Its habits are the same, being seen in the stomach of the horse, occupying the same situation as those of the eur mystax, from which they can only be distinguished by their smaller size and greater whiteness. When it approaches maturity it acquires a red colour. It is frequently seen adhering to the extremity of the rectum; which circumstance, along with its colour, has occasioned it to receive the name of hemorrhoideal. In about two days after it has left the body of the horse, it is changed into a pupa, in which state it remains nearly two months.

Wings faintly dotted; the abdomen variegated with white and black. 5. A native of Europe. The larva occupies the frontal sinuses of the sheep; they are flat on the one side, and convex on the other, of a whitish colour; and nearly of the same size with the larva of the O. eur mystax. When young these larvae are perfectly white and transparent, except the two brown plates, which are black. As they increase in size, the upper side becomes marked with two transverse brown lines on each segment, and some spots are seen on the sides. When full grown they fall through the nostrils, and change to the pupa state, lying on the earth. The insect deposits its eggs on the inner margin of the nostrils of the sheep. The moment the fly touches that part of the sheep, they shake their heads, and strike the ground violently with their fore feet; at the same time holding their noses close to the earth, they run away, looking about them, on every side, to see if the fly returns. They do not, like the horses and cows, take refuge in the water; they have recourse to a rut, or dusty road, or a gravel pit, where they crowd together during the heat.
ENTOMOLOGY.

Diptera.

Wings transparent and shining; body of a brownish *regulac-ash* colour. 21. A native of Europe. This species *tenea*.

appears very early in the spring; and may be seen dancing in the air in great numbers in mild weather.

B. Wings inclement. Culiciformes.

Thorax greenish; wings white, marked with a black *plumosa*
dot; the antennae feathered. 26. A native of Europe; in marshy places.

Greenish; wings spotted; the fore legs very long. *litoralis.*

27. A native of Europe; on the sea coast.

Black, smooth; wings white, marked with a black *jahannis*
dot; the antennae short; legs black. 41. A native of

Europe; in shaded places.

Black, smooth; wings transparent, marked with a *pomona*
dot; the thighs of a rusty colour. 101. A native of

Europe, and Norway; on the flowers of fruit
trees.

Black, silky. 45. A native of Europe; on the *florilega.*

flowers of fruit trees, which it injures very much. It frequently blasts the hopes of the farmer.

Wings transparent; the outer edge black. 46. A *hortula*;
native of Europe. It is very destructive to asparagus, *ma*.

and to the flowers of fruit trees. The thorax and abdomens sometimes black, sometimes red.

Wings of an ash colour; the thorax and abdomens *moschis*.
yellow. 123. A native of Chili. This insect has *sora.*

very pleasant smell, and is made use of by the young
girls of Chili for perfuming their clothes.

Of a tawny colour; wings white and transparent, *triste*;
hairy on the margins; the eyes black. A native of

England. Larvae leps; without feet; is orange-coloured,

and margined; the margin folded with papilla; the head aceto; the tail terminating abruptly. The pupa is narrow, acute at both ends, and reddish.

126 species of this genus have been described in the last edition of the System of Nature.

96. Diopis.

The head furnished with two filiform horns, without articulations, much longer than the head, on the tops of which the eyes are placed.

1. A native of North America and Guineas. Red-ichneumo-
dish; antennae very small and setaceous; the horns of *ma*.

a rusty colour; the eyes which terminate the horns are globular and black; the thorax black; furnished with two yellow tapering projections behind, and with a single one on each side; wings transparent, and marked with a black dot before; the abdomen clavate; and attached to the trunk by a narrow stalk: the two last segments of the abdomen black; the legs yellow; the thighs of the legs clavate. It resembles an *ichneumon,* and is about the size of the red ant.

Only one species of this genus has been described in the last edition of the System of Nature.

97. Musca, Fly.

Mouth furnished with a fleshy projecting proboscis, with
two equal lips, with a sucker furnished with bristles, and with two short feelers. Antenna short (in most species).

Flies live chiefly in dunghills; their larvae are without feet,
ENTOMOLOGY.

A. The Sucker composed of a single volve; the Antenna connected at the bases, and sharp at the points.

Bibionidae.

*plebica.* Of an ash colour, and hairy; the abdomen conical; the edges of the segments white. 1. A native of the north of Europe. The thorax is sometimes yellow, and abdomen of a rusty colour.

*margiata.* Black; the abdomen conical; the edges of the segments white; the wings spotted. 130. A native of Europe.

B. Sucker without a sheath.

† The Antenna pointed and connected at the base.

Stratiomyidae.

*chaeras.* The scutellum pale yellow, and furnished with two small projections; the abdomen black, marked on the sides with yellow bands. 3. A native of Europe; on flowers. The larva lives in fresh water.

*pigrosa.* Body black; the scutellum without projections; the abdomen white, and black at the extremity. 22. A native of Europe. The forehead yellow; the joints of the legs white; the shanks of the legs pale.

*vallata.* The scutellum marked with six projections; the abdomen and thighs yellow. 165. A native of Britain; on hedges. Wings of a faint rusty colour; incumbent and plain; the nerves of the wings marked with a brown dot in the middle; the poises yellow; the feet, and lower extremity of the shanks of the legs, brown.

*sectarea.* Black; antennae cylindrical and perforated; wings white. 24. A native of Europe; on the flowers of apple trees. It drinks the nectarious juice, and lodges all day long within the flower; it is very small, and not larger than a common flea; body oblong; legs long.

†† The Antenna short and elevated, furnished with a bristle.

*feathery, or with hairy feathered Antenna.*

*inamia.* Brown; the abdomen transparent, marked with three black belts. 61. A native of Europe; in thickets.

*pellucens.* Black; the first segment of the abdomen white, and transparent. 62. A native of Europe; in shaded places.

*caesar.* Shining green; legs black. 64. A native of Europe; on carrion.

*ornicina.* Thorax of a shining copper colour; the abdomen of a greenish yellow with a metallic lustre; legs black.

65. A native of Europe. The sides of the lips of a shining silver colour.

Shining; the thorax blue; the abdomen green. 65. *cadaverea.* A native of Europe; on carrion.

The thorax black; the abdomen shining blue; the *comitoforehead tawny. 67. A native of Europe and America.*

*rice; on carrion; they consume dead bodies very quickly; they likewise feed on milk.*

Black; the thorax marked with pale lines; the *carnaria* abdomen shining, and chequered. 68. A native of Europe; on carrion. The eyes reddish; the anus tawny. The larvae likewise infest bee-hives.

*Common house-fly.* The thorax marked with lines; *domesti* the abdomen chequered, and pale on the under side at the base. 69. A native of Europe and America; in houses. The larvae live in horse dung.

Brown; the thorax blue and downy, marked with* tegula,* three eminences; the tip of the scutellum and thighs yellow. 390. A native of Europe; very destructive to olives. The female deposits a great number of eggs in the month of July, on the fruit of the olive; the larva consumes the pulp.

**The Antenna furnished with a naked bristle.**

Smooth; black; the abdomen wrinkled on the *upper fenestrata* side, marked with white steaks; wings brown. 14. A native of Europe; in windows.

Blackish; the tip of the scutellum of a faint brick *larvae* colour; the abdomen chequered. 78. A native of *rim.*

Europe; on the caterpillars of moths and butterflies, and likewise on the roots of cabbage and colewort, rendering the root knotty; the tips and base whitish; thorax black, marked with lines.

Black; the abdomen of an ash-colour, marked with *radium* black bands. 79. A native of Europe; on the roots of the radiis.

Hairy and whitish, marked with a black line on the *neprobraz* back, with several black lines along the sides. 208. *sicca.*

A native of Europe; on the roots of the turnip, which it destroys, and causes to appear as if rotten; it attacks those turnips chiefly that have been sown in light sandy soil. The larva is white, without feet; the head is pointed and tip with black; it undergoes its transformation about September. Pupa is oblong, brown, composed of several segments, and becomes a perfect insect in May.

Of an ash colour; the thorax marked with five black *pluvialis* spots; the abdomen marked with very faint spots. 83. A native of Europe. It is to be seen flying about in swarms before rain.

Hairy and ash-coloured; the extremity of the thighs *rapax* and shanks of the legs of a rusty colour. 212. A native of Britain; and feeds on other flies.

Black; the abdomen pale; the eyes of a rusty *cellaris* colour. 87. A native of Europe; in cellars.

Black; the abdomen of an ash-colour; the wings *messor* yellowish at the base. 88. A native of Europe.*

They fly about very much in the air immediately before rain, and collect about the mouths of horses in great swarms, particularly about the summer solstice. The larvae are sometimes found in the human stomach.

Shining black; eyes brownish; wings shining red *pomer.* and green. 216. A native of Europe; in oasts, which it
ENTOMOLOGY.

**Diptera.**

Black; the divisions between the segments of the colorado-abdomen, the tibias of the legs, and fest white. 324. *scheini.*

A native of Europe and Asia. It is about half the size of the common grasshopper, and is frequent in the beginning of spring and end of summer, in Servia, Russia, and Siberia, when it invades itself into the bodies of cattle, which it frequently destroys, as its bite proves fatal in a few hours. Sickness is very offensive to it; and in the places where it prevails the people have recourse to it, as their only mode of defence.

Antennae, body, and wings hairy. 325. *nativo popepatae.*

A native of Europe. It is very troublesome in Lombardy in the night time, during the whole summer. It is very minute; eyes black, dotted with white; the wings, when the insect is at rest, diverge so as to form an obtuse angle; the abdomen red.

Black; the abdomen long, slender, and tapering to acuminate wards the extremity; the wings spotted, the thighs reddish yellow; the tibiae of the legs and feet brownish. 226. A native of Europe.

c. The Sucker furnished with four bristles. *Syriti.*

**Bristle of the Antenna feathered.**

Black; the abdomen hairy, and reddish behind. 25. *bombyx.*

A native of Europe; among bushes.

The anterior part of the thorax yellow; the extremity of the abdomen white; the wings of a rusty colour at the tip. 528. A native of Europe; the posterior part of the thorax, the forehead, and abdomen black; wings obscure.

**Bristle of the Antenna simple and smooth.**

Black, without hairs, the sides of the thorax marked conquestra, with yellow lines, the abdomen with three yellow lines. 21. A native of Europe; among bushes.

The thorax marked with four yellow lines; the abdomen with three interrupted yellow bands. 23. A native of Europe. The larva lies in stagnant water, and is suspended by a long siliform tube through which it breathes.

Thorax gray; the abdomen brown; the tibiae of *tenax.*

The hind legs compressed. 32. A native of Europe; in dunghills, in necessaries, and in putrid water. The larva is very tenacious, and difficultly destroyed by pressure.

Very slightly hairy; black; the thorax without spots; *pygastri.*

The abdomen marked with six white circular spots. 51. A native of Europe; and feeds on the aphides on the leaves of the pear tree.

Black; not hairy; the thorax spotted; the abdomen *merus.*

Marked with four yellow bands, the costellum yellow. *tri.*

A native of Europe; on flowers, chiefly on the mint. The perfect insect feeds on honey, the larva on aphides.

Naked; yellow; the upper part of the abdomen palmatius.

Brown; the thorax marked with three brown lines. 60. A native of Europe; in meadows, where it leaps about on the ground like a grasshopper; the longitudinal line on the thorax, somewhat broad, marked with an oblong black spot, and with a black line on each side towards its extremity; poisons white.


Of an sub-colour; the abdomen marked with three rows of black dots; the thorax spotted; the wings without spots. 17. A native of Europe; in loose sand.

vermiculio.

Of an sub-colour; the abdomen marked with three rows of black dots; the thorax spotted; the wings without spots. 17. A native of Europe; in loose sand.
ENTOMOLOGY.

365 species of this genus have been described in the last edition of the System of Nature, published by Gmelin.

98. Tabanus. Os-fly.

Mouth furnished with a straight, projecting, and membraneous proboscis; with a small and oval head; with two equal lips; with a long projecting suckor, which can be concealed in a groove on the back of the proboscis. Sheath of one valve, and furnished with five bristles. Feelers two, equal, clavated, and sharp at the points. Antennae short, cylindrical, approaching to one another, pointed, and composed of seven articulations.

These insects live by sucking out the blood of various animals, of which they are very greedy. The larvae are found under ground, in moist meadows; the colour of the eyes vanishes when the insect is dead, but may be restored by placing it in warm water.

lovius.

Eyes greenish; the back of the abdomen marked with long triangular white spots. 4. A native of Europe. It is very troublesome to horses, and harmed cattle; their bite is painful; they even molest the human species in very warm weather; they are most frequent in moist situations.

ardanis.

Eyes green; the segments of the abdomen yellow on the edges; legs reddish. 7. A native of Europe. They wound the tender horns of the rein-deer, and spoil their shape; they are met with in Italy, and the southern parts of Europe, as well as in Lapland.

Icemen. Black; eyes marked with bands; first segment of the abdomen bluish; the shanks of the legs pale.

paganus.

The anterior parts of the eyes green, marked with three tawney bands; the abdomen marked on both sides with rusty-colored spots. 25. A native of Britain.

tropicalis.

Eyes marked with three purple bands; the sides of the abdomen of a rusty colour. 14. A native of Europe; very troublesome to cattle, especially to horses, immediately before rain.

pluvialis.

Eyes green, marked with four waved bands; wings dotted with brown. 16. A native of Europe. This little animal fixes on the hands, face, and legs, and excites a painful inflammation in the part in which it has drawn blood.

excitans.

Eyes green, dotted with black; wings without spots. 17. A native of Europe. It is extremely troublesome in hot weather, especially before rain, fixing on the hands and face, or any uncovered part; it draws blood very dexterously, and leaves an inflamed bloody portion behind.

Of an ash colour; the abdomen marked with eight pipiens. brown rings. 1. A native of Europe, and the northern parts of Asia and America; in the neighborhood of fresh waters, and in marshy places. It is larger in more southerly climates, and its bite occasions more pain and inflammation. When on the wing it makes a constant shrill noise, whence it has received its name pipiens. The male is not easily distinguished from the female by its pectinate antennae: it is more troublesome, and its bite more painful, than that of the female.

Ducks, and other aquatic fowls, feed their young with them; different species of the tibellus likewise devour them. They sometimes insinuate themselves into the lungs and intestines of quadrupeds, where their bite excites a fatal inflammation. The natives of countries where they are very troublesome, have recourse to the smoke of different vegetables as a defence. In warm climates they are frequently compelled to make use of gauze curtains, which they draw close round them when asleep. They are said to shine in the dark.

Brown; the abdomen and feet marked with white annulatus. rings; the wings spotted. 8. A native of the north of Europe; the snout half the length of the body.

Brown; the thorax faintly marked with lines. 3. * effusus.

A native of Europe; in marshy situations.

Brown; wings white, marked with three obscure pulicaris. spots. 10. A native of Europe; it creeps about with a great deal; its bite is succeeded by a brown spot.

13 species of this genus have been described by Gmelin, in the last edition of the System of Nature.

192. Empus.

Sucker with a sheath of one piece, furnished with three bristles, and an inflected proboscis. Feelers short, and filiform. Antennae setaceous.

The minute insects which compose this genus, live by sucking out the blood and juices of other animals.

Black; wings nearly round, and of a rusty colour. * boraeus.

1. A native of Europe; they may be seen dancing in the air in great numbers in the evening when the weather is good.

Black; the hind legs long and feathered. 2. * penipes.

A native of Europe; it is frequently found on the leaves of the geranium syvaticum, and cardamine pratensis.

Livid; thorax marked with lines, the base of the livida.

Wings and legs of a rusty colour. 3. A native of Europe; it is frequently to be found on the Jerusalem, spandylus; the upper part of the abdomen very dark.

Brown; wings oblong, marked with brown veins.
ENTOMOLOGY.

101. STOMOXYs.

Sucker consisting of a sheath of one piece, and furnished with enclosing bristles. Feels two, short, bristle-shaped, and composed of three articulations. Antenna setaceous.

The insects of this genus live by sucking the blood and juices of other animals; those of the division rhinigia principally attack insects of the orders lepidoptera and diptera.

A. The Sheath convoluted, and bent at the base, with an angular flexure, and furnished with two bristles.

Gray; antennae slightly feathered; legs black. 4. A native of Europe. It resembles the common fly very much in every respect, except in the snout, and in having the segments of the abdomen marked with two black spots. It is very troublesome to hordes of cattle; by getting about their feet, it causes them to kick, and stamp with their feet: before rain it bites more frequently. It does not spare the human species, particularly in autumn.

irritans.

Of an ash colour, and somewhat hairy; the abdomen spotted with black. 5. A native of Europe. This species is very frequent, and troublesome to cattle; by fixing on their backs, it causes them to keep their tails almost in constant motion to lash it off.

pungens.

Of an ash colour, with black thighs. 6. A native of Europe. It is very troublesome to cattle, resembles St. irritans, but much smaller wings; whitish, without spots; the abdomen sometimes of dark colour.

B. Sheath covering the mouth, and furnished with bristles. Rhinigia.

rostrata.

Thorax faintly marked with lines; the snout, legs, and abdomen of a brick colour. 8. A native of Europe. Very troublesome to cattle; about the size of the common fly; wings pale.

lineata.

Thorax marked with lines; abdomen black, marked on the sides with yellow spots. 9. A native of Europe. The lip long, yellow, with a black emarginated tip, and formed of a horny substance enclosing the proboscis. The antennae black, with a rusty-coloured knob, and furnished with a bristle; the thorax marked with four white lines; the scutellum of a brick colour; wings whitish; legs yellow; the thighs marked with a white belt.

Only 9 species of this genus have been described by Gmelin in the last edition of the System of Nature.

102. CONOPS.

Mouth furnished with a projecting snout, which is bent with an angular flexure. Antennae elevated, and pointed at the extremity.

Diptera.

The insects of this genus live by sucking the blood and juices of other animals.

A. Sucker furnished with a short valve of one piece, and with a single bristle.

Blackish; back part of the head vesicular, the ab. vesiculodemen yellowish and black at the base. 4. A native of Europe; in groves.

Black; six segments of the abdomen yellow on the macroscidges; antennae and legs reddish. 5. A native of Europe; in groves.

B. The Sucker bent both at the middle and at the base, with an angular flexure. Sheath consisting of two pieces, the two pieces which compose the sheath equal.

Myope.

Of a rusty colour; the abdomen cylindrical, and bent ferrugino inwards; the forehead reddish. 8. A native of Europe; in groves.

Abdomen cylindrical, and bent inwards; body black. 2. A native of Europe; among bushes.

14 species of this genus are described in the edition of the System of Nature published by Gmelin.

103. ASILUS.

Mouth furnished with a sucker, composed of a horny substance, projecting, straight; consisting of two pieces, and turgid at the base. Antenna fimbriate.

They prey on other insects, especially those of the lepidopterous and dipterus orders.

The abdomen hairy; on the fore part there are three crabro of the segments black; behind yellow and bent inwards. niformis. 4. A native of Europe. The larva lies under ground. This is the largest species of the genus which is to be met with in Britain. Its sting is very painful.

Hairy, black; the thorax white at the base. 19. A epiphium. native of Europe.

Hairy, black; with a whitish band. 7. A native of Europe. It rests by leaning on its breast, with its legs spread. Claws white.

Black; wings black; the forehead white. 22. A diadema. native of Europe. Band and wings wholly black.

Of an ash colour, without hairs; legs of a rusty co. tipulcolour; feet black. 14. A native of Europe. des. Black; the thorax marked on each side with an ab. stratus. coloured line; the poisons yellow. 44. A native of Europe.

Gmelin has described 48 species of this genus, in his last edition of the System of Nature.

104. BOMBYLUS, Bom-byl.

Mouth furnished with a sucker, very long, setaceous, straight, and composed of two valves, the valves unequal, and likewise with three bristles. Feels two, short, and hairy. Antenne tapering towards the point, and connected at the base.

The species of this genus feed on the nectarious juice of flowers, which they collect when on wing. Humble
ENTOMOLOGY.

215

sugar, decayed wood, and putrid substances. The lar-
va and pupae are six-footed, active, and swift.

Scaly, and resembling silver; tail triple. 1. A na-

tive of America; among sugar. They have been in-
risonium, introduced into Europe, and are frequently to be met

There are 15 species of this genus described in the

105. HIPPOBOSCA.

Mouth furnished with a short, cylindrical, straight

sucker, composed of two equal pieces. Antennae fi-

The species of this genus live on the blood of other

insects.

aequina. Horse-fly. Wings obtuse; thorax variegated

with white; legs terminating in four claws. 1. A native

of Europe and America.—They are very troublesome

to horses; they hide themselves under the hairs, and

Wings obtuse; thorax of one colour. 2. A native

of Europe; on the bodies of various birds, especially

swallows. Wings longer than the body by one half,

marked with black veins; the hind part of the abdo-

men flattened and dotted.

Wings tapering towards the extremity; legs termi-

nating in six claws. 3. A native of Europe; on the

bodies and nests of swallows.

No wings. 4. A native of Europe; among the

Wings brownish at the base; body yellowish and white

and grey; snout and legs black. 7. A native of Europe.

Very small; antennae black; wings white.

Wings white, without spots; body hairy, and green-

ish; the snout short. 12. A native of Europe; on

flowers. Thickly covered with greenish hair.

There are seven species of this genus described by

Gmelin.

107. PODURA, Spring-tail.

Mouth furnished with four feelers, slightly clavated;

the lip divided. Eyes two, composed of eight facets.

Tail forked, bent under the body, and acting like a

spring. Legs six, formed for running.

The insects of this genus, through all their stages,

feed on vegetables. The larva and pupa have six feet,

and are active, and very much resemble the perfect

insect.

Nearly globular, and green. 1. A native of Eu-

ripterus; on plants of different kinds, especially on the

seemal leaves of the buck wheat (Polygonum fucogen-

rum.) Oblong, and ash-coloured, with black marks. 6. nivalis.

A native of Europe; among bushes, in wood. It is

frequently to be seen in the winter on the snow, in the

footsteps of men and other animals.

Black, and lives in water. 12. A native of Eu-

aqueaticus. Rope. Assembles in troops, early in the morning, on

the banks of pools and fish-ponds.

White; lives on land. 13. A native of Europe; fumaria-

found very early in the spring on recently ploughed

land.

31 species of this genus have been described in the


108. TERMES, White Ant.

The mouth furnished with two jaws, formed of a horny

substance. Lip likewise formed of a horny substance; it

is divided into four, the division linear and sharp.

Feelers four, equal and filiform. Antennae monilif-

form in most species. Eyes two.

These insects might with more propriety be placed

under
under the order Neuroptera or Hymenoptera, most of them having either two or four wings in the perfect state. They are very destructive, and destroy provisions, clothes, furniture, books, and timber of whatever magnitude, leaving a thin shell not thicker than paper; in houses they are not only troublesome, but dangerous, as they destroy the beams which support the floors and roofs, and occasion them to fall in.

Brown above; the thorax is composed of three segments; wings pale, furnished with a rib or nerve of a brown colour. 1. A native of India and Africa. Larva small, about a quarter of an inch long, furnished with six feet, pale with a roundish brick-coloured head, without eyes; mandible short and strong, antennae as long as the thorax; the abdomen oval. Pupa larger; about half an inch long, with a very large oval polished head, without eyes; jaws projecting, as long as the head, forked, without teeth, sharp and black; thorax and abdomen polished. The perfect insect both male and female has a brown head, antennae yellowish and globular, prominent black eyes, the segments of the thorax margined, the abdomen variegated with white streaks, wings twice the length of the body, legs yellowish. Of the white ants we have a very curious and interesting description in the Philosophical Transactions for 1781, by Mr. Henry Smeathman of Clement's Inn. According to this account, the works of these insects surpass those of the bees, wasps, bees, and other animals, as much at least as those of the most polished European nations excel those of the least cultivated savages. With respect to the interior construction, and the various members and dispositions of the parts of the building, they may come into comparison with some of the most celebrated works of man himself. The most striking parts of these structures are the royal apartments, the nurseries, magazines of provisions, arched chambers and galleries, with their various communications; the ranges of Gothic shaped arches, projected, and not formed by mere excavation, some of which are two or three feet high, but which diminish rapidly as the arches of aisles is perspective; the various roads, sloping staircases, and bridges, consisting of one vast arch, and constructed to shorten the distance between the several parts of the building, which would otherwise communicate only by winding passages. In some parts near Senegal, their number, magnitude, and close arrangement, make them appear like the villages of the natives. But these and many other curious instances of the great sagacity and powers of these insects cannot be understood without viewing the plates in which their feasible schemes, and comparatively stupendous works are delineated. See Phil. Trans. above referred to. The economy of these industrious insects appears to have been very attentively observed by the ingenious author, as well as their buildings. There are three distinct ranks or orders of them, constituting a well regulated community. These are, first, the larve, labourers, or working insects; second, the pope, soldiers, or fighting order, who do no kind of labour, and are about twice as long as the former, and equal in bulk to about fifteen of them; and lastly, the winged or perfect insect, which may be called the nobility of the state, for they neither labour nor fight, being scarcely able to defend themselves. These only are capable of being elected kings or queens; and nature has so ordered it, that they emigrate within a few weeks after they are elevated to this state, and either establish new kingdoms, or perish within a day or two. The first order, the working, are most numerous, being in the proportion of 500 to one soldier. In this state they are about a quarter of an inch in length, and twenty-five of them weigh about a grain, so that they are not so large as some of our ants. See Plate DII, fig. 1. and 2. The second order, or soldiers, have a very different form from the labourers, and have been by some authors supposed to be the males, and the former the neuters; but they are, in fact, the same insects as the foregoing, only they have undergone a change of form, and approached nearer to the perfect insect. They are now much larger, being half an inch long, and equal in bulk to 15 of the labourers (fig. 3. and 4.). The third order, the insect in its perfect state, varies its form still more. The head, thorax, and abdomen, differ almost entirely from the same parts in the labourers and soldiers; and besides this, the animal is now furnished with four fine large brownish, transparent wings, with which it is at the time of emigration to wing its way in search of a new settlement. It differs so much from the other two, that they have not been noticed, excepting by the inhabitants of the same community. In fact, they are not to be discovered in the nest, till just before the commencement of the rainy season; when they undergo the last change, which is preparative to the formation of new colonies. They are equal in bulk to two soldiers, and about 30 labourers (see fig. 5.), and by means of the wings with which they are furnished, they soon about for a few hours, at the end of which time they lose their wings, and become the prey of innumerable birds, reptiles, and insects; while probably not a pair out of many millions of this unhappy race, get into a place of safety, fulfill the first law of nature, and lay the foundation of a new community. In this state, they fall into the neighbouring waters, and are eaten with avidity by the Africans. The author found them delicate, nourishing, and wholesome, without sauce or other help from cookery, they merely roasting them in the manner of coffee. The few fortunate pairs who happen to survive this annual massacre and destruction, are represented by the author as being generally found by the women of the labourers, that are continually running about on the surface of the ground, and are elected kings and queens of new states. Those who are not so elected and preserved, certainly perish, and most probably in the course of the following day. By these industrious creatures, the king and queen elect are immediately protected from their innumerable enemies, by being inclosed in a chamber of clay, where the business of propagation soon commences; their voluntary subjects, then employed in constructing wooden nurseries, or apartments entirely composed of wooded materials, seemingly joined together with gum. Into these they afterwards carry the eggs produced from the queen, lodging them there as fast as they can obtain them from her. The author even furnishes us with plausible reasons to believe, that they here form a kind of garden for the cultivation of a species of microscopic mushrooms, which Mr. König, in an Essay on the East Indian Termites, read before the society of naturalists of Berlin, conjectures to be the food of the young insects. But perhaps the most wonderful, and at the
same time best authenticated part of the history of these singular insects is that which relates to the queen or mother of the community in her pregnant state. After insemination, a very extraordinary change begins to take place in her body, or rather in her abdomen only. It gradually increases in bulk, and at length becomes of such an enormous size as to exceed the bulk of the rest of her body 1000 or 2000 times. She becomes 2000 times heavier than her consort, and exceeds 30,000 or 50,000 times the bulk of one of the labourers. In this state, the matrix has a constant peristaltic or undulating motion, the consequence of which is (as the author has counted them), (fig. 8.) the protrusion of a great many thousands of eggs in twenty-four hours. These eggs, says the author, are instantly taken from her body by her attendants, of whom there always are a great number in the royal chamber and the galleries adjacent, and carried to the nurseries, which are sometimes four or five feet distant in a straight line. Here, after they are hatched, the young are attended and provided with everything necessary, until they are able to shift for themselves, and take their share of the labour of the community. Many curious and striking particulars are related of the great devastations committed by this powerful community, which construct roads, or rather covered ways, diverging in all directions from the nest, and leading to every object of plunder within their reach. Though the mischief they commit is very great, such is the economy of nature, that it is probably counterbalanced by the good produced by them, in quickly destroying dead trees, and other substances, which, as the author observes, would, by a tedious decay, serve only to encumber the surface of the earth. Such is their activity and dispatch in this office, that the total destruction of deserted towns is so effectually accomplished, that in two or three years a thick wood fills the space, and not the least vestige of a house is to be discovered. From the many singular accounts here given of the police of these insects, we shall mention one respecting the different functions of the labourers and soldiers, or the civil and military establishments in this community, an attempt to examine their nest and city.

On making a breach in any part of the structure with a hoe or pickaxe, a soldier immediately appears and walks about the breach, as if to see whether the enemy has gone, or to examine whence the attack proceeds. In a short time he is followed by two or three others, and soon after by a numerous body, who rush out as fast as the breach will permit them, their numbers increasing as long as one continues to batter the building. During this time they are in the most violent agitation and bustle, while some of them are employed in beating with their forceps upon the building, so as to make a noise that may be heard at three or four feet distance. On ceased to disturb them, the soldiers retire, and are succeeded by the labourers, who hasten in various directions to the breach, each with a burden of mortar in his mouth ready tempered. Though there are millions of them, they never stop or embarrass each other; and a wall gradually arises that fills up the chasm. A soldier attends every 500 or 1000 of the labourers, seemingly as a director of the works; for he never touches the mortar, either to lift or carry it. One in particular places himself close to the wall which they are repairing, and frequently makes the noise above mentioned; which is constantly answered by a loud hiss from all the labourers within the dome; and at every such signal they evidently redouble their pace, and work as fast again. The work being completed, a renewal of the attack constantly produces the same effects. The soldiers again rush out and then retreat, and are followed by the labourers loaded with mortar, and as active and diligent as before. Thus, says the author, the pleasure of seeing them come out to fight or to work alternately may be obtained as often as curiosity excites or time permits; and it will certainly be found, that the one order never attempts to fight, or the other to work, let the emergency be ever so great. The obstinacy of the soldiers is remarkable. They fight to the very last, disputing every inch of ground so well as often to drive away the negroes, who are without shoes, and make the white people bleed plentifully through their stockings. Such is the strength of the buildings erected by these puny insects, that when they are raised to little more than half their height, it is always the praefectus who stands upon them and the rest of the herd is ruminating below. When at their full height of ten or twelve feet, they are used by Europeans as places to look out from over the top of the grass, which here grows to the height of thirteen feet, upon an average. The author has stood with four men on the top of one of these buildings, in order to get a view of any vessel that might come in sight. These termites indeed are frequently pernicious to mankind, but they are also very useful and even necessary; one valuable purpose which they serve is to destroy decayed trees and other substances, which, if left on the surface of the ground in hot climates, would in a short time pollute the air. In this respect they resemble very much the common flies, which are regarded by mankind in general as noxious, and at best as useless beings in the creation; but it is certainly for want of consideration. There are not probably, in all nature, animals of more importance; and it would not be difficult to show that we should feel the want of one or two species of large quadrupeds much less than one or two species of these despised looking insects. Mankind, in general, are sensible that nothing is more disagreeable than putrid substances, and nothing more pestiferous.

Of a brick colour above, head black ; antennæ yellow. 4. A native of America, Africa, and India. They build strong oval nests round the branches of trees. It very much resembles the T. fatale, but is only half the size, the lower stemmata are impressed with a dot on the centre; wings brownish, marked with a yellowish rib. Larva pale brown; head black, conic, and projecting forwards.

Black; segments of the abdomen tinct with white; cerci legs pale. 5. A native of Africa; and resembles in economy the T. fatale. It builds a nest of a cylindrical shape, two or three feet high, of brown clay and vegetables mixed up together, with a round vaulted dome, surrounded by a prominent terrace. Labourers and labourers have a pale head, without eyes; mandibles short, furnished with teeth; thorax and abdomen oval, grayish head colour; legs of a brick colour. Pupa or guards have a very large brick-coloured head, cladated and swelled out before, oval and extended behind;
mandible projecting and forked; antennae of a brick colour, as long as the head, without eyes; thorax small; abdomen oval, greyish lead colour; legs of a brick-colour. Perfect insect less than the former ones, with incumbent black wings, and pale brick-coloured legs.

mordax. Black; segments of the abdomen tisp with white; legs black. 6. A native of Africa. Builds cylindrical houses. Larva and pupa like the last, but much less.

capense. Pale yellow; wings transparent, edged with brown.
7. A native of India and Africa. Larva furnished with two black eyes; and wanders about in the daytime in troops like the common ant.

faticicum. Abdomen oval; mouth pale; eyes brown; antennae setaceous. 3. A native of Europe.

*pulsetorium. Abdomen oblong; mouth red; eyes yellow; antennae setaceous. 3. A native of Europe and America. Frequent in houses, in old books, wood, decayed furniture, museums, and is rarely found with wings. The female beats like the ticking of a watch, and is often mistaken for the pisus pulsatior.

divinatorium. Abdomen transversely furrowed; mouth brown; eyes black. 7. A native of Europe; found in books, and is very active and lively. Body whiteness.

These eight species are all that have been described by Gmelin: other two, the morio and flavicollis, have been described since.

106. Pediculus, Louse.

Mouth furnished with a sucker, which the insect can stretch out or draw back at pleasure; without feelers or probosics. Antennae of the same length with the thorax. Eyes two. Abdomen flattish. Legs six, formed for running.

The insects of this genus live by sucking the juices of animals. The larvae and pupae have six feet, and are active, resembling the perfect insect.

Abdomen ash-coloured, and lobed. 1. There are two varieties of this species, the one softer and whiter, occupying the body and clothes, the other harder and darker-coloured, occupying the heads of those that do not attend to cleanliness, particularly of children.

Humans. The louse which infests the human body makes a very curious appearance through a microscope. It has such a transparent shell or skin, that we are able to discover more of what passes within its body than in most other living creatures. It has naturally three divisions, the head, the breast, and the tail part. In the head appear two fine black eyes, with a horn that has five joints, and is surrounded with hairs standing before each eye, and from the end of the nose or snout there is a pointed projecting part, which serves as a sheath or case to a piercer or sucker, which the creature thrusts into the skin to draw out the blood and humour which are its destined food; for it has no mouth that opens in the common way. This piercer or sucker is judged to be 700 times smaller than a hair, and is contained in another case within the first, and can be drawn in or thrust out at pleasure. The breast is very beautifully marked in the middle; the skin is transparent, and full of little pits; and from the under part of it proceed six legs, each having five joints, and their skin all the way resembling shagreen, except at the ends, where it is smoother. Each leg terminates by two claws, which are hooked, and are of an unequal length and size. These it uses as we would a thumb and middle finger: and there are hairs between these claws as well as all the legs. On the back part of the tail there may be discovered some ring-like divisions, and a sort of marks which look like the strokes of a rod on the human skin: the belly looks like shagreen, and towards the lower end it is very clear and full of pits: at the extremity of the tail there are two semicircular parts all covered over with hairs, which serve to conceal the anus. When the louse moves its legs, the motion of the muscles, which all unite in one oblong dark spot in the middle of the breast, may be distinguished perfectly, and so may the motion of the muscles of the head when it moves its horns. We may likewise see the various ramifications of the veins and arteries, which are white, with the pulse regularly beating in the arteries. But the most surprising of all the sights is the peristaltic motion of the guts, which is continued all the way from the stomach down to the anus. If one of these creatures be placed on the back of the hand, when hungry, it will thrust its sucker into the skin; the blood which it sucks may be seen passing in a fine stream to the front part of the head, where falling into a roundish cavity, it passes again in a fine stream to another circular receptacle in the middle of the head; from thence it runs through a small vessel into the breast, and then to a gut which reaches to the hinder part of the body, where, in a curve, it turns a little upwards; in the breast and gut the blood is moved without intermission with a great force, especially in the gut, where it occasions such a contraction of the gut, as is very surprising. In the upper part of the crooked ascending gut above mentioned, the propelled blood stands still, and seems to undergo a separation, some of it becoming clear and waterish, while other black particles are pushed forwards to the anus. If a louse is placed on its back, two bloody darkish spots appear, the larger in the middle of the body, the lesser towards the tail: the dark bloody spot, in or over which the bladder seems to lie. This motion of the systole and diastole is best seen when the creature begins to grow weak; and on piquing the white bladder, which seems to be the heart, the creature instantly dies. The lower dark spot is supposed to be the excrement in the gut.

The posterior part of the abdomen emarginated; legs *pubes, formed like claws. 2. A native of Europe. It is found about the hairs of the groin, and sometimes, though rarely, on the eyebrows of people who do not attend to cleanliness. The antennae have five articulations; the hind part of the abdomen hairy.

The abdomen orbicular, marked with a white line; ricinodes. scutellum composed of three lobes; the snout white.

3. A native of America. It gets into the legs of the naked inhabitants, where it draws blood, and depositing its eggs in the wound occasions foul and malignant ulcers.

6. A native of Europe; on sheep.

The abdomen is marked with eight transverse rusty-coloured lines. 9. A native of Europe; on horned cattle.
ENTOMOLOGY.

110. Pulex, Flea.

Mouth without jaws or feelers. The snout long, and bent inwards. A sheath of two pieces, consisting of five articulations, covered at the base with two oval scales, and furnished with a single bristle. Lip round, fringed with sharp points, which are bent backwards. Antenna subequal, projecting, and becoming thicker towards their outer side. Eyes two. Abdomen compressed. Legs six, formed for leaping.

The genus *Pulex* is rather doubtful; it approaches in many respects to the insects of the order Hemiptera. They live on the juice and blood of other animals. Larva without feet, cylindrical, active, and furnished with two spines under the tail.

*irritans.* The snout shorter than the body. x. This familiar insect is to be met with everywhere; it lives by sucking the blood of other animals, and is very troublesome to many of them, especially to the hare and rabbit. They deposit smooth round eggs at the roots of the hair of the animals on which they feed, on blankets, and articles made of wool, fur, &c. From these eggs are hatched the larva, resembling small white shining warms, which feed on the scurfy substance adhering to the cuticles of animals, or on the downy matter collected on clothes. About a fortnight after they are hatched, they acquire a considerable size, and become very active; when disturbed they roll themselves up into a ball. After they have acquired their full size, they retire into some undisturbed situation; they form small bags for themselves composed of silky threads, which they spin from their mouths. These bags are very white internally; but on the outside they are of the colour of dust, and are very little discernible. They remain in the state of pupa about 24 days. It continues to be of a white colour till the second day before its escape from the bag, when it acquires a dark colour, becomes firmer, and is transformed into a perfect insect.

The flea, when viewed in the microscope, exhibits a very singular appearance. It is covered all over with black and hard scales, which are curiously jointed, and folded over one another, so as to comply with all the nimble motions of the creature. These scales are polished, and are best about the edges with short spikes in a very beautiful and regular order. Its neck is finely arched, and somewhat resembles the tail of a lobster. Its eyes are very large and beautiful. The sucker contains a couple of lances or darts; which, after the sucker has made an entrance, are thrust farther into the flesh, to make the blood flow from the adjacent parts, and occasion that round red spot, with a hole in the centre of it, which remains for some time after the puncture of a flea, commonly called *flæte-bite.* A proper view of the sucker with its two lances is not easily obtained, as the insect puts out its sucker only at the time of feeding. The best way of obtaining a view is to cut off the head, and subject it to the microscope by itself. There is an hospital at Surat where a number of fleas are kept, and some poor creature, for pay, allows himself to be fixed down and fed upon by them.

*Chiguar.* Snout of the same length with the body. *penetrans.*

2. A native of America. This insect is very troublesome in the sugar colonies, penetrating into the feet of the inhabitants, where it lodges its eggs and causes malignant ulcers. Body reddish brown. The female produces a very great number of eggs, and when pregnant the abdomen swells to 100 times the size of the rest of the body. It penetrates chiefly under the nails of the toes, and eats its way seawards, depositing its eggs, which are exceedingly minute, in a bag. It is discovered by the uneasy itching it occasions, and must be extracted with great caution and dexterity; for if the bag be burst, and if any of the eggs or animals remain, a very troublesome ulcer ensues, which sometimes renders the limb useless. The slaves who go barefooted are chiefly exposed to this calamity, and they are most dexterous at extracting them.

There are only two species of this genus described in the last edition of the System of Nature published by Gmelin.

111. Acarus, Tick or Mite.

Mouth without a proboscis. The sucker with a cylindrical sheath, composed of two pieces. Feelers two, compressed, equal, and of the same length with the sucker. Eyes two, placed on the sides of the head. Legs eight.

The insects of this genus are very minute, and very prolific; they abound everywhere; most of them live on the juices of other animals. The larva and pupa have six feet, (those of the division *trombidium* have eight feet); they are active, and very much resemble the perfect insect.

A. The Antennae are filiform, compressed; end of the same length with the legs.

Transparent; convex above and flattened beneath; *urcellus.*

Marked in the middle with a blackish spot. 36. It is very common in waters, on the muscus which covers the spawn of frogs. Very small, slow, inoffensive, and legs terminating in three nails.

Oval, almost globular; abdomen marked at the base *rivicus.*

With a round brown spot; antennae elevated. 7. A native of Europe; it is very common on oxen and dogs.

Second pair of legs very thick. 8. A native of *crassi* Europe; and very common. It is active, gregarious, pes. frequently to be found in gardens among the earth in spring.

Thorax angularly cruciform; the legs, terminating in hooks, and longer than the body. 9. It is found on the body of the bat (*vespertilio murinus*) of an uncommon figure, resembling the *phalangium.* It cannot walk on a flat surface.

Commonly called Red Spider. Transparent and red. *tetarius.*

Dish; the abdomen marked on each side with a brown spot. 14. A native of Europe; on various plants, particularly those that are not exposed to the weather, or shut up in hot-houses. It forms webs of parallel threads, by which it sometimes suffocates plants in green-houses.
ENTOMOLOGY.

The abdomen reddish; the hind-legs very long and siliform. 24. A native of Europe; on different species of flies.

Abdomen red, marked on each side with scarlet dots. 25. It is to be found on bees, wasps, dragon-flies, &c.

Oval, and reddish; the anus whitish. 27. It is found on many insects, particularly on the common black beetle; which, on that account, has been called the "lousy beetle": they run very quickly.

The posterior part of the abdomen crenated; the scutellum oval, and somewhat tawney; the antennae divided into three. 6. A native of America; they fix on the legs of travellers and suck the blood; they adhere so closely, that they are removed with difficulty; the forelegs are furnished with short prickles, near their junction with the body.

The first pair of legs very thick, and furnished with claws; the second pair very long, and furnished with two bristles at the extremity. 62. Found in books kept in damp places, particularly about the backs, where the sheets have been glued together. It is very injurious, and not visible without the help of a glass.

Hemispherical, pale, and smooth. Legs equal. 31. It is found in troops on the body of the acarus croceus.

Oval; furnished with several long hairs at the extremity of the abdomen; the legs are furnished with a single bristle. 61. Found on the bodies of insects and other subjects of natural history which are kept in too moist places, and is more destructive to museums than even the pinus fur, and not visible to the naked eye.

B. Antennae setaceous. Trombidina.

The abdomen hairy, red, and obtuse behind; the inner fore legs whiter than the rest. 22. A native of Surinam and Guinea; very hairy; it becomes white when immersed in spirits of wine.

The abdomen of a blood colour, flat, and downy, turned up behind. 22. A native of Europe and America; is said to be poisonous if swallowed.

82 species of this genus have been described in the last edition of the System of Nature.

II. HYDRACHNA.

Head, thorax, and abdomen united. Feelers two, jointed. Eyes two, four, or six. Legs eight.

The insects of this genus are inhabitants of the water, swim with great velocity, and prey on the larvae of tipulae and monomach. They deposit red spherical eggs, which in about a month acquire a linear form, and produce six-footed larvae furnished with a single proboscis, which, after they have changed their skin several times, become perfect insects furnished with eight feet.

A. Eyes two.

Those which are furnished with a Tub.

Globular; eyes red. It is to be found in ditches containing water: male greenish and spotted; female bluish and without spots, and double the size of the male.
ENTOMOLOGY.

Aptera. Oval, red, and black behind; furnished with a yellow cylindrical tail, and straightened at the base. 3. It is found on the banks of rivers; black beneath, eyes reddish, legs black.

Apilator. Purple and glebular, furnished with a papilla on each side of the tail; legs black. 12. It is to be found early in the spring in overflowed meadows.

** Furcate. Back marked with a fork.

Assipes. White and oval; the disk black and marked with a reddish fork, and furnished with papillus near the anus; fore legs thick. 13. It is found in fish ponds and ditches containing water; the legs twice or thrice the length of the body, which renders it easily to be distinguished. It is transparent; breast whitish; eyes black; when walking freely, it directs its legs forwards; after it has gone a few steps, it extends its legs horizontally, and rests as if it were dead, and a little afterwards it renew its motion.

Avicorinio. Reddish and oval; marked with a yellow fork, feelers clavated, legs pale. 15. It is found in marshes; eyes small and black, feelers and legs white.

*** Glabre.

Expicenis. Round and red, marked with several spots; the eyes placed on the under part of the body. 23. It is to be found in ditches full of water; it resembles the *E. maculata* in every respect, except the positions of the eyes; flatish, wrinkled, full of dimples, marked with nine spots; eyes blackish; legs yellowish.

Ersicolor. Nearly square, marked with white, blue, and brown spots. 44. It is found in places overflowed with water; white above, brown beneath, edge yellowish; the feelers and legs white and transparent.

B. Eyes four.

Icrea. Round, brown, and very white in the middle. 45. It is to be found, though rarely, in moist places; eyes black, feelers pointed, legs pale and transparent.

Neculata. Oval and red; marked on the back with black spots. 48. It is found in wet ditches; shining; eyes black; legs yellow and transparent; feelers yellow, sometimes long, sometimes short.

C. Eyes six.

Umbrata. Round and red, marked with several spots. 49. It is found in woody marshes; smooth, somewhat depressed, marked with more than ten obscure spots, blackish beneath; eyes black; feelers very small, tift with black; legs yellow.

49 species of this genus have been described in the last edition of the System of Nature.

93. PHALANGIUM.

Mouth furnished with two filiform feelers; the mandible composed of a substance like horn; the second joint furnished with a sharp tooth, moveable, and furnished with a jaw. Antennae small. Two eyes on the top of the head contiguous, and two lateral eyes. Legs eight. Abdomen (for the most part) round.

The insects of this genus in their various stages of transformation prey on the smaller insects and worms; the larvae have eight feet, active, and resemble the perfect insect.

A. Sucker a conical tube. Pycnogonae.

Feelers four; body filiform; legs very long. 1. A *grosipes* native of the north of Europe; found in the Norwegian seas; very slow, and very minute; it is composed of several articulations, and has a very narrow linear tail; it enters the shells of muscles, and consumes their contents.

Feelers two; body oval. 6. It is found in the *balanoceras* north seas, under stones; it is red on the back, the worm sucker projecting, straight, obtuse at the extremity, and perforated with a round entire perforation; the feelers inserted at the base of the sucker, and almost equalling it in length; the legs jointed and angular.

B. Without a sucker.

Body oval and black; the under part of the body marbled and legs pale. 10. A native of Europe; it is to be found on rocks.

Long-legged spider, or shepherd's spider. Abdomen *opilios* oval and gray, beneath white. A native of Europe and America; wandering about in the night time.

Abdomen inverted, oval and flatish; claws smooth, *conoritis* the fingers hairy. 4. A native of Europe; in confined places, in boxes and damp cellars; it feeds on termites and mites, and moves like a crab; it is destructive to collections of dried plants; it likewise enters the skin of the human body, and excites a very painful simple about the size of a pea.

Abdomen cylindrical, the claws smooth; head *fur-tarsoides* furnished with an appendage. 5. A native of America; in confined places in tropical countries. Its bite is said to be dangerous; yellowish, the claws oval.

Claws notched, and hairy; body oblong. 15. A *aranecoris* native of Italy, Africa, Persia, and the southern shores of the Volga; its bite occasions very violent pain, livid tumors, delirium, and sometimes death; soft, lurid, and woolly, the claws very turgid.

15 species of this genus have been described by Gmelin in the last edition of the System of Nature.

214. ARANEID, Spiders.

Mouth furnished with short horny jaws; the lip round at the tip. Feelers two, bent inwards; jointed and very sharp at the extremity: in the males they are elevated, and have the organs of generation placed in them. Antennae none. Eyes eight; sometimes six, though seldom. Legs eight. The anus is furnished with papille, with which the insect spins threads, and forms its web.

These insects, through every stage of their existence, prey upon other insects, especially those of the order Diptera; they even do not spare those of their own genus or species: from the papille at the end of the abdomen they throw out at pleasure a number of fine threads, which they unite in various ways for the purpose of entangling their prey. They every year cast their old skin, which they perform by suspending themselves in some solitary corner, and creeping out of it. The young ones have the power of ascending the air to
a great height; to accomplish which, they climb up some eminence, and are wafted about by the winds, filling the air with their threads. They are destroyed by the aphex and ichneumon.

Linnaeus has subdivided this genus according to the number and position of their eyes.

**ENTOMOLOGY.**

A. **Eyes eight.**

1. **Eyes placed thus,**...:...

**fasciata.** Of a silver colour; the abdomen marked with yellowish bands; the legs surrounded with brown rings. 48. A native of Europe, on trees; it is a very beautiful insect.

**diadema** Abdomen nearly globular and reddish; brown, marked with a white cross composed of dots. 1. A native of Europe, on trees; it is a very beautiful insect.

**aquinus** Brown; abdomen oval and of an ash colour; the back brown, marked with two dots. 39. A native of Europe, in stagnant waters, where it dives to thebottom in search of its food. It takes up its winter quarters in an empty snail shell, the aperture of which it closes up with a web; jaws black, claws red.

2. **Eyes placed thus,**...:...

**intro.** Thorax hairy, and of an ash colour; the abdomen oval, black, and spotted with red. 95. A native of America; large, the thorax oval, legs black, thighs pearly.

**domestica** Abdomen oval and brown, marked with five black spots nearly contiguous, the anterior ones larger than the others. 9. A native of Europe, in houses, and about windows; feeds chiefly on flies.

3. **Eyes placed thus,**...:...

**globosa.** Black; sides of the abdomen of a blood-red colour. 69. A native of Europe, in meadows.

4. **Eyes placed thus,**...:...

**argentata.** Abdomen white, and brown behind, and marked round the edge with six small projections. 70. A native of South America.

5. **Eyes placed thus,**...:...

**fumigata.** Abdomen oval and brown, marked at the base with two white dots. 16. A native of Europe, in meadows; it watches near the nests of the larvae of different insects, and waits their coming out, when it seizes on one after another, and sucks out their substance.

**saccata.** Abdomen oval, of a brownish colour. 40. A native of Europe, in gardens, and carries its eggs behind it enclosed in a bag; legs livid, marked with unequal brown rings set close together.

**Eyes placed thus,**...:...

**entacea.** Abdomen long, of a silver colour tinged with green, the legs extended longitudinally. 22. A native of Europe, in woods; its legs are applied closely to the branches.

**sidulans.** Shining black; the abdomen hairy and black. 73. A native of America; it forms a nest under ground, and spins a large cylindrical web, which is covered with a lid; its bite is very painful, and frequently occasions fever and delirium, which is soon removed by a gentle sudorifice; thorax marked with a large depressed circular spot; abdomen oval; legs equal.

7. **Eyes placed thus,**...:...

Black, thorax marked with a white line on the back. 9.

79. A native of Britain.

Marked with triangular black spots on the back of the abdomen; the legs spotted with black. 34. A native of the south of Europe, particularly Italy and Barbary. It is found in caverns in argillaceous soil; its bite was formerly supposed to be curable by nothing but music; though it occasions a great deal of pain, it is almost never fatal.

8. **Eyes placed thus,**...:...

Oval and oblong; thorax hairy, white; abdomen solid, legs black, marked with yellow bands. 32. A native of Europe.

9. **Eyes placed thus,**...:...

Black, abdomen oval, forehead white, and legs agnus its prey. 84. It is to be found frequently in woods about Vienna; abdomen marked with two compressed dots.

10. **Eyes placed thus,**...:...

Thorax orbicular and convex, with a transverse central excavation. 31. It is a native of South America, among trees, where it preys upon the larger insects, and even small birds, dropping into their nests, and sucking their blood and eggs; it is of so enormous a size, that its fangs may be compared to the talons of a hawk, and its eyes are very large.

11. **Eyes placed thus,**...:...

Of a grayish rusty colour, and slightly clouded; thorax globular, and slightly heart-shaped; abdomen somewhat triangular, and marked with a faint longitudinal cross. 85. A native of Europe, on oak and other trees; abdomen marked with four impressed dots on the back; papillae three.

12. **Eyes placed thus,**...:...

Abdomen oval, obtusely conic behind, variegated with brown and white; beneath black. 36. A native of Europe, among bushes; it spins and spreads out a web, to the surface of which it attaches the insects it has ensnared, after it has sucked out their juices. Thorax black, slightly tinged with rusty colour, and nearly double behind; legs gray, marked with brown rings; abdomen marked with a whitish spot, beneath resembling a horse shoe; papillae four.

13. **Eyes placed thus,**...:...

Hair; body oval, black, variegated with brown ash.

99. A native of Europe.

B. **Eyes six, placed thus,**...:...

Abdomen greenish, the sides yellow. 99. A native of Europe.

C. **Eyes**
Abdomen oval, oblong, and silky; marked underneat

Eyes - - -

Abdomen oval, oblong, and silky; marked under neath near the base with two yellow dots. A native of Europe. It is found within the leaves of plants which it rolls up.

Thorax orbicular, smooth, and black; abdomen oval, downy and brown. A native of America. It constructs a tenacious cylindrical nest about a foot in length, furnished with a lid.

96 species of this genus have been described by Gmelin, in the last edition of the System of Nature.

115. SCORPIO, Scorpio.

Legs eight; likewise two claws situated on the fore part of the head. Eyes eight; three placed on each side of the thorax, and two on the back. Feelers two, furnished with claws, and projecting. Lip bifid. Antennae none. Tail long, jointed, terminating in a sharp crooked sting. On the under side, between the breast and abdomen, are two excrescences resembling combs.

Scorpions have been conceived to be the most malignant and poisonous of all animals. Though this opinion be now very generally exploded, there are none of the insects we are acquainted with so formidable. It is true the effect of their sting differs greatly, according to the circumstances of the constitution of the person receiving the wound, as well as of the animal itself, the heat of the climate in which it lives, and the degree of violence with which the wound may have been inflicted.

The common European scorpion certainly is not of so terrible a nature as is commonly supposed; its sting being very rarely productive of bad consequences. But the large scorpions of Africa, which are said to be nearly a foot in length, may well be supposed capable of inflicting a wound of the most severe pungency, and of the most dreadful malignity. The poison is evacuated through three very small foramina near the tip of the sting; viz. one on each side of the tip, and the other on the upper part. A diversity of opinion has subsisted among naturalists, relative to the slit or foramina in the fangs of spiders, through which their poison is evacuated; and the same variety of opinion has prevailed with respect to the foramina in the scorpion's sting. The celebrated Redi, assisted by the best microscopes he could procure, was not able to discover them, though he was well convinced of their existence, from having perceived the minute drop of poison exude from near the tip of the sting. Others have denied the existence of the foramina; but Valisnerius and Leeuwenhoek have both described two, viz. one on each side of the tip, and which in shape are inclining to triangular; besides these a third has sometimes been seen, so that the sting of the scorpion can with greater facility discharge its venom, than that of any other animal. The poison is whitish, and is contained in a small bladder near the tail. When this bladder is pressed, the poison may be seen issuing out through the foramina of the sting.

Maupertuis has made many experiments with the scorpion of Languedoc, the result of which were by no means uniform. He provoked one to sting a dog in three places of the belly, where the animal was without

hair. In about an hour after the animal seemed greatly swollen and very sick. He then cast up whatever he had in his bowels, and for about three hours continued vomiting a whitish liquid. The belly was always greatly swollen when the animal began to vomit, but this operation always seemed to abate the swelling; thus alternating for the space of three hours. The poor animal after this fell into convulsions, bit the ground, dragged himself along on his fore feet, and at length died five hours after he had been stung. There was no partial swelling round the wound inflicted, as is usual after the sting of a wasp or bee; but the whole body was inflated, and there only appeared a red spot on the places stung. Two days afterwards the same experiment was tried on another dog, and even with more aggravated cruelty; yet the dog seemed no way offended by the wounds, but howling a little when he received them, continued alert and well after them, and soon after was set at liberty, without showing the smallest symptoms of pain. The experiment was repeated with fresh scorpions upon seven other dogs, and three hens, but not the smallest deadly symptom was seen to ensue. He put three scorpions and a mouse into the same vessel, and they soon stung the animal in different places. The mouse was not killed, stood for some time on the defensive, and at last killed them all one after another, and did not seem to have received any material injury itself, at least no fatal consequences followed, though it had received several severe wounds. From hence it appears, that many circumstances which are utterly unknown must contribute to give efficacy to the scorpion's venom. Whether the nature of its food, long fasting, the season, age of the insect, or the part of the body which it wounds, add to or diminish the malignity of the poison, still remains to be ascertained. The insects employed by Maupertuis were newly caught, seemingly vigorous, and were of different sexes. The result of these experiments may serve to shew, that many of the boasted antidotes which are given for the cure of the scorpion's sting, owe their success more to accident than to their own efficacy. The scorpions of tropical climates are very large, and perhaps more venomous. Halipius, who resided long in the coast, says that he was often attacked by these poisonous, and never suffered any material injury from the wound, though a painful tumour generally ensued, which was cured by rubbing with a piece of iron or stone, as he had seen the Indians do, until the part became insensible. Seba, Moore, and Bosman, give a very different account of the scorpion's malignity; and assert that without the speedy application of proper remedies, the wound proves fatal. Several fabulous anecdotes have been recorded of these animals by the older writers on natural history, which are totally unworthy of notice. The most remarkable of these is, that scorpions sometimes commit suicide, when they find themselves in a situation from which they cannot make their escape. It is said that a newly caught scorpion, placed in a circle formed with pieces of burning charcoal, runs round endeavouring to effect its escape, but finding no exit, it applies its tail to the back part of its head, and stings itself to death. Scorpions are viviparous, and produce about forty or fifty young ones at a time, which are completely shaped, and undergo no further change except losing their skin from time to time like spiders. They feed on flies, spiders, worms, &c. and even on one another.
ENTOMOLOGY.

Thorax nearly square; edge somewhat sharp; the legs compressed. 8. It is found in the open sea, particularly on the focus natione, and runs about on the surface of the water.

Very smooth; the anterior part of the thorax is pinched on the sides; the tail is carinated and knobbed in the middle. 9. A native of the Asiatic seas. It resides within the shell of the pinnae. The ancient supposed that this was a friendly connection formed for mutual defence: that the pinnae being destitute of eyes, and thus exposed, when he opened his shell, to the attacks of the cuttle-fish and other enemies, was warned of their approach by his little budger, on which he immediately shut his shell, and both were safe.

Land Crab. The first joint of the legs prickly; the second and third joints set with tufts of hair. 11. A native of South America. This species resides in the woods in the Bahama islands they are so numerous that the ground seems to move as they crawl about. At breeding time they generally make to the sea-shores, for the purpose of washing off their spawn, and depositing it in the sand, and no obstruction will make them turn aside from the straight road, when they are on their progress towards the sea. They are esteemed very excellent food. They feed on vegetables, but when they have fed on the manchineel apple they are reckoned poisonous. When taken, they will seize the person's finger with their claw, and endeavour to escape, leaving the claw behind, which for the space of a minute after it has been separated from the body, continues to squeeze the finger closely. They vary in size and colour; the light coloured ones being esteemed the best food.

Thorax marked along the sides with incisions.

Thorax marked with one small projection, one of the claws larger than the other; the eyes long. 14. A native of Jamaica. It conceals itself under stones, and utters a cry when caught, and pinches severely.

The thorax furnished with two projections on each side; claws very long. 110. A native of England. Found in the sea near Weymouth. The claws are three times the length of the body.

Hairy; thorax notched on both sides; the hind-legs terminating in two nails. 24. A native of the Indian seas. Black; the extremities of the claws smooth and white. It is reckoned poisonous.

Common Crab. Thorax marked on each side with nine obtuse folds; the tips of the claws black. 27. A native of both the European and Indian seas. This is the crab most generally used in this country for the table; they are in season and heaviest in the summer; and cast their shells in the winter and spring. They frequent rocky shores.

Thorax hairy or prickly on the upper side.

Thorax hairy, marked with knobs, and oval; furnished with a beak which is divided at the extremity; claws oval. 30. A native of the European seas. This species is supposed to be injurious to oyster-beds; on this account the fishermen, when they meet with them in the course of dredging, are careful not to return them into the water, but carry them on shore, and destroy them.

Thorax

A. Antennae four.

† The last articulation bifid; the Tail short.

‡ The Thorax smooth.

|| And entire on the sides.

cursor.

The posterior parts of the sides of the thorax furnished with sharp points; the tail bent back. 1. A native of the Mediterranean and Indian seas. About sunset it leaves the water, and runs about the sands with great velocity.

pennum.

Thorax orbicular, unequal and fringed; four dorsal legs. 5. A native of America, within the shell of the chamae hervanta, to which it gives notice of the approach of the cuttle-fish.

* pisum.

Thorax orbicular, obtuse; the tail of the same length with the body. 6. A native of the Mediterranean seas. About the size of a pea; the tail very obtuse; the legs smooth and without spines; claws somewhat oblong; toes equal.


Legs eight, (seldom six or ten), likewise two claws. Feelers six, unequal. Eyes two, placed at a distance from one another, and set on moveable stalks in most species. Mandible composed of a horny substance, and thick. The lip triple. The tail jointed and without a sting.

These live chiefly in water; and feed on insects, worms, dead fish, and dead bodies of any kind. They every year cast their shell, which is performed with much difficulty and pain; during the change they become weak and sickly.

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ENTOMOLOGY.

Aptera.

Thorax prickly; claws toothed and covered with spines; the fingers of the claws covered with tufts of hairs; legs six. 47. A native of the Norwegian seas.

* horridus. The thorax set with spines, and covered with knobs; claws oval; tail carious. 43. A native of the Asiatic and Norwegian seas. There is a large variety of this found on the east coast of Scotland, which has its legs and claws covered with spines.

§ § Antennæ set on stalks; the last articulation of the posterior pair bifid; Tail long and without leaves. Paguri Fabrici. Parasitici.

Iatro.

Thorax divided into four; the tail simple and big-bellied beneath. 56. A native of East India, in holes of rocks. Wanders about on land by night in search of cocoons-nuts, on which it feeds. To procure them it mounts the trees, and having detached the nuts, and let them drop to the ground, it descends and tears them open with its claws. This species is eatable, except the intestines.

Claws heart-shaped, and covered with sharp points; the claw on the right side larger than the other. 57. A native of the European seas. This species being destitute of shell towards the tail, takes possession of the empty shells of different species of cockles, changing from one to another as it increases in size; the tail, which is soft and without a shell, is furnished with a book to secure itself in its habitat.

Claws smooth and downy; the claw on the left side larger than the other. 53. A native of the American and Asiatic seas. It occupies the empty shells of different species of cockles.

Claws smooth and downy, covered with a hemispherical cap. A native of the Mediterranean sea. It is of a dirty grey colour; hemispherical and without spines. It very much resembles a skull or death's head, whence it has received its name; it is about the size of a chestnut. The cap proceeds, as it were, from the hind legs, and is turned over the body; the fingers of the claws equal and naked at the tips; the extremity of the legs sharp.

Claws rough; the tail callous at the extremity, and furnished with a hook. 143. It is found in the fissures of the rocks on the sea-shore near Edinburgh. It occupies the empty shells of the merita or turbo.

Thorax wrinkled, ciliated, and prickly on the fore part; the beak furnished with three small projections, the claws Siliform. 149. A native of the Mediterranean and north seas. It is found on the sea-shore near Banff in Scotland. This is the C. Bantius of Pennant, and the C. Brochius of Shaw.

§ § Antennæ set on stalks, the posterior pair cleft; Tail long.

† The shell of the Thorax not covering the Thorax completely. Astaci. Lobsters.

|| The posterior Antennæ bident.

† † † The posterior Antennæ bident.

The shell of the Thorax covering the Thorax completely. Astaci. Lobsters.

Lobster. Thorax smooth; the beak notched on the sides, marked on the upper side, at the base, with a double tooth. 62. It inhabits the sea, on rocky shores. This is reckoned the most delicate species; and is most

in request for the table. They chiefly frequent deep clear water. They are taken in wicker-baskets, with holes on the sides, which allow the lobsters to enter, and prevent their egress; or with small nets attached to iron hoops. They breed in the summer months, and deposit many thousands of eggs in the sand. They cast their shell annually, and when any of their legs or claws happen to be torn off they grow again. They are in season from October to May. Lobsters are said to be very much alarmed at thunder, so much so as sometimes to cast their claws.

Craw-fish. Thorax smooth, the beak notched on the astace. sides, with a single tooth on each side at the base. 63. It inhabits fresh waters; it lodges in holes in the clayey banks of rivers or lakes. It is reckoned a delicacy, and is much in request as food.

Antennæ projecting; beak tapering towards the ex. halecum. extremity; eyes globular and prominent. 156. A native of the north seas. This little animal is very abundant, and is the principal food of the herrings and codfish.

|| The posterior Antennæ divided into three.

Prawn. Thorax smooth; the beak serrated above, quills. beneath furnished with three small projections; the edge of the thorax furnished with five small projections. 66. Native of the European seas. The beak is sometimes straight, sometimes crooked. There is a smaller variety of this, called in London the white shrimp, which is white when boiled. Prawns are much relished by most people; and are very abundant in sandy shores.

Shrimp. Thorax smooth; beak short and entire; crangon the moveable toe of the claw longer than the other. 67. A native of the northern seas. This species is reckoned the most delicious of the genus. It is very plentiful on the sandy shores of Britain.

† † The shell of the Thorax not covering the Thorax completely. Squilla Fabricii.

Claws furnished with a single fang; crooked, compressed, and notched; without a moveable toe. 76. A native of the Mediterranean and Asiatic seas. It is reckoned a delicacy by the Italians.

|| || Antennæ set on stalks, and simple. Gammarus Fabricii.

Claws consisting of a single fang; legs fourteen; ampulla. the thighs of the hind-legs compressed and dilated. 170. A native of the north seas. Large, almost white; the beak short, curved, and sharp; the tail composed of six leaves or plates; the last articulation bifid.

Claws four, furnished with a single fang, and desti. pelae. tute of a moveable toe; legs ten. 81. A native of Europe. It is frequent on the sea-shore, in wells, ditches, rivulets, and likewise in the salt lakes of Siberia; it swims on its back, and leaps. It is injurious to fishermen by eating their nets, and also harmful to fishes, by exciting ulcers on their gills. It shines in the dark.
B. Antennæ two.

Two arched Scales in place of the posterior Antennæ.

Sceyllari Fabricii.

arcus. The scales of the antennæ fringed with prickles. 75.

A native of almost every sea.

Scales none; Antennæ fringed with thickly-set hairs.

Hippe Fabricii.

canthus. Thorax wrinkled and oval; claws compressed and prickly along the edges. 72. A native of South America and India.

18 species of this genus have been described by Gmelin, in the last edition of the System of Nature.

117. Monocusus.

Legs formed for swimming; very long; from four to eight. Body covered with a shell, composed of from five to ten segments, growing smaller towards the tail. Antennæ two; those of the male thicker and shorter than those of the female. In some species they are wanting. Sometimes one eye, more frequently two, approaching very near to one another. Feelers four, constantly in motion while the animal is swimming; the posterior pair are very small, and bent like hooks.

The insects of this genus live in water; some of them are found in the sea, others in rivers, but most of them in stagnant waters; they have been called monocusus from the circumstance of some of them having but one eye, or two eyes placed so close together as to appear but one. Some of them are viviparous, some oviparous.

A. Those which have one Eye.

Body covered with a hard Crust.

Antennæ none. Polyphemus Mulleri.

oculus. Feelers two; long and divided; tail reflected. 10.

A native of Europe. To be found in lakes and marshes from May to September. It swims on its back, frequently in large swarms; eye very black, occupying almost the whole of its head.

Antennæ two or four. Cyclopes Mulleri.

Antennæ four.

quadricornis. Tail straight; and divided at the extremity. 6. A native of Europe; in fresh waters. Body grayish or greenish, smooth or covered with hair; legs eight and hairy. Female with an oval bag on each side of the tail, which contains the eggs. The antennæ in the male are much thicker and shorter than in the female; the tail is composed of four articulations; in the female it is furnished with two small spines. When viewed in the microscope they are found to have two eyes placed very close together. They are very frequent even in the purest water, and are often swallowed along with it.

Antennæ two.

Antennæ linear.

rubens. Reddish; tail straight and forked. 13. A native of Europe; in fresh water.

Europe; in marshes, lakes, and rivulets; it is to be met with throughout the whole year. The antennæ as long as the body; legs eight.

Antennæ nearly elevated.

Antennæ still; tail blind. 18. Inhabits, though claviger, rarely, the rivers of Germany; and glides slowly along, alternately on its back, belly, and sides; and sometimes raises itself upright. Upper part of the body white, beneath red; legs eight; tail very small and without articulations.

Antennæ dilated.

Antennæ short; tail furnished with two sharp points. Cressicolor.

19. A native of Europe; in marshes. It is very rare. Body composed of five segments; the antennæ swelling from the base to the middle, and becoming sharp towards the extremity.

The tip of the Antennæ terminating in three points.

Antennæ very small and straight; body without ac-curticornis articulations; claws smooth; tail furnished with two bristles. 20. Inhabits salt water.

Antennæ bent backwards.

Antennæ short; body without articulations, furnish-chelifer. ed with claws; tail furnished with two bristles. 21. Inhabits salt water.

Antennæ of the (male) furnished with little hooks.

The bristles of the tail very short. 22. Inhabits breviscor-salt marshes. It very much resembles the M. quadricornis; the top of the antennæ in the female larger, and forked at the extremity.

Those which have a bivalved Shell.

Head exposed; two-branched Antennæ; legs from eight to twelve. Daphnæ Mulleri.

Tail bent inwards.

The posterior part of the shell set with sharp points. Pules.

4. It is found everywhere in stagnant waters, and in great abundance. It is a frequent cause of the water assuming the colour of blood. The shell is yellowish; the abdomen, intestines, and ten legs red. The female is three times the size of the male; and produces from eight to twelve green eggs; the back is marked with a large square spot resembling a saddle.

Tail bent downwards.

The shell without prickles; the head furnished with crystalli-two short projecting horns. 29. A native of the north mus. of Europe; in lakes and rivers. White and oblong; very transparent; viviparous, and furnished with twelve hairy feet.

Tail bent backwards.

A native of Europe; in pediculus. fresh water.
ENTOMOLOGY.

\[ \text{Aptera.} \]

\[ \text{\textbf{Tail straight.}} \]

\[ \text{\textbf{30. A native of Europe; in stagnant waters; transparent, of an oblong oval form; antennae divided into three, furnished with eight or more hairy legs; the extremity of the tail terminating in two books.}} \]

\[ \text{\textbf{Head concealed; Antennae two, and hairy; Legs eight.}} \text{ Cytherea Mulleri.} \]

\[ \text{\textbf{Iridid.}} \]

\[ \text{Shell kidney-shaped and downy. 31. A native of Europe; found on various species of fucus and con-} \]
\[ \text{\textbf{fervus; the extremity of the antennae terminating in three points; the fore-legs formed like hooks.}}} \]

\[ \text{\textbf{Head concealed; Antennae two, thin hairs; Legs four.}} \text{ Cyprides Mulleri.} \]

\[ \text{\textbf{Concha-}} \]

\[ \text{Shell oval and downy. 7. Found in clear stagnant waters; the antennae white or yellowish, and stretched out; swims very swiftly, with ten bristles. It is green, opaque; feet yellowish; abdomen nearly bilobed and orange-coloured, marked in the middle with a black circle. It conceals itself within its shell, and swims on its belly. It resembles a muscle in miniature, is very minute, and seldom exceeds the tenth part of an inch.}} \]

\[ \text{\textbf{Those with shells consisting of one valve.}} \]

\[ \text{\textbf{Legs four; Antennae two.}} \text{ Anomya Mulleri.} \]

\[ \text{Satyrus.} \]

\[ \text{Shell oval; antennae obtuse, and extended in a vertical direction. 46. It is frequent in clear fresh water; it is agitated at intervals with a tremulous motion; the shell is flat and membranaceous; antennae rigid, furnished with three very short bristles on the extremity; the fore-legs thick and bifid; tail terminating abruptly, eight-cleft in the middle. The insect is transparent.}} \]

\[ \text{\textbf{Legs six; Antennae two.}} \text{ Nauplii Mulleri.} \]

\[ \text{\textbf{Racteatus.}} \]

\[ \text{Shell orbicular, and without spines or bristles. 52. It is rare; found in clear fresh water; the} \]
\[ \text{\textbf{shell very transparent; the antennae resembling legs; the legs} \]
\[ \text{\textbf{terminating in three bristles; the eye not conspicuous.}}} \]

B. \text{\textbf{Eyes two.}} \text{ Bineculi.} \]

\[ \text{\textbf{Those with shells composed of one valve.}} \]

\[ \text{\textbf{Eyes two, placed beneath; Antennae two; Legs four to eight.}} \text{ Argulii Mulleri.} \]

\[ \text{\textbf{Delphi-}} \]

\[ \text{\textbf{Legs eight. 55. Found in rivers.}}} \]

\[ \text{\textbf{Eyes situated on the back; Antennae two or six; \textbf{Legs varying in number.}} \text{ Limulii Mulleri.} \]

\[ \text{\textbf{Hyph-}} \]

\[ \text{Shell orbicular; suture in the middle of the form of a crescent; tail triangular, long and tapering. 1. A} \]
\[ \text{\textbf{native of the Indian seas, particularly in the neighborhood of the Molucca islands. It is likewise found on the shores of Carolina. It is the largest of all known insects; sometimes it grows to the length of four feet. It is frequently found in pairs, male and female. It is very rarely found among petrifications. There are seven spines on the anterior part of the back of the shell; legs 14.}} \]

\[ \text{Shell oblong; the suture before of the form of a *opus. crescent; tail composed of two bristles. 5. A} \]
\[ \text{\textbf{native of Europe; in ditches, ponds, &c. and though dried in summer, when the water has evaporated, yet they revive when the water returns. This is the largest species to be found in Britain.}}} \]

\[ \text{\textbf{Eyes placed on the sides; Antennae two, sessilae; \textbf{Legs eight or ten.}} \text{ Caligii Mulleri.} \]

\[ \text{Body short; tail bifid, and composed of one thin flap. *piscinus.} \]

\[ \text{2. A native of the European seas. Found on flounders, cod-fish, salmon, &c. adhering on the out-} \]
\[ \text{\textbf{side between the scales; running swiftly both on the fish and on the water.}}} \]

\[ \text{\textbf{Those with Shells composed of two valves; Head not enclosed within the shell; the Eyes placed on} \]
\[ \text{\textbf{the sides; Antennae two or four, resembling hairs, and} \]
\[ \text{\textbf{placed beneath; Legs eight and more.}} \text{ Lyncoides Mulleri.} \]

\[ \text{Tail inflected; shell globular. 60. A native of Eu-} \]
\[ \text{\textbf{e sphinx-}} \]
\[ \text{\textbf{rope. It is found about the edges of stagnant waters, eus.}} \]
\[ \text{\textbf{and among duck-weed. It is very minute; the shell} \]
\[ \text{\textbf{is reddish; antennae two; legs twelve; tail furnished}} \]
\[ \text{\textbf{with a small hook at the extremity and concave beneath; the ovari} \]
\[ \text{\textbf{a green.}}} \]

\[ \text{66 species of this genus have been described in the last edition of the System of Nature.} \]

\[ \text{118. ONYSCUS.} \]

\[ \text{Jaw terminating abruptly, and furnished with small teeth. Lip bifid. Feelers unequal, the posterior ones} \]
\[ \text{\textbf{being longer than the others. Antennae sessilae.}} \]
\[ \text{Body oval. Legs fourteen.} \]

\[ \text{The species of this genus feed on the leaves of plants,} \]
\[ \text{on filth, and on the juices of animals; some of them are} \]
\[ \text{\textbf{very injurious to the fruit of wall-trees; they undergo no other change but a change of skin. They are}} \]
\[ \text{\textbf{found under stones, in old walls, houses, and woods; some species live in water.}} \]
\[ \text{Abdomen covered with two thin plates; the tail co-} \]
\[ \text{\textbf{axiulius.}} \]
\[ \text{miroval. 1. A native of the European seas. Viviparous; and is very injurious to fishes.}} \]
\[ \text{Antennae four; tail long and sharp. 5. Inhabits*entomon.} \]
\[ \text{the sea. It swims very quickly. It lives on crabs and fishes; the fishermen dislike it very much.} \]
\[ \text{Oval, and of a brownish ash-colour; tail obtuse and *armadil-} \]
\[ \text{\textbf{dente. 15. A native of Europe; under stones. When-} \]
\[ \text{to touched it rolls itself up into a hard motionless ball; from which circumstance it has received the name of armadillo.}} \]

\[ \text{Oval; tail obtuse, furnished with two simple append. *acellius.} \]
\[ \text{ages. 14. A native of Europe; in houses, walls, woods, &c. The young are contained in a follicle of} \]
\[ \text{four valves on the abdomen of the mother. This species was formerly used in medicine.} \]

38 species of this genus have been described in the last edition of the System of Nature.
ENTOMOLOGY.

119. SCOLOPENDRA.

Antennae setaceous. Feelers two, filiform; articulated and connected within the jaws. Lip divided and marked with small projections. Body flattish. Legs very numerous; one on each side of each of the segments of the body.

These insects live in decayed wood, about houses, under stones, and some of them in fresh water. They feed on other insects in every stage of their existence. The larvae differ but little from the perfect insect, except that they have fewer feet. The pupae likewise are active, and very much resemble the perfect insect. All the European species are small, but in tropical countries they are to be seen a foot long and an inch and a half in circumference.

* lagura. Twelve legs on each side; body oval; tail furnished with a white tuft of hairs. 1. A native of Europe; in mossy ground.

* forscata. Legs fifteen on each side. 3. A native of Europe and America. Very frequent under stones.

* gigantea. Legs seventeen on each side. 4. A native of America.

* morsitans. Legs twenty on each side; eyes eight. 5. A native of America and India. Body composed of 22 segments; the antennae consisting of 20 articulations. It is much dreaded on account of its bite, which is said to be poisonous.

* electrica. Legs 70 on each side; body linear. 8. A native of Europe; in close damp places, and shines in the dark.

* phosphorea. Legs 76 on each side. 9. A native of Asia. It shines in the dark like the *lampyris*; it is said that this insect has dropped from the air into a ship 100 miles from land, in the Indian and Ethiopian seas. Head oval; yellowish, and marked with two grooved lines, and a third transverse line; body filiform, and is about the thickness of a goose-quill, marked with two parallel yellow lines; antennae tapering, of a rusty colour, and consisting of 14 articulations.

12 species of this genus have been described in the last edition of the System of Nature.

120. JULIUS.

Antennae moniliform. Feelers two, filiform and jointed. Body semicylindrical. Legs very numerous, two on each side of every segment of the body.

The insects of this genus feed on other insects, particularly acori. The larva and pupa have many feet, are active, and resemble the perfect insect.

Legs 20 on each side. 1. A native of the Euro-ovatif. pean seas.

Legs 134 on each side. 9. A native of America. maximus. This is the largest species of the genus. It bites severely, but is not poisonous.

Legs 120 on each side. 5. A native of Europe; *sabius* in sandy places, and on the hazel.

12 species of this genus have been described in the last edition of the System of Nature.

The following table exhibits the number of species included under each order.

<table>
<thead>
<tr>
<th>ORDER</th>
<th>NUMBER</th>
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<tr>
<td>Coleoptera</td>
<td>4087</td>
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<td>Hemiptera</td>
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<td>Hymenoptera</td>
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<td>Diptera</td>
<td>692</td>
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<tr>
<td>Apterida</td>
<td>679</td>
</tr>
</tbody>
</table>

In all 10,894

GENERAL OBSERVATIONS.

Though the definition of an insect which we have already given from Linnaeus be perfectly correct, (viz. a small animal breathing through pores on its sides, furnished with many feet and movable antennae, covered with either a hard crust, or a hairy skin,) it may not be improper to mention, more at large, those circumstances which form the line of distinction between insects and other animals.

1. Insects are not furnished with red blood, but instead of it their vessels contain a transparent lymph. This may serve to distinguish them from the superior animals, but it is common to them with many of the inferior; though Cuvier has lately demonstrated the existence of a kind of red blood in some of the *vermes*.

2. They are destitute of internal bones, but in place of them are furnished with a hard external covering to which the muscles are attached, which serves them both for skin and bones; they are likewise without a spine formed of vertebrae, which is found in all the superior classes of animals.

3. They are furnished with articulated legs, six or more; this circumstance distinguishes them from all other animals destitute of a spine formed of vertebrae.

4. A very great number of insects undergo a metamorphosis; this takes place in all the winged insects.

5. They frequently change their skin in the progress of their growth.

6. A very great number of insects are furnished with jaws placed transversely.

7. The wings, with which a very great number of insects are furnished, distinguish them from all other animals which are not furnished with a spine composed of vertebrae.

8. Insects are oviparous; scorpions and aphides during the summer months are viviparous.

9. Insects have no nostrils.

10. Insects are destitute of voice.

11. They are not furnished with a distinct heart composed of ventricle and auricle.

12. Incubation is not necessary for hatching their eggs.

The Organisation of Insects.

When we wish to become thoroughly acquainted with natural objects, we must not confine ourselves to an examination of their external appearance and configuration,
ENTOMOLOGY.

In the four superior classes of animals, viz. quadrupeds, birds, reptiles, and fishes, the bones form the most solid part, and occupy the interior part both of the trunk and limbs; they are surrounded with muscles, ligaments, cellular membrane, and skin. The matter is entirely resublimable as any of their parts, and the part is most solid, serving at the same time both for skin and bones; it encloses the muscles and internal organs, gives firmness to the whole body, and by means of its articulations, the limbs, and different parts of the body, perform their various motions. In many insects, such as the crab, lobster, &c., the external covering is very hard, and distinet of organization; it is composed of a calcareous phosphate, mixed with a small quantity of gelatin, formed by an exudation from the surface of the body. As its great hardness would check the growth of the animal, nature has provided a remedy; all of these crustaceous insects cast their shell annually. The skin of most of the other insects, though composed likewise of calcareous phosphate, is softer and organized, being formed of a number of thin membranes adhering closely to one another, and putting on the appearance of horn. It owes its greater softness to a larger proportion of gelatin. The muscles of insects consist of fibres formed of fasciculi; there are commonly but two muscles to produce motion in any of their limbs; the one an extensor, the other a flexor. These muscles are commonly attached to a tendon composed of a horny substance, connected to the part which they are destined to put in motion. The articulations of insects are formed in a variety of ways; Cuvier, in his Comparative Anatomy, tom. i. page 445, has given a very minute account of them. Though Linneus, and several others following him, have asserted that insects have no brain, yet it is certain that at least a number of the larger kind, as the lobster, crab, &c., have a soft substance similar to brain, from which the optic and other nerves take their rise; besides, when this substance is irritated, the animal is thrown into convulsions; hence we would conclude, that insects have a brain as well as the animals of the four superior classes, though it be smaller in proportion to their body.

In most insects the brain is situated a little above the oesophagus; it divides into two large branches, which surround the oesophagus, and unite again under it, from which proceed a whitish nervous chord proceeds, corresponding to the spinal marrow of the superior animals, which extends the whole length of the body, forming in its course twelve or thirteen knots or ganglions, from each of which small nerves proceed to different parts of the body. Those who deny that insects have no brain, lay much stress on this circumstance, that many insects are capable of running about after they have been deprived of their heads; the hippocampus, in particular, is frequently instanced, which moves about quite readily, and is even said to copulate after its head has been cut off. The ganglions which are formed in the course of the larger nerves, perform in a great measure the function of the brain, indeed each of these ganglions may be viewed as a subordinate brain; in this way it may be easily conceived how the various parts which derive their nerves from any one of these ganglions, may be enabled to perform their different functions, after they have been separated from the other parts of the body, and deprived of all connexion with the brain.

Whether insects be endowed with any senses different from those of the superior animals, cannot easily be ascertained, because we are only acquainted with the five which we ourselves enjoy. It appears pretty evident that they possess vision, hearing, smell, and touch; as the sense of taste we are left in ignorance; all the other senses are acquainted with no facts, by which we can prove that insects enjoy the sense of taste, nor do we know of any by which we can prove that they do not.

The eyes of insects are of two kinds; the one compound, composed of a number of lenses, large, and only two in number; the other are small, smooth, and vary in number from two to eight. The small lenses which form the compound eyes are very numerous; they amount in some insects to many hundreds. Leeuwenhoek has counted 800 of them in the eye of a fly. Polet says he observed upwards of 12,000 in the eye of a butterfly. The eyes of insects are without eyelids, and are covered externally with a hard smooth substance. Cuvier has given the anatomy of the eye of a dragon-fly. The internal surface of the lenses is covered with a black varnish. Under each of the lenses of which the eye is composed, there is a small nervous fibre, attached to the edge of the black covering which lines the internal surface of each lens by one extremity, and by the other to a membrane which is of the same extent with the cornea, which Cuvier calls the choroid. It is easily detached from the small nervous fibre, and appears to the naked eye, finely radiated with black and white; behind this there is still another membrane composed entirely of medullary substance, which is connected on each side with the hemisphere of the brain.

Whether insects from the compound nature of their eyes see objects multiplied, or enjoy only single vision, cannot be ascertained; were objects to be seen multiplied in proportion to the vast number of lenses of which the eyes of insects are composed, vision would certainly be very confused; and were we to be guided by analogy, we might naturally enough suppose that insects saw objects single with their compound eyes, as we ourselves see objects single with two eyes.

The eyes of insects, according to Swammerdam, do not contain the same humours which are found in the eyes of animals which compose the superior classes. The external membrane which covers the eyes, varies in size in different insects; in many of the dipterus insects, particularly the gaddly, it is agreeably variegated.

The far greater number of insects have only two eyes, like the animals of the superior classes; some have three, e. gr. the scrobipendria; some four, e. gr. gyrianus; some six, e. gr. scorpion; some eight, e. gr. spiders.

The eyes of insects are commonly immovable; crabs, however, have the power of moving their eyes.

That insects are endowed with the sense of hearing can no longer be disputed, since frog-hoppers, crickets, &c. furnish us with undeniable proofs of the fact. Nature has provided the males of these insects with the means of calling their females, by an instrument fitted to produce a sound, which is heard by the latter. The males
ENTOMOLOGY.

male and female death-watch give notice of each others presence, by repeatedly striking with their mandibles against old wood in houses, or decayed trees, their favourite haunts. Their ears have been discovered to be placed at the root of their antennae, and can be distinctly seen in some of the larger kinds, as the lobster.

That insects enjoy the faculty of smelling, is very evident. It is the most perfect of all their senses. Bees of various sorts, wasps, the different species of dermestes, sphinx, &c. perceive at a very considerable distance, the smell of ordure and dead bodies, and resort in swarms to the situations in which they occur, either for the purpose of procuring food or laying their eggs. The common blue flesh-fly, is attracted by the strong smell of the arum draciæntium, which very much resembles that of carrion, anddeposit its eggs on it; these flies are likewise deceived, and deposit their eggs on the flowers of the stelpia hispina, which has a very odourous smell. But though we can thus easily prove the sense of smell among insects, it is difficult to discover the seat of that particular sense. Several naturalists have supposed that it resides in the antennæ. Dumeril, in a dissertation published in 1759, attempts to prove, that it must be situated about the entrance of the spiracula or respiratory organs, as Bataix had previously supposed. Notwithstanding his arguments, Latreille is still disposed to follow the opinion of those who believe the antennæ to be the organs of smell. His reasons for favouring this opinion are:

1. Smell is produced by the action of air, impregnated with odoriferous particles, on the nerves or olfactory membrane, which transmits the sensation.

If insects be endowed with an organ, furnished with similar nerves, capable of receiving impressions from air charged with odoriferous particles, such organs may be regarded as that of smell. Should the antennæ present a tissue of many nerves, what inconvenience can result from supposing that this tissue is capable of transmitting odour? Would not this hypothesis, on the contrary, be more simple, and more consonant to anatomical principles, than that which fixes the seat of smell at the entrance of the spiracula?

2. Many male insects have their antennæ more developed than the females; a fact easily explained, if we admit that these organs are the seat of smell.

3. It is certain that most of these insects which live or deposit their eggs on putrid animal or vegetable matters, stagnant waters, &c. are almost uniformly distinguished by a greater development of the antennæ; such, for example, as the beetle, sphix, leather-eaters, tipulæ, &c. These required a more perfect sense of smell, and are organized accordingly.

4. A great many insects which are entirely rapacious, have simple antennæ; and those which are characterized by similar manners, and which are sedentary, have none at all; as for instance some of the spiders.

5. Insects discover their habitations and food by the sense of smell. Latreille deprived several insects of their antennæ, and found they instantly fell into a state of stupor or derangement, and seemed to be incapable of recognising their haunts or their food, though placed close by them. Such experiments deserve to be prosecuted. With this view, were the antennæ of dung-beetles to be coated with varnish, and the animals placed near excrement (their usual food), a decisive proof would be obtained; for were they readily to find their way to the excrement, it may be fairly inferred that the antennæ were not the organs of smell. Should the reverse take place, an opposite conclusion might naturally be drawn.

6. Nerves terminate the antennæ, the articulations of which, though externally covered with a pretty thick membrane, are hollow, lined within with a soft substance, which is often of a watery consistence, the extremities of which, when exposed to the air, may receive impressions from it.

Some have imagined the antennæ to be the organs of touch; but Latreille contends that such an opinion is by no means supported by facts, and alleges that the shortness of the antennæ in most species, and the way in which most insects carry their antennæ, seem to prove the contrary. He thinks their antennæ ill adapted to become the organs of touch, because they have a hard and scaly covering. He is rather inclined to believe that the sense of touch, at least in certain species, is situated in the paws or extremities of the fore legs. The palpi or feelers in spiders and some other insects, seem to possess the sense of touch in an eminent degree; but many are disposed to consider these palpi rather as the organs of taste. Though we have no direct proof that insects enjoy the sense of taste, yet we may naturally enough suppose that they do, both from analogy and from the circumstance that most insects prefer some particular kinds of food to all others; many of them will rather die of famine, than eat any other kind of food than that which is peculiar to them. The superior part of the oesophagus has been supposed by some to be the seat of the organ of taste.

Aliment of Insects.

Insects feed on a great variety of substances; there are few things either in the vegetable or animal kingdoms which are not consumed by one or other of them. The leaves, flowers, fruit, and even the ligneous parts of vegetables, afford nourishment to a very numerous class; animal bodies both dead and alive, even man himself, is preyed on by many of them; several species of the house, of acarus, of the gnat, and the common flies, draw their nourishment from the surface of his body; the geiger or chigoe, (pedicul sacchari), penetrates the cuticle, and even enters his flesh. A species of gadfly (atrasformis) deposits its eggs under his skin, where the larva feeds; the phlebotomus pirogumii frequently finds its way into his stomach, where it sometimes swallows a fatal lodger. Other caterpillars insinuate themselves into different cavities of his body. All the inferior animals have their peculiar parasitical insects which feed on them during their life.

There are some insects which can feed only on one species. The caterpillars both of moths and butterflies, which feed on the leaves of some particular vegetable, would die without being able to taste any other. There are others which can make use of two or three kinds of vegetables, but which never attain full perfection, except when they are fed on one particular kind; for example, the common silk-worm, which eats readily all the species of mulberry, and even common lettuce, neither attains so great a size, nor produces so much silk, as when fed on the white mulberry. Although that species of coc-
ENTOMOLOGY.

The organs of deglutition present nothing very remarkable. The oesophagus is a straight short tube, reaching from a little way under the brain to the first gusulation of the nerves, which perhaps may be considered as the cerebellum of insects. In the insects without jaws, deglutition is performed by a tube composed of amnial muscular fibres. The trunk of the butterfly, the proboscis of the common fly, and the neck of hemipterous insects, may be considered as part of the oesophagus projecting beyond the mouth.

The organs of digestion consist of the stomach and intestinal canal. The stomach of insects varies much according to the nature of the aliment on which they subsist. Sometimes it is single, frequently double, at other times manyfold. The greater number of insects have a single stomach, which is sometimes entirely membranaceous, sometimes muscular, and at other times it is merely the continuation of the oesophagus without any perceptible dilatation. These insects which have a dilated membranaceous stomach, subsist commonly on the juices of vegetables; such as the bee, which seek the nectar of flowers, the butterflies &c. Their stomachs are almost always dilated, owing to the disengagement of gas from the substances they contain. Those which are furnished with a muscular stomach, such as the bug, the boat-fly, and almost all the hemipterous insects, feed on animal substances. Finally, those which have no dilatation in the oesophagus so as to form an evident stomach, commonly feed on the leaves and roots of vegetables, such as the cock-chaffer and all the beetles. The whole of the alimentary canal in these insects is very long, without any perceptible enlargement. The double stomach is to be found in those coleopterous insects which feed on other live insects, such as the cicindela, carabus, cutelipes, &c. all of them are likewise distinguished by six palps. The first of their two stomachs is muscular, and is in the form of a gizzard, the muscles of which are composed of slender fibres. The second is a long membranaceous canal, which appears villous when examined by the microscope; this villosity at first sight may appear singular, but a little attention to the manner in which nutrition goes on in insects, will suggest an explanation of this peculiarity. When we consider that circulation proceeds very slowly, and that the nutritive fluids must be nearly in a state of stagnation, digestion could not proceed without the assistance of absorbent tubes, which may take up these fluids. We may naturally enough suppose this villosity to be nothing else, but a number of absorbent vessels which take up the nutritive part of the circumanent fluid. These insects which have many stomachs may be called ruminants, because they have
ENTOMOLOGY.

General Observations.

have the power of causing the food to return from the stomach to be chewed over again; such as the grasshopper, cricket, &c.

The mole cricket has a long oesophagus terminating in a round membranaceous stomach, which may perhaps be compared to the first stomach of the ruminating animals of the class Mammalia; where the food is accumulated, to be thrown back into the mouth, again to undergo a farther mastication.

A short intestine proceeds from this into a second stomach much less than the former, but muscular and apparently thicker, and furnished with parts which resemble the grinders in the stomach of crabs. They are small laminae, resembling saws, disposed in five longitudinal rows, each composed of from ten to twelve smaller laminae, which perform a sort of peristaltic motion by means of the muscular action of the stomach; and it appears pretty evident that the action of those laminae is exerted on the food contained in the stomach. The other two stomachs are very similar, and placed one opposite to the other at the opening of the intestine which corresponds to the duodenum of the superior animals; they are wrinkled and thicker than the first stomach, but not so thick as the second.

This apparatus is to imbibe some part of the fluid from the aliment.

In the grasshopper the stomachs are similarly arranged. The cricket has to the number of five small and slender stomachs; indeed the two first seem only to be simple dilatations of the oesophagus.

In the cockroach there is only one stomach, which is very large, and almost entirely membranaceous; at the extremity of which, there is a number of partial enlargements which may be considered as so many stomachs. The stomachs of the larvae frequently differ from those of their perfect insects; viz. the alimentary canal of the caterpillar differs very much from that of the butterfly; and the intestinal canal of the grub differs widely from that of the beetle.

The oesophagus of the grub of the sciarabaeus nasicornis dilates suddenly, forming a cylindrical stomach which is furnished with three ranges of coecum, which have their extremities simple and loose. The intestine proceeds in a straight line from the stomach; then having formed a coiling, becomes larger, and puts on the appearance of a colon, four times the length of the stomach; on which is to be perceived two tendinous lines. At the extremity of the colon there is a considerable dilatation; beyond which it becomes slender, and forms the rectum. The intestinal canal of the scarabaeus melolontha, or cock-chaffer, is almost exactly similar; but nothing analogous to this structure is observable in the perfect insect. The intestines of the scarabaeus melolontha, and sc. nasicornis are very long, very much contorted, and equal throughout their whole length.

The larvae of the hydrophila have a very evident stomach, and a very short intestine. In the perfect insect the intestine is long, without any visible enlargement or stomach, which may be accounted for, perhaps, in this way: the larvae subsist on animal food, while the perfect insects feed on vegetables. The examples we have just given are striking. It may be remarked, that whenever the larvae and the perfect insect subsist on the same kind of food, the difference in structure is less remarkable; only the intestinal canal is longer in the perfect insect.

The anus or the posterior orifice of the intestinal canal, not only affords a passage for the excrement, but encloses the extremities of the parts of generation. There are neither kidneys, bladder of urine, pancreas, nor any of the conglomered glands observable in animals of the superior classes, to be found in insects.

Instead of the liver, there is a number of small floating filaments which surround the intestinal canal for almost two-thirds of its length. There is a great quantity of fat in many insects, particularly in those which spend a considerable portion of their lives in a torpid state. It is contained in loose membranes that fill up the intervals between the bronchi. This fat in caterpillars is very white, and both in taste and consistence very much resembles that of other animals. The quantity is so considerable in some insects as to equal one-third of the bulk of the body. All the insects which undergo metamorphosis, are abundantly supplied with this fat; without it, indeed, they seem unable to go through their destined changes; for it has been observed, that those caterpillars which have been fed on by the larvae of the various species of ichneumon, though they may survive the ravages of these parasitical insects till they are changed into pupae, commonly die before they become perfect insects.

The Respiration of Insects.

Respiration is the act of inhaling and exhaling the air into, and out of the lungs. Quadrupeds, birds, and most of the amphibia, breathe through the mouth and nostrils. The air when received into the lungs is mixed with the blood, and imparts to it something necessary, and carries off something noxious.

Some authors have asserted that insects have no lungs. But late experiments and observations show, that no species wants them, or at least something similar to them; and in many insects they are larger in proportion to their bodies than in other animals. In most of them they lie at or nearer to the surface of the body, and send out lateral pores or tracheae. The respiration of insects has attracted the attention of many naturalists, particularly Swammerdam, Malpighi, Reaumur, Lyonet, Muschenbroek, Degeer, Bonnet, Vanquelin, &c.

From their observations it may be inferred,

1. That insects do not breathe through the mouth or nostrils.

2. That there are a number of vessels for the reception of air placed along on each side of the body, which are commonly called spiracula, which are subdivided into a number of smaller vessels or bronchi.

3. That the vessels or tracheae which proceed from the pores on the sides, are not composed of a simple membrane, but are tubes formed of circular rugae.

4. That the spiracula are distinguishable, and are covered with a small scaly plate, with an opening in the middle like a button hole, which is furnished with membranes, or threads, to prevent the admission of extraneous bodies.

Reaumur is of opinion that the air enters by the spiracula into the tracheae and bronchi; and is expired through small pores on the skin, without returning by the same way through which it entered. Were this...
ENTOMOLOGY.

Circulation and Secretion of Insects.

All the animals of the two first classes have a double circulation; their hearts consist of two distinct auricles and ventricles. The heart in the amphibia has two distinct auricles without any communication; and under these there is the appearance of two ventricles similar in shape to those of the former class; but they may be considered as one cavity; for the ventricle sends out not only the pulmonary artery, but likewise the aorta; for there is a passage in the septum, by which the ventricles communicate freely, allowing the blood to pass from the left into the right one.

The heart of fishes has but one auricle and one ventricle, and one great artery which conveys the blood to the gills. The circulation in insects differs considerably from that of the superior animals. In the lobster, and others of the larger insects, when a piece of the shell is broken, the pulsation of the heart is seen distinctly, and that sometimes for several hours after it has been laid bare. A long delicate vessel runs along the back parallel to the intestines of many insects, particularly caterpillars, in which an alternate contraction and dilatation is perceptible. The heart, or principal artery which performs the function of the heart, seems to be composed of a great number of small hearts, connected together, which transmit the blood from one to another. But when this vessel is injected it becomes continuous, and the small hearts disappear. In the caterpillar the pulsation begins at the posterior part, and proceeds from one segment to another, till it arrive at the head. Reaumur has alleged, that the pulsation of this artery changes its direction in the pupa, and that the blood is propelled from the head towards the tail: he says this may be plainly observed in a pupa newly stripped.

Lycomet denies the accuracy of Reaumur’s observations; and says that he found a species of caterpillar, the pupa of which is very transparent, in which the longitudinal artery was to be seen very distinctly; having examined it carefully, a few days after its change, he ascertained that the motion of the artery had not at all changed its direction, and that it still continued to move from the tail towards the head as in the caterpillar. Further observations can alone determine which of these two opinions is the most correct. One anatomist has lately asserted that the dorsal canal observable in insects, serves the purpose of respiration. Cuvier has proved, that the conglomerate glands which are to be met with in all the animals that have a heart, do not exist in insects; but instead of them, that they are furnished with very long slender vessels which float in the internal cavities of the body, without being even connected into fasciculi; from this circumstance Cuvier is disposed to believe that insects have no heart. It is by means of these fine tubes that the different fluids are secreted, which are peculiar to various kinds of insects. Some insects discharge an acid and fetid fluid, others discharge an oil of a very pleasant smell.

The bee, the wasp, the aphes, the crysia, have two vessels situated at the bottom of their sting, which contain a very acrid fluid, secreted from the mass of blood, which the animal discharges at pleasure through a perforation in the sting; it is this fluid which causes the pain.
ENTOMOLOGY.

Insects are the only animals without vertebrae in which the sexes are distinguished. Copulation is performed by the introduction of the parts of generation of the male into those of the female.

All insects are either male or female, except in a few of the genera of the order Hymenoptera (such as the bee, ant, &c.), where individuals are to be found, which are neither male nor female; and, on that account, called neutras. Among the bees, the neutras form the far greater part of the community, and perform the office of labourers. Among the ants, the neutras are very numerous, and constitute the only active members of the society. It has been alleged that these neutras are nothing but females, whose parts have not been developed for want of proper nourishment. Olivier, however, after strict examination, is disposed to think them really different, though he does not adduce facts sufficient to establish his opinion.

The parts which distinguish the male from the female, may be divided into two classes, viz. 1. Those which are not directly connected with generation. 2. Those which are absolutely necessary for the purposes of generation. The circumstances which have no direct communication with generation, which serve to point out the distinction between the sexes, are, 1. The difference of size observable in the male and female. 2. The brightness of the colour in each. 3. The form and number of articulations of the antennae. 4. The size and form of their wings. 5. The presence or absence of a sting. The male is always smaller than the female. The female ant is nearly six times larger than the male. The female coxal base is from 12 to 15 times the size of the male. The female tergites are 200 or 300 times the size of the male. The colours of the male are commonly much more brilliant than those of the female; this is particularly the case in lepidopterous insects. In some insects, the colour of the male is totally different from that of the female. The antennae of the male are commonly of a different form, and larger than those of the female. Frequently the males are furnished with wings, while the females have none; the lampryes, cocca, and blatta, and several moths, afford an example of this. The female bee is furnished with a sting, while the male is destitute of one. The males of some insects are furnished with sharp prominent points, resembling horns, situated either on the head or breast, which are either not perceptible or very faintly marked in the female. The parts essential to generation afford the best distinguishing mark. In most insects they are situated near the extremity of the rectum. By pressing the abdomen near to the anus they may frequently be made to protrude. But the parts of generation are not always situated near the anus. In the spiders they are situated in the feelers. In the libello, the male organ is situated in the breast, while that of the female is placed at the anus.

Organs of Generation.

In male insects, the organs which serve for the preparation of the semen, bear some resemblance to those organs in the animals which compose the class Mammalia. All of them have four organs, two of which may be compared to the testicles, and the other two to the vesiculae seminales. They vary very much in form in different species. During the period the male is usually employed in impregnating the female, these parts are very distinct; after that, they disappear totally. In the larger aquatic insects (particularly in the hydrophilus) besides these four organs already mentioned, there are other two small vesicles, which may be compared to the prostate gland of the superior animals. The vesica deferentia in the hydrophilus are somewhat reflected, its testicles are very large, and terminate in a very slender folded filament. In the grasshopper, these four organs are likewise found, but the vesiculae seminales are of a compound nature; the testicles have a good deal the appearance of those of the mammalia.

They are of an oval form, and are fixed to the inside of the back, their convex surface is covered with several tubes of a bright golden colour. After these yellow tubes have been removed, the testicles are easily unfolded; like all the other secretory organs of insects, they seem to be nothing but a collection of convoluted vessels. The vesiculae seminales, which are attached to the testicles, are formed into clusters. In the season of copulation, they increase in bulk so much as nearly to occupy three-fourths of the abdomen; they are full of a limpid fluid, which is the semen.

The vesica deferentia, which in most insects are very short, in the blatta murostata are of a considerable length, and form several convolutions before they arrive at the penis.

The penis, in insects, is either single or double. Those which have a single penis, have it placed at the posterior extremity of the abdomen; in the libello, however, it is placed at the anterior part: it is membranaceous externally; internally it is composed of a substance, analogous to the corpus cavernosum of other animals; its form is either cylindrical or conical; it is furnished with two scales, one on each side, which form a sort of wedge; this wedge being introduced into the vagina of the female, and the scales being separated by means of particular muscles, which are situated at their base, open the vagina, and make way for the introduction of the
ENTOMOLOGY.

Insects which have a double penis (such as the spider) have this organ placed at the extremity of the feelers of the lower jaw; these feelers are large in the male. During copulation, they are introduced into two vagines situated in the anterior part of the abdomen of the female. In these insects, the two small scales are likewise to be found, which serve to open the vagina of the female.

The female is furnished with two ovaria; they are long tubular canals, in which the eggs are arranged like a string of beads. The eggs which are situated next the opening into the oviduct, are largest, and they diminish gradually as they recede from it, till they disappear altogether. The tubular canals unite, and terminate in a common canal, which communicates with an oblong cavity, analogous to the uterus. It is in this cavity that the semen of the male is deposited. Malpighi asserts that the fluid penetrates into the oviduct, by means of a canal of communication, and that the eggs are fecundated the instant they pass the mouth of this canal, as they proceed towards the external orifice of the uterus.

In viviparous insects, such as the *Hippobosca, scorpion,* &c. the ovaria are different. Sometimes the little animals are arranged in clusters; at other times they compose a spiral cord, the length of which corresponds to the number and size of the foetuses.

Copulation is not performed exactly in the same way by all insects. In most of the species, the male mounts on the back of the female; but the spiders, dragon-flies, and some others, have a mode of performing copulation peculiar to themselves. After copulation; they soon begin to lay their eggs. Some deposit their eggs gradually, one after another; others discharge them all at once, for example, the *ephemera,* the very short duration of whose existence renders this necessary. But the far greater number of insects lay them one by one. There are some which lay considerable numbers at once; and the large blue flesh-fly (muscus carnis) when it finds carrion in a proper state for the reception of its eggs, deposits a good number of them at once in the same place; but when it does not find a proper situation in which to deposit its eggs, it can refrain for some time, till it finds a proper place and opportunity. There are some insects that do not lay their eggs till a very long time after copulation; bees, wasps, &c. are impregnated before winter, but do not lay their eggs till spring.

Eggs of Insects.

The eggs of insects are of two sorts; the first membraneous, like the eggs of the tortoise and the other reptiles; the other covered with a shell like those of the birds; their figure varies exceedingly; some are round, some elliptical, some lenticular, some cylindrical, some pyramidal, some flat, some square, but the round and oval are the most common. The eggs of insects seldom increase in size, from the time they have been deposited by the parent till they are hatched. Those of the *testaceus,* however, and of some others, are observed to increase in bulk.

At first there is nothing to be perceived in the eggs of insects but a watery fluid: and after some little time an obscure point is observable in the centre; which, ac-

according to Swammerdam, is not the insect itself, but only its head, which first acquires consistence and colour. And the same author alleges, that insects do not increase in bulk in the egg, but that their parts only acquire shape and consistence. Under the shell of the egg there is a thin and very delicate pellicle, in which the insect is enveloped, (which may be compared to the chorion and amnions which surround the fetus in quadrupeds. The little insect remains in the egg till the fluids are dissipated, and till its limbs have acquired strength to break the egg, and make its escape. The different species of insects remain enclosed in the egg for very different periods. Some continue enclosed only a few days, others remain for several months. The eggs of many insects remain without being hatched during the whole winter; and the young insects do not come forth from them till the season at which the leaves of the vegetables on which they feed begin to expand. When the insects are ready to break their prison, they commonly attempt to pierce the shell with their teeth, and form a circular hole, through which they put forth first one leg, and then another, till they extricate themselves entirely.

Number of Insects.

Insects are by far the most numerous class of animals. About eleven thousand species have been described by Linne in the last edition of the System of Nature. A great many more have been described by other naturalists since the publication of that work, and a very considerable number are to be met with in the cabinets of the curious, which have not as yet been described by any author.

In those parts of the world which we are best acquainted with, we may easily suppose that many species of insects exist which have hitherto escaped notice. The miutness of some insects makes them easily overlooked; the agility of others renders the catching of them difficult. The retired situations which many of them haunt favour their concealment. In the unknown parts of America, Africa, and Asia, many hundred species must exist utterly unknown to naturalists. All these circumstances render it very probable that not one half of the insects which exist in the world have hitherto been described.

Utility of Insects.

Insects afford nourishment to a great number of the superior animals; many of the fishes, reptiles, and birds, draw the principal part of their sustenance from that source. The immense swarms of different species of crab which abound in every sea, directly or indirectly form the principal part of the food of the cod, haddock, herring, and a great variety of fishes. The snake, lizard, frog, and many other reptiles, feed both on land and aquatic insects. Gallinaceous fowls, and many of the small birds, &c. feed on insects. Swallows, indeed, feed entirely on winged insects. They afford food likewise to many of the mammals, &c. to many species of the bat, to the ant-eater, &c. and even to man himself. Many species of crab, viz. lobster, common crab, shrimp, prawn, land-crab, &c. are reckoned delicacies. The larvae of some coleopterous insects and locusts form part of the food of man.

Insects likewise, by consuming decayed animal and vegetable
ENTOMOLOGY.

In collecting insects, both male and female ought if possible to be procured; and the time of the year when they are taken ought to be noted. Specimens with injured wings or antennae must be rejected.

For collecting insects in their perfect state, a sort of forceps are made use of, which have their extremities covered with gauze. Besides these, the entomologist, in his walks, should be furnished with a pin-cushion, stored with pins of various sizes, and a tin box lined with cork, of a convenient size for the pocket in which the insects when caught are to be placed; the lepidopterous insects being first carefully killed by squeezing their thorax, lest their flowing should injure their wings. Coleopterous insects are most expeditiously killed by being immersed in boiling water; and those who prefer this method may carry them home without injury in common pillboxes. Most insects are killed with a few drops of spirit of turpentine; the lepidoptera and hymenoptera may easily be killed by being stuck through with a pin dipped in aquafortis. When the insects are killed, they are to be transfixed with pins, their wings, antennae, and feet spread out and kept displayed. In some of the lepidoptera, two specimens should be preserved; the wings in the one displayed, and in the other placed as much as possible in their natural position.

Insects may likewise be collected by breeding them from their larvae; and this, when it is convenient, is by far the best method for procuring fine specimens; it is chiefly practised with the lepidopterous kinds. When the caterpillars are taken, they are to be fed on the leaves of the plant or tree on which they were found, and kept in a box with some moist earth at the bottom; they will afterwards turn into a chrysalis, either by going into the earth, by spinning a web and enclosing themselves in it, or by changing into a pupa obesa, according to their kinds. Having continued in this state their appointed time, the perfect insect will come forth, and must then be killed before it has injured its wings by flying.

Lepidopterous insects are likewise to be collected in their pupa state, by seeking for them under the projections of garden walls, pales, and out-houses, summer-houses, &c. or by digging for them in the winter months under the trees they feed on. When thus dug up, they are to be put into a box with moist earth, and kept till they come out.

When the insects are prepared in this manner, they are to be placed in the cabinet, which may consist of boxes or drawers deep enough to hold a long pin, and lined on the bottom with cork, or with wax; the insects of each order in drawers by themselves; and the different genera close together. The generic and trivial name of each insect is to be written on a piece of paper, fixed to the bottom by the same pin which supports the insect. The drawers must be made to shut very close, so as to exclude the dust and minute insects; some cover them with glass. A little lamp in each drawer is likewise useful.

Insects of the apera order, such as spiders, scolopendra, juli, &c. are best preserved in some kind of spirits. The ovisci and cancri may be preserved like beetles.

HISTORY OF ENTOMOLOGY.

THOUGH the attention of man must have been attracted by the vegetables and animals with which he found himself surrounded, and by the earth and minerals on which he trod, even at the very earliest periods of human society, yet a very considerable time must have elapsed before any attempts were made at arrangement or classification. Aristotle was the first (as far as we know) who deserved the name of natural historian; his arrangement of animals was the only one followed for many centuries. He divided all animals into viviparous and oviparous; the first contained quadrupeds, the second birds, fishes, and insects. Under insects were comprehended all small animals whose bodies were divided into segments. This definition of insects was followed by all natural historians down to the time of Linnæus.

Theophrastus, the disciple of Aristotle, the only other person among the ancient Greeks who deserves the name of natural historian, bestowed the most of his attention on vegetables and minerals. Pliny has given us an account of all that was known in natural history down to his own time. Though he has mentioned many insects, owing to his want of method little is to be learnt from him respecting entomology. Diocorides, who was nearly contemporary with Pliny, has confined himself chiefly to natural history connected with medicine. He has given an enumeration of all the natural bodies which entered into the materia medica. On the revival of learning in Europe, writers on natural history seemed to have confined themselves to writing commentaries on the ancients; and nothing was done in entomology till the times of Gesner, who was the greatest naturalist the world had seen from the time of Aristotle, and who was the first who made a collection of the objects of natural history, and formed a museum. He was born in Zurich in 1516, and died in 1565. Aldrovandus lived nearly about the same time with Gesner, and, like him, formed a museum which served for the foundation of the public museum at Bologna, where many specimens may be still seen marked with the venerable hand of the first collector. Gesner formed his zoology on the principles of Aristotle; his history of animals is very voluminous. Aldrovandus made a collection of all that had been written on natural history before his own time, without discriminating truth from fiction. He has given a methodical arrangement of insects in the seventh book of his large work published in 1602. He followed nearly the same arrangement with Gesner. Gesner, in conjunction with some other natural historians, wrote a treatise on insects, which was published by Mouret,
ENTOMOLOGY.

History. Mouffet, an English physician. About this time our countryman, the illustrious Harvey, ventured to controvert Aristotle's erroneous opinion with respect to equivoal generation. Though his phronism, omnis ex ovo, at first met with great opposition, it was at last established by his own experiments and those of Rhedi and Malpighii. From this period the writers on entomology have been numerous; we shall content ourselves here with giving little more than an enumeration of the principal works on the subject.

Agricola, in a work entitled de Animalibus Subterraneis, published in 1549, has given a methodical arrangement of insects: he divides them into 1. Creeping insects; 2. Flying insects; and 3. Swimming insects. After giving this arrangement, he proceeds to give an account of each species.

A work entitled Theatrum Insectorum Thomas Moufseti opera concinnatam, Lond. 1634, the joint labour of several of the most eminent natural historians who lived about the middle of the sixteenth century, though not published till 1734, about 30 years after the death of Moufset, by whose care the work had been abridged, and prepared to meet the public eye, is the next worthy of notice. It is divided into two books; the first treats of winged insects; the second of insects without wings: these two grand divisions are subdivided into several families, characterized by the number and position of the legs. There is but little method displayed in the arrangement of the insects which compose the different families.

Aldrovandus divides insects into terrestria et aquatica (land insects, and aquatic insects). The different orders and subdivisions of these two classes, are for the most part determined by the number, nature, and position of their wings and legs. He calls his first order Fuvifica, (those which form combs). As to the rest, according to his own declaration, he follows Aristotle.

Wolfgang Frenzius, in his Historia Animalium sacra, published in 1612, has divided insects into three classes, viz. 1. Aerius, (such as fly); 2. Aquaticus, (such as inhabit the water); 3. Terra et Repentina, (such as creep about, or are lodged in the earth). His descriptions are much more accurate than those of any of the authors who preceded him.

John Johnston has borrowed freely from his predecessors, in his Historia Naturalis Insectorum, published in 1653. He divides insects into terrestria et aquatica, (into land and aquatic insects); the land insects he divides into three orders: 1. Such as have wings and legs; 2. Such as have legs without wings; and 3. Such as have neither wings nor legs. These three orders occupy his three first books; his fourth contains aquatic insects.

Walter Charleton follows the system of Aldrovandus in his Omastomatic Zoonon, published in 1668.


Likewise in 1675, a work of his appeared, de Insectis in Methodum redactis, opera Mart. Leister. Ebor. In this work insects are divided into ten families: The 1st includes butterflies with erect wings; 2d, Butterflies with horizontal wings; 3d, Butterflies with deflected wings; 4th, Libellules, (dragon-flies); 5th, Apes, (bees); 6th, Coleopterous insects; 7th, Locusts, and grasshoppers; 8th, Flies corresponding to the order.

diptera of Linneas; 9th, Millepede; and 10th, Spiders. This work is full of typographical errors and mistakes in natural history.

The discovery of the microscope in 1618, tended greatly to the advancement of entomology, as by means of it the most minute parts of insects could be viewed, and their organization examined. Naturalists were much engaged in making microscopic discoveries, particularly Borel, Rhedi, Swammerdam, Bonani, Bono, Leeuwenhoek and Joblot.

John Swammerdam, in his Biblia Nativae, published in 1669, has divided insects into four classes.

John Ray published his Historia Insectorum. Lond. 1710. This work was properly the joint production of J. Ray and Francis Willoughby. These illustrious friends laboured together with uncommon ardour in the study of nature. Death carried off Willoughby in the prime of life, before he had properly digested what the industry of his early years had collected; and his labours would have been lost to the world, and his name might have sunk in oblivion, but for the friendship of Ray. So close was the intercourse between these two naturalists, and so intimately were their labours blended together, that it is not easy to assign each his due share of merit. Indeed Ray has been so partial to the fame of his departed friend, and has cherished his memory with such affectionate care, that we are in danger of attributing too much to Mr Willoughby, and too little to himself. Though what Dr Derham asserts be not correct, that Mr Willoughby had taken the animal kingdom for his task, and Mr Ray the vegetable one, yet it is generally agreed, that the Historia Insectorum is principally to be ascribed to Willoughby.

In that work insects are divided into Transmutabiles et Intransmutabiles, (those which undergo a metamorphosis, and those which undergo none). These two grand divisions are subdivided into several orders, which are ascertained by the number of their legs, or total want of legs; by the places which they inhabit; by their size; by the configuration of the various parts of the body; by the smell which they diffuse, &c. The transmutabiles are divided into four orders. 1. Vaginipennis, (those which have their wings covered with a sheath). 2. Papillones, (lepidopterous insects). 3. Quadrupennes, (those which have four wings); and 4. Bipennes, (those which have two). The papillones, quadrupennes, and bipennes are again subdivided into families, the characters of which are taken, either from the appearance and conformation of their larve, or from the form, colour, and different properties of the perfect insect.

Eleazar Albin published a natural history of English insects in 1730. He likewise published the Natural History of Spiders in 1736.

Antony Valinieri, in his work entitled Esperimrce e Observazioni intorno agli Insetti, published in 1730, has divided insects into four orders, according to the situation in which they pass their lives.

Mary Syble Merian, published in 1730, Histoire d'Insectes d'Europe et de Surinam. She likewise published in 1705, Metamorphosis Insectorum Surinamensium ad vivum picta et descripta; and in 1717, Cronus Ortus.

George Bernard Rhump published in 1706, and again in 1741, a work entitled Ambobinische Revisita-}

Hann.
Hans Sloane, in the years 1707 and 1725, published a Voyage to the Islands of Madeira, Barbadoes, Nevis, Saint Christophers and Jamaica.

Henry Bauisch in 1710 and 1718 published Theatrum Universale omnium Animalium.

J. Petiver published in 1715 his Lices et Nomina Aquatilium Animalium Amboinae.

Richard Bradley published in 1721 his Philosophical Account of the Works of Nature.

Linnæus, the most celebrated natural historian the world ever produced, in his first edition of the Systema Naturæ, published in 1735, divided insects into four orders, from the number and different appearances, of their wings: 1. Coleoptera; 2. Angiopetera; 3. Hemiptera; and 4. Aptera. This was but an imperfect sketch, a first essay. In the subsequent editions of the System of Nature which he published, to the number of twelve, he completed the arrangement of insects, of which we need say nothing here, as we have followed it in preference to all others; and most authors who have written on the subject for more than half a century past, have either followed it closely, or with very slight alterations. His extensive genius embraced all the three kingdoms of nature. In botany and entomology in particular he far excelled all who went before him, and as yet remains unrivalled. Writers on entomology became so numerous after Linnæus had published his System of Nature, and established entomology on a solid foundation, that a mere enumeration of their names and titles of their books would occupy more room than we can afford to bestow on the article; we shall therefore only notice a few of the most remarkable.

Charles DeGeer, in his Mémoires pour servir à l'Histoire des Insectes, in 1752, has arranged insects into fourteen orders, distinguished by the different appearances of the various parts which compose their bodies, particularly the elytra, wings, and most remarkable parts of the head. He published again in 1778.

M. de Saumur published his Mémoires pour servir à l'Histoire des Insectes at Paris in 1737. No one has paid so much attention to the habits of insects, and to everything that concerns them, as Saumur. He ought to be read by every student of entomology.


M. Geoffroy, in his Histoire Abrégé des Insectes, published at Paris in 1762, has divided insects into six orders; Coleopteræ, Hemipteræ, Tetrapteræ ailes fari- neuses, Tetrapteræ ailes nues, Dipteræ, and Apterae. He determined his families by the number of the articulations of the feet, and his genera by characters drawn from all the parts of the body. He has formed a great number of new genera.

John Antony Scopoli, in his Entomologia Carniolica, published in 1762, has followed the arrangement of Linnæus, and only changes the names of some of the orders; e. g. Procrustae, instead of Hemiptera; Acnu-

lenta, instead of Hymenoptera; Halterata, instead of Dipteræ; and Pedestria, instead of Apterae.

J. C. Schaffer published in 1766, Elementa Entomologica, 135 tabulæ were excusacæ; he follows in many points the method of Linnæus. He divides insects into seven classes. 1. Coleoptero-macropetera. 2. Coleoptero-micropteræ. 3. Hemiptera. 4. Hymeno-lepidoptera. 5. Hymeno-gymnopa. 6. Diptera; and 7. Aptera. His first and second classes correspond with the Coleoptera of Linnæus; the fourth with the Lepidoptera; and the fifth with the Hymenoptera.

John C. Fabricius is the founder of a new system of Entomology, which he published in his Systema Naturae 1775. He discriminates his orders and genera, by the parts of the mouth, (instrumentum cibariæ). He afterwards published Species Insectorum, Entomologia Systematica, and Mantissa Insectorum.

The arrangement of Fabricius has acquired great reputation, especially on the continent. It may not therefore be amiss to give a slight view of it. He divides insects into eight classes.

Class I. Eleuthera. Mouth armed with jaws, and four or six feelers. The jaws naked and free.

Class II. Ulanata. The jaws covered with an obtuse helmet.

Class III. Synistata. The jaws united with the lip.

Class IV. Agonata. The under jaw wanting.

Class V. Unogata. Mouth armed with jaws and two feelers; the under jaw generally furnished with a small unguis or nail.

Class VI. Glossata. Mouth furnished with feelers, and a spiral tongue.

Class VII. Rhynota. Mouth furnished with a snout, and an articulated sheath.

Class VIII. Antliata. Mouth furnished with a hasting-tellum and a sheath not articulated.


Moses Harris published an Exposition of English Insects, &c. with coloured plates, 1776.


A. W. Knock; Beschreibung un Insektenkunde, 1781.

James Barbut published the Genera Insectorum of Linnæus, exemplified by various specimens of English insects drawn from nature. Loud. 1781.

John Nepomuk de Laicharting, has divided insects into ten orders, characterised by the configuration of various parts of the body. He adheres pretty closely to the
ENTOMOLOGY.

Olivier, in 1780, published Entomologie, ou Histoire Naturelle des Insectes, in 3 vols. afo. Paris. In 1795, in the Dictionnaire des Insectes, forming a part of the Encyclopédie Methodique, he has given an arrangement of insects little different from that of Linnaeus. He has added one order which he calls Orthopteres, distinguished by the mode of folding the lower wings, and a part on the head, which he terms galea. He has likewise subdivided the order Aptera, into Arachnoidea and Crustacea. Latreille in 1795, in a work entitled Precis du Caractere des genres, divides insects into two grand divisions, viz. insectes ailés, et insectes apteres (winged insects, and insects without wings). These two grand divisions he subdivides into 14 orders. 1. Coleopteres. 2. Orthopteres. 3. Hymenopteres. 4. Neuropteres. 5. Lepidopteres. 6. Socceurs. 7. Thysanneurs. 8. Parasites. 9. Acephales. 10. Entomostracés. 11. Crustaces. 12. Myriapodes. Since he has published a more detailed account of this method in a work entitled les genres et les families des insectes.

Clairville in 1795, in the introduction to his Entomologie Helvetica, has given an arrangement of insects, in which he differs from Linnaeus almost in nothing, except in the names of his orders, viz. Elytropteres, Dictyopteres, Thlebopteres, Haltipteres, Lepidopteres, Hemipteres, Rophoteires, and Pododoneeres.

Link, in his Magasin sur Thiergeschichte, has divided insects into eleven orders; he follows de Laicharting, almost in everything, even in the names of his orders; he has indeed added an order which he calls Pediculoides.

Cuvier and Durréril, in their Comparative Anatomy, have very nearly followed the method of Linnaeus; they have however divided the order Aptera into two, viz. Gnathoptera and Aptera; they have likewise altered the arrangement of the orders, and have placed those first which contain insects furnished with jaws, viz. Gnathoptera, Neuroptera, Hymenoptera, Coleoptera, and Orthoptera; and have thrown those last which are destitute of jaws, viz. Hymenoptera, Lepidoptera, Diptera, and Aptera.

We shall refrain from noticing those authors who have written partial treatises; though there are several works of that kind which the entomologist might peruse with advantage, such as the Fauna Suecica, published in 1761 by Linnaeus, at Stockholm. Fauna Germanica, by Panzer. La Faune Particulier de Walkair. Kirby's Monogrophia sapum Anglia. Latreille's treatise on Ants.

See a more detailed historical account of the writers on this science, in the article ENTOMOLOGY, SUPPLEMENT.

EXPLANATION OF PLATES.

PLATE CCXII.

Fig. 1. ANTENAE PECTINATE, or feathered; as in the phalana, meths.
2. PERFORATE, or perforated; as in the dermestes and dytiscus.
3. FISSILE, or fissile, divided into laminae at the extremity, as in the scarabaeus, beetles.
4. CLAVATE, or club-shaped, as in the papilio, butterfly.
5. MONILIFORMES, like a necklace of beads; as in the chrysomela.
6. SETACEE, setaceous, or bristle-shaped; as in many of the phalana.
7. ARISTATE, furnished with a lateral hair, as in the fly.
8. a, Caput, the head.
b, Palpi, or feelers.
c, Antenna, or horns.
d, Oculi, the eyes.
e, Thorax.
f, Scutellum, or escutcheon.
g, Pectus, or breast.
h, Sternum, or breast-bone.
i, Abdomen, and its segments.
j, Anus.
k, Elytra, or shells.
m, Membranous wings.
n, Pedes, or feet, which are natatorii.
10. a, Femur, or thigh.
b, Tibia, or leg.
c, Tarsus, or foot.
d, Unguis, or claw.
11. a, The anterior part of the wing.
b, The posterior part.
c, The exterior part.
d, The interior part.
e, The margin.
f, The disk or middle.
g, Oculus, or eye.
12, 13, 14, 15. Represent the insect in its egg, caterpillar, pupa, and perfect state.

Order I. COLEOPTERA. Fig. 16. Scarabeus. Fig. 17. Ptilus. Fig. 18. Buprestis. Fig. 19. Carabus.
Order II. Fig. 20. Mantis. Fig. 21. Fulgora. Fig. 22. Notonecta. Fig. 23. Cimex. Fig. 24. Aphis. Fig. 25. Corus.
Order III. Fig. 26. Papilio. Fig. 27. Sphinx.
Fig. 28. Phalaena.
Order IV. Fig. 29. Libellula. Fig. 30. Hemerobius. Fig. 31. Ponorpa.
Order V. Fig. 32. Tenthredo. Fig. 33. Ichneumon. Fig. 34. Chrysia. Fig. 35. Formica.
Order VI. Fig. 36. Oestra. Fig. 37. Tipula.
Order VII. Fig. 38. Asius.
Order VIII. Fig. 39. Lepisma. Fig. 40. Aranea.
Fig. 41. Scorpio. Fig. 42. Cancer. Fig. 43. Scolependra.

INDEX.
INDEX

ABDOMEN, p. 146
Acerus, 219
Achini, a subdivision of papilio, 183, 184
Actaeon, largest coleopterous insect known, 152
Aculeus, 147
Adonidiom, species of coccus, 176
Afer, species of scrobio, 234
Aliment of insects, 230
Althus, 157
Animal cotton, 199
Ant, 207
Ant-eater, 196
Ant-egee, 207
Ants do not store up for the winter, ib.
Antenna, use of, 246
Antheres, 250
Anus, 216
Apalus, 160
Aphides, propagation of, 175
Aphid, 162
Aporius, species of stelatus, 203
Aris, 231
Arum, 227
Aruid, 214
Artace, 225
Atlas, species of phalaen, 190
Atrora, species of sphinx, 228
Attacca, a subdivision of phalaen, 189
Attelabus, 161
Auricularia, species of forficula, 170
Auxicularia, species of aranea, 222

B
Barbed, 146
Bac, ib.
Baku, ib.
Bee, 203
Bleet, 152
Blatta, 171
Blistering-fly, 169
Bluens-eater, ib.
Boat-fly, 173
Bomblykes, division of phalaen, 189, 190
Bombylus, 214
Bon, 160
Bostrichus, 134
Botte, 209
Bovinus, species of tabanus, 213
Boois, species of carus, 208
Breast, 146
Breeze, 208
Brentus, 160
Bruchus, 139
Bug, 173
Bull-comber, 152
Bull-head, 167
Buprestis, 166
Butter-fly, 182
Bus-fly, 214
Byrrhus, 146
C
Cacao, species of bruchus, 159
Cacti, species of coccus, 157
a species of coccus, 195
Caddo, 159
Calcitrantes, a species of stemonyx, 214
C-alopus, 163
Campanis, cochinel, 217
Cancer, 224
Canadoides, species of phalangium, 221
Candora, species of fulgens, 173
Candidi, a subdivision of phalaen, 183
Cantharidis, 165
Capitata, 146
Carabus, 167
Caropers, species of musca, 211
Carrius, 156
Carrius-eater, 164
Cassida, 157
Catapeta, 213
Cells of waist, bow formed, 202
Cerambyx, 162
Ceraria, a species of phalaen, 192
Cerriella, a species of phalaen, 194
Chalice, 201
Cheese-mite, 220
Chela, 147
Chermes, 176
Chermes grains, 182
Cheger, 219
Chrysolita, 147
Chrysia, 203
Chrysomela, 138
Cicada, 173
Cicindela, 166
Cicimex, 174
Circulation of fluids in insects, 233
Clavata, 146
Claw, 147
Clock beetle, 153
Coccidella, 157
Coccus, 176
Cottus, 152
Coeloptera, falsely supposed a vegetable
production, introduced into Bengal, 177
Experiments of Manipetius on scorpions, 223
Colombacchensisi, species of musca, 212
Comparison quantity of wax made from sugar and from honey, 206
Conops, 214
Costus, species of phalaen, eaten by the Romans, 191
Cow-burner, 166
Crawfish, 225
Crawfish, 171
Cratoxylum, 158
Crane-fly, 210
Crangon, species of cancer, 225
Cratagi, a species of papilio, 185
Craula, 165
Culex, 213
Culinaris, species of tenebrio, 218
Curculio, 160
Cynips, 197
D
Danaa, a division of papilio, 183, 185
Day-fly, 195
Death-watch, 155
Dentated, 147
Dermestes, 154
Destruct, a species of aecus, 220
species of termes, 217
Deflected, 146
Diamoed-beetle, 160, 161
Dipetis, 210
Diptera, 147, 208
Domestica, species of musca, 211
Domesticus, species of gryllus, 173
Door-beetle, 153
Drugon-fly, 194
Drone-bee, 203
Dug-beetle, 153
Dysenterica, species of aecus, 220
E
Ear-wig, 170
Economy of termes fatale, 216
Elater, 165
Elytra, 147
Emett, 207
Empis, 213
Ephemera, 195
Equi, species of carus, 209
Equina, species of hippoboscos, 215
Equites, a division of papilio, 183
Erosia, 169
Eurucha, 147
Eyes of insects, 229, 146
F
Extremities, 146
ENTOMOLOGY.

ORDER I. COLEOPTERA.

Fig. 16.
Scarabaeus Hercules, Hercules Beetle.

Fig. 17.
Piusus Faticicus, Magnifrid.

Fig. 18.
Hureatis Guttata, Spotted Cow Burner.

Fig. 19.
Carabus Vulpes, Common Carabus.

Fig. 19.
Carabus Colaceus, Slagreen Carabus.
Index.

F
Farina of flowers, the food of the young bees, p. 205
Farinula, a species of phalena, 193
Fastigiata, 147
Fatale, a species of termes, 216
Fausta, a species of mantis, a Hotten
tot deity, 171
Fejeus, 146
Female bee, 203
Femina, a division of papilio, 183, 188
Ficus indica, food of the locust insect, 180
religion, food of the locust insect, ib.
species of cocculus, ib.
Field-cricket, 172
Figulus, a species of sphex, 200
Filiform, 146
Fire-fly, 164
Fissie, 146
Flea, 219
Flouers do not always contain honey, 208
Fly, 210
Forceps, 147
Forficula, 170
Forrsm, 207
Formicarius, species of attelabus, 161
species of myrmeloon, 148
wasoria, species of vespa, 205
Frut, species of musca, 212
Frog-hopper, 173
Fruementarius, a species of curculio,
 injurious to corn, 160
Fulgora, 173
Fullo, largest British scarabaeus, 153
Furca, 147

G
God-fly, 208
Gill-fly, 197
Ganmma, species of cancer 225
Gemmatia, a subdivision of papilio, 183, 186
Gemmatia, a division of phalena, 189, 192
Generation of insects, 234
Glamoratus, a species of ichneuomon, 200
Glow-worm, 164
Ghuton, 139
Gnat, 213
Golden-fly, 201
Grane-flies, compared with grana-syl
estrias, 179
compared with Bengal cochoineal, 180
Grane sylvestrias improveable, 179
Granarius, a species of curculio, in
jurious to grain, 160
Granella, a species of phalena, 144
Gryllotalpa, a species of gryllus, 173
Grilla, 171
Gum lac, 180
Gyrumus, 155

H
Habitations of the white ant, 211
Hemorrhoidalis, a species of cestrus, 209
Hellerus, 147
Hawk-moth, 187

ENTOMOLOGY.

Hapali, a division of phalena, p. 190, 194
Hearing of insects, 229
Heliconia, division of papilio, 183, 185
Hemelytra, 147
Hemiptera, 147, 171
Hemorobius, 196
Hippobosca, 215
Hispa, 139
Hisur, 135
Hominis, a species of castrus, 210
Honey-bee, 202
Horia, 165
Hornet, 202
Horse-fly, 219
House-bug, 174
House-cricket, 211
Humble-bee, 206
Humulus, a species of phalena, 194
Hyalius, a species of fulgorna, 173
Hydraechna, 167
Hydaphus, 220
Hymenoptera, 147
Ichneuomon, 199
Icicia, a species of coccus, 182
Imago, 147
Imperialis, a species of curculio, 125
Incumbat, 146
Insect definition of,
Insects, characters of,
classification of, 248
Irritans, a species of pulex, 214
Itch insect, 220
Isus, 228
Jacculator, a species of ichneuomon,
Japonica, a species of lampyris,
Jarpeada, a kind of cochoineal, 177

L
Locca, 180
Lac insect, 160
Lady-bird, 157
Lady-cow, 156
Lampyris, 164
Land crab, 224
Lantus, a species of fulgorna, 173
Lanthorn-fly, 173
Larve, 147
Latro, a species of cancer, 225
Leather-eater, 154
Lectularius, a species of cimex, 174
Lepidoptera, 147, 192
Lepisma, 215
Leptura, 163
Lecopus, 201
Libellula, 194
Lion-ant, 196
Lobster, 225
Locust, 173
Locustae, 221
Long-legged spider, 218
Louse, 153
Lousy beetle, 227

Lucanus, p. 154
Lyta, 169
Maclao, a species of papilio, 181
Macrocephalus, 175
Male bee, 203
Manticora, 169
Mantis, 174
Mastixic cochoineal, 177
Maurus, a species of scorpio, 224
Maxilla, 146
May bug, 153
Meliffico, a species of apis, 203
Melitome, a species of phalena, 194
Meloe, 169
Mekotonka, 153
Melyris, 183
Metamorphosis, 147
Meteorica, a species of musca, 212
Method of rearing cochoineal, 177
Migratorius, a species of gryllus, 173
Milet, 219
Mole-cricket, 172
Molitor, a species of tenebrio, 168
Moniliform, 146
Monoculus, 226
Mordella, 170
Mori, a species of phalena, 191
Moricz, a species of apis, 207
Mortens, a species of scolopendra, 183
Moth, 210
Musca, 217
Musquita, 207
Murta, 196
Myrmeloon, 246

N
Nacalis, a species of cantharis, inju
rious to oak timber, 165
Nerydalia, 164
Negra, a kind of cochoineal, 177
Nepa, 174
Neuroptera, 147, 194
Neuter bee, 203
Neueter, 147
Nibbler, 170
Natalus, a species of araneus, 222
Nymph, 147
Nymphalea, a division of papilio, 183, 186
Notibala, 164
Noctilucus, a species of elater, 166
Noctua, a division of phalena, 189, 193
Nopal, food of the true cochoineal, 177
Notocnesta, 173
Noturus, 163
Number of bees in a hive, 203
of species of insects, 228, 235
of bottles in the stomach of horses, 209
Nursing bees, O
Ocellic, 147
Ostruzus, 209
Oleracea, a species of tipula, 210
Oleracena, a species of cimex, 174
Quicus, 227

Opatrum,
ENTOMOLOGY.

Opisthod, a species of phalangium,
Organisation of insects,
Organs of digestion of insects, generation, mastication,
Orientalis, a species of blatta,
Osna; a species of cicada, larva, etc.,
Ovix, a species of castrus,
Oxy-fly,
Pagurus, a species of cancer,
Palaearctica, a subdivision of papilio, 189, 185
Pastel, a preparation of cocoon ilicis, 182
Panus, 159
Pediculus, 218
Pectinata, 146
Penetarea, a species of pulic, 219
Perfoliata, 146
Phalangium, 321
Phalaena, 189
Phalera, a subdivision of papilio, 185
Phalopus, a species of scolopendra, 228
Phalopus, a species of elater, 166
Phryganea, 195
Pilularius, a species of scarabaeus, 153
Pimelic, 168
Pincers,
Pingualinalis, a species of phalaena, sometimes found in the human stomach, 193
Pinnophylax, a species of cancer, 224
Pipiens, a species of culex, 213
Piss, a species of bruchus, introduced into Europe from America, 159
Plant-lace,
Plebeii, a division of papilio, 183, 187
Pneumora, 171
Podura, 215
Polonicus, a species of coccus, 176
Polyphemus, a species of monocytes, 237
Praxus, 235
Preservation of insects in cabinets, 236
Psilophor, a division of phalaena, 190, 194
Prima, 155
Pubis, a species of pediculus, 228
Pulex, 219
a species of monocyte, 237
Pulex, a species of termites,
Pumilopa, a species of musca, 212
Pyralides, a division of phalaena, 189, 193
Q
Queen bee,
Quercus gemme, species of cynips, folia,
R
Raphidion, 197
Red spider, go to the mountains to shun the heat,
Reina, a kind of cochineal, 277
Repiration of insects, 292
Recursus, 146
Rhagoneura, jujube, food of the live insect,
Rhizophora, 161
Robisania, a species of bruchus, introduced into Europe from America, 159
Rosmarinus, a species of cynips,
Rostroca, a species of stomonyx, 157
Rose-bettle,
Rutrales, a subdivision of papilo, 183
Ruticola, a species of cancer, 224
S
Sabulosa, a species of sphex, 200
Saccharinum, a species of lepism, 215
Sanguinarius, a species of acarus, 197
Saturn fly, 230
Scabia, a species of acarus, 197
Scarabaeus, 158
Scolopendra, 228
Scorpion fly,
Scolopendria, 228
Scorpio, 229
Scolopendria, 228
Scolopentia, 146
Seculus, a species of phalaena, 193
Secretion of insects, 233
Seductor, a species of ichneumon, 199
Sexta, a species of elater, 166
a species of curculio, destructive to grain, 161
Senses of insects, 239
Serracrus, 165
Setaceous, 146
Senses of insects, 147
Shanks, 1b.
Shepherd’s spider,
Shrimp,
Silk, by whom first made, 191
Silk-wool, 1b.
Siro, 198
Siro, a species of acarus, 146
Skepper,
Snake,
Sooty-pan, 171
Spanish fly, 185
Sparkler, 166
Sphex, 200
Sphinx, 187
Spider, 221
Spiracuia, 146
Splendida, a species of lampyris, 164
Springtail, 215
Sphaera, a species of cicada, 173
Squillo, a species of cancer, 235
Sting-beetle, 154
Stephanus, 170

State of the atmosphere most favourable for the secretion of honey,

Bombeaux,
Stemum,
Sting,
the European scorpion not so dangerous as is commonly supposed,
Stigmati,
Stomonyx,
Sulcata, a species of pismola,
Sycopebata, a species of canesca,
Syphic, 214
Syloesster, a species of cochineal,

T
Tarabous, 1
Tar, 1
Tawed wap,
Tepenelle, a species of phalaena,
Terandii, a species of castrus, 1
Teramotia, a species of aranea, 1
Terarius, a species of acarus, 1
Tenebria, 1
Tentheada, 1
Temes, 1
Terebratia, 1
Termes, 1
Terebrata, a species of alpin, 1
Terebrata cochineal, 1
Therma, 1
Thrip, 1
Thysanura, 1
Tick, 1
Tineca, a division of phalaena, 1
Tipha, 1
Tipula, 1
Tortrices, a division of phalaena, 1
Triteci, a species of phalaena, 1
a species of tipula, 1
Tritoma, 1
Trog, a subdivision of papillio,
Tronpe, a species of castrus, 1
Trunk, 1
Turnip-fly,

V
Verrucioorat, a species of gyllas, 1
Venicatatoria, a species of lynta, 1
Veepa, 1
Vittelino, a species of tetnusdrac, 1
Vine-fretter, 1
Violes, a species of aphia, 1
Vita, a species of aphia, 1
Vaporia, a species of cancer, 1
Vulvaria, a species of veepa, 1
Vulgoa, a species of ephemera, etc., as manner by the inhabitants of Carniola,
Urbicola, a subdivision of papillo, 1
Urticea, a species of papilo,
Use the bees make of the farina of flowers,
Utility of insects,

W
Warbles, 1
Warps, 1
ENTRÉPAS, in the manege, a broken pace or going, that is neither walk nor trot, but has somewhat of an amble.

This is a pace or gait of such horses as have no reins or back, and go upon their shoulders; or, of such as are spoiled in their limbs.

ENTRING LADDERS, in a ship, are of two sorts; one used by the vessel's sides, in a harbour, or in fair weather, for persons to go in and out of the ship: the other is made of ropes, with small staves for steps; and is hung out of the gallery to enter into the boat, or to come aboard the ship, when the sea runs so high that they dare not bring the boat to the ship's side for fear of staving it.

ENTROCHUS, in Natural History, a genus of extraneous fossils, usually of about an inch in length, and made up of a number of round joints, which, when separate and loose, are called trochilites: They are composed of the same kind of plated spar with the fossil shells of the echinoderm, which is usually of a bluish-gray colour, and very bright where fresh broken; they are all strated from the centre to the circumference, and have a cavity in the middle.

The entrochi are found of all sizes, from that of a pin's head to a finger's length, and the thickness of one's middle finger; and are plainly of marine origin, having often sea-shells adhering to them. They are sometimes known by the name of St. Cuthbert's beads, and are usually found in limestone.

ENTRY, in Law, signifies taking possession of lands or tenements, where a person has a right to do so.

ENTRY of an Heir, in Scots Law, that form of law by which an heir vests in himself a proper title to his predecessor's estate.

Bill of Entry, in commerce. See BILL.

In making entries inwards, it is usual for merchants to include all the goods they have on board the same ship in one bill, though sometimes they may happen to be upwards of 20 several kinds: and in case the goods are short entered, additional or post entries are now allowed; though formerly the goods so entered were forfeited. As to bills of entry outwards, or including goods to be exported, upon delivering them, and paying the customs, you will receive a small piece of a parchment called a cotter, which testifies your payment thereof, and all duties for such goods.

If several sorts of goods are exported at once, of which some are free, and others pay customs; the exporter must have two coffers, and therefore must make two entries; one for the goods that pay, and the other for the goods that do not pay custom.

Entries of goods, on which a drawback is allowed, must likewise contain the name of the ship in which the goods were imported, the importer's name, and time of entry inwards. The entry being thus made, and an oath taken that the customs for those goods were paid as the law directs, you must carry it to the collector and comptroller, or their deputies; who, after examining their books, will grant warrant, which must be given to the surveyor, searcher, or land-waiter, for them to certify the quantity of goods; after which the certificate must be brought back to the collector and comptroller, or their deputies, and oath made that the said goods are really shipped, and not landed again in any part of Great Britain.

ENVELOPE, in Fortification, a work of earth, sometimes in form of a simple parapet, and at others like a small rampart with a parapet: it is raised sometimes on the ditch, and sometimes beyond it.

ENVIRONNE', in Heraldry, signifies surrounded with other things: thus, they may be a lion environed with so many bezants. See BEZANTS.

ENUMERATION, an account of several things, in which mention is made of every particular article.

ENUMERATION, in Rhetoric, a part of peroration: in which the orator, collecting the scattered heads of what has been delivered throughout the whole, makes a brief and artful relation or recapitulation thereof.

ENVOY, a person deputed to negotiate some affair with any foreign prince or state. Those sent from the court of Britain, France, Spain, &c. to any petty princes or state, such as the princes of Germany, the republics of Venice, Genoa, &c. go in quality of envoys, not ambassadors; and such a character only do those persons bear, who go from any of the principal courts of Europe to another, when the affair they go upon is not very solemn or important. There are envoys ordinary and extraordinary, as well as ambassadors; they are equally under the protection of the law of nations, and enjoy all the privileges of ambassadors; only differing from them in this, that the same ceremonies are not performed to them.

ENVY, in Ethics, pain felt, and malignity conceived, at the sight of excellence or happiness in another. See EMULATION.

EON, or AON. See AON.

EONIANS, in church-history, the followers of Eon, a wild fanatic of the province of Bretagne, in the 12th century, whose brain was disordered. He concluded from the resemblance between cum, in the form for exercising malignant spirits, viz. Per cum, quasi secutor utique et mortuus, and his own name Eon, that he was the son of God, and ordained to judge the quick and the dead. Eon, however, was solemnly condemned by the council at Rheims, in 1148, at which Pope Eugenius III. presided, and ended his days in a miserable
EPA

misery prison. He left behind him a number of followers and adherents, whom persecution and death so weakly and cruelly employed could not persuade to abandon his cause, or to renounce an absorption which, says Mosheim, one would think could never have gained credit, but in such a place as Bedlam.

EONIA, in Mythology, a feast celebrated by the Athenians in honour of Frigona, who, by way of punishment for their not avenging the death of his father Icarus, engaged the gods to inflict the curse on their daughters, that they should love men who never returned their passion. The feast was instituted by the order of Apollo.

EOSTRE, in Mythology, a Saxon goddess to whom they sacrificed in the month of April, called the month of Eostra; and thence the name Easter, which the Saxons retained after their conversion to Christianity, applying it to the festival celebrated in commemoration of our Saviour's resurrection.

EPACRIS, a genus of plants belonging to the pentandra class. See Botany Index.

EPACTS, in Chronology, the excess of the solar month above the lunar synodical month, and of the solar year above the lunar year of twelve synodical months; or of several solar months above as many synodical months, and several solar years above as many dozen of synodical months.

The epacts, then, are either annual or menstrual.

Menstrual epacts are the excesses of the civil or calendar months above the lunar month. Suppose, e.g., it were new moon on the first day of January; since the lunar month is 29 days 12h. 44' 3", and the month of January contains 31 days, the menstrual epact is 1 day 11h. 15' 57".

Annual epacts are the excesses of the solar year above the lunar year. Hence, as the Julian solar year is 365 days 6h. and the Julian lunar year 354 days 8h. 48' 36", the annual epact will be 10 days 21h. 11' 22"; that is, nearly 11 days. Consequently the epact of 2 years is 22 days; of 3 years, 33 days; or rather 3, since 30 days make an embolismic or intercalary month.

Thus the epact of 4 years is 14 days, and so of the rest; and thus every 19th year, the epact becomes 0; or 0; consequently the 20th year the epact is 11 again; and so the cycle of epacts expires with the golden number, or lunar cycle of 19 years, and begins with the same, as in the following table:

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Again, as the new moons are the same, that is, as they fall on the same day every 19 years, so the difference between the lunar and solar year is the same every 19 years. And because the said difference is always to be added to the lunar year, in order to adjust Epaminondas or make it equal to the solar year; hence the said difference respectively belonging to each year of the moon's cycle is called the epact of the said year, that is, the number to be added to the said year, to make it equal to the solar year, the word being formed from the Greek empe, meaning, together.

Upon this mutual respect between the cycle of the moon and the cycle of the epacts, is founded this rule for finding the Julian epact, belonging to any year of the moon's cycle. Multiply the year given of the moon's cycle into 11; and if the product be less than 30, it is the epact sought; if the product be greater than 30, divide it by 30, and the remainder of the dividend is the epact. For instance, I would know the epact for the year 1712, which is the third year of the moon's cycle. Therefore 3 is the epact for 1712; for 11X3=33, and 33 being divided by 30, there is left 3 of the dividend for the epact. But the difference of the Julian and Gregorian years being equal to the excess of the solar above the lunar year, or 11 days, it happens that the Gregorian epact for one year is the same with the Julian epact for the preceding year.

EPAMINONDAS, a celebrated Theban, the son of Polymnis, and one of the greatest captains of antiquity. He learned philosophy and music under Lycon, a Pythagorean philosopher; and was from his infancy inured to all the exercises of body and mind. He was learned, generous, well-skilled in war, brave, modest, and prudent; and had such a regard for truth, that he would not tell a falsehood even in jest. He served first under the Lacedaemonians; saved the life of Pelopidas their chief, who received in a battle seven or eight wounds; and contracted a strict friendship with that general, which lasted till his death. At his persuasions, Pelopidas delivered the city of Thebes from the yoke of the Spartans, who had rendered themselves masters of Cadmea, which occasioned a bloody war between the two nations. Epaminondas was made general of the Thebans; on which he gained the celebrated battle of Leuctra, in which Cleombrotus, the valiant king of Sparta, was killed. He then ravaged the enemy's country, and caused the city of Messene to be rebuilt and peopled. At length, the command of the army was given to another, because Epaminondas had kept his troops in the field four months longer than he had been ordered by the people; but, instead of retiring in disgust, he now served as a common soldier, and distinguished himself by many brave actions, that the Thebans, ashamed of having deprived him of the command, restored him to his post, in order to carry the war into Thessaly, where his arms were always victorious. A war breaking out between the Eleans and the inhabitants of Mantinea, the Thebans took the part of the former. Epaminondas then resolved to endeavour to surprise Sparta and Mantinea; but not succeeding, he gave the enemy battle, in which he received a mortal wound with a javelin, the bearded iron remaining in the wound. Knowing that it could not be drawn out without occasioning immediate death, he would not suffer it to be touched, but continued to give his orders: and on his being told, that the enemy were entirely defeated, "I have lived long enough (be exult)},
cried), since I die without being conquered; and at the
same time he plucked the javelin from his wound, and
expired, 353, B. C.

EPANALEPSIS. See ORATORY, No. 73.

EPANODOS. *Ibid.* No. 73.

EPANORTHOSIS. *Ibid.* No. 73.

EPARKER, in the manage, signifies the flinging
of a horse, or his yoking and striking with his hind-
legs.

EPAULEMENT, in Fortification, a work raised to
cover sidewise, is either of earth, gabions, or fascines
loaded with earth. The epaulements of the places of
arms for the cavalry, at the entrance of the trenches,
are generally of fascines mixed with earth.

EPAULETTE, are a kind of shoulder-knots
chosen for the soldiers, which are to be of the colour
of the facing, with a narrow yellow or white tape
round it, and worsted fringe; those for the officers
are made of gold or silver lace, with a rich fringe; they
are badges of distinction worn on one or both shoulders.
Those of the dragoon-guards, horse, and dragoons,
are worn on the left shoulder: the light dragons, and
officers of grenadiers, have one on each shoulder:
those of the battalion wear one on the right shoulder
only, which is to be made of embroidery or lace with
a gold or silver fringe. Those of the royal regi-
ment of artillery are to be gold and embroidery, with
gold fringe or scarlet cloth, and worn on the right
shoulder.

EPATHESIS, in Grammar, the interposition or
insertion of a letter or syllable in the middle of a word;
as altum, for altum; religio, for religio; indoper-
tor, for imperator, &c.

EPENS, the line of Endymion, the inventor of
the battering-ram, an engine of great service in sieges
to make a breach. He is thought to have built
the Trojan horse, and to have founded the city of Meta-
pontum.

EPHA, or EEPH, in Jewish antiquity, a measure
for things dry, equal to 3 pecks and 3 pints.

EPHEBIAEUM, in antiquity, the place where
the ephbe or youth exercised; or, as some say, where those
who designed to exercise met, and agreed what kind of
exercise they should contend in, and what should be
the victor's reward.

EPHEBI, among the Athenians, a designation
given to their young men when they arrived at 18 years
of age, at which time they had their names entered in
a public register.

EPHEMA, a genus of plants belonging to the
dicotyle class, and in the natural method ranking under
the 5th order, Conifera. See BOTANY Index.

EPHEMA, from ἐψήμα, "a day;" a daily fe-
vor, or a fever of one day's continuance only. In this
case, such a heat as attends an excess of wine, a pulse
somewhat full and quick, but soft and regular, a slight
headache, a nausea and restlessness, are all the symp-
toms, and which terminate without any sensible eva-
cuation. If it continue to the third day, it is not a
diary fever; and if the constitution is very dry, a he-
tic is to be dreaded.

EPHEMERA, the Day-fly, a genus of insects be-
longing to the order of neuroptera. See ENTOMOLOGY
Index.

EPHEMERIDES, in Astronomy, tables calculated
by astronomers, shewing the present state of the hea-
vens for every day at noon; that is, the places where
all the planets are found at that time. It is from
these tables that the eclipses, conjunctions, and aspects
of the planets are determined; horoscopes or celestial
schemes, constructed, &c. We have ephemerides of
Orion, Kepler, Argoli, Heckerus, Mezzarachia,
Wirtz, De la Hire, Parker, &c. S. Cassini has cal-
culated ephemerides of the sidera medicinae or satellites
of Jupiter, which are of good use in determining the
longitude.

In England, the Nautical Almanack, or Astronomi-
cal Ephemerides, published annually by anticipation,
under the direction of the commissioners of longitude,
is the most considerable. In France, celestial ephem-
erides have been published by M. Desplaces every ten
years, from 1715 to 1745; they were afterwards con-
tinued by the Abbé Caille, with many additions; of
which an account may be seen in the History of the
Academy of Sciences for 1743. The Academy of
Sciences have likewise published annually, from the
beginning of the present century, a kind of ephemeris
under the title of Connoissance des Temps.

EPHEUS, a city of antiquity, much celebrated
on account of its temple of Diana, and for being
the most famous mart or staple town of Hither Asia.
EPHEUS was in ancient times the metropolis of all
Asia. Stephanus gives it the title of Epiphanides, or
most illustrious; and Pliny styles it the ornament of
Asia. The ancient city stood about 30 miles south of
Smyrna, near the mouth of the river Cayster, and
the island of the Icarian sea, which is a bay of the
Egyptian; but as it has been so often destroyed and rebuilt, it
is no easy matter to determine the precise place. Most
of our modern travellers are of opinion, that the an-
cient city stood more to the south than the present;
which they argue from the ruins that still remain.
EPHEUS was, in ancient times, known by the names of
Alopex, Ortygia, Morges, Smyrna, Trachea, Samornion,
and Pelo. It was called Ephesus, according to Hes-
aclidus, from the Greek word epheus, signifying per-
mission; because Hercules (says he) permitted the Ama-
zons to live and build a city in that place. Others tell
us, that Ephesus was the name of the Amazons that
founded the city; for Pliny, Justin, and Orosius,
unanimously affirm that it was built by an Amazon;
while others bestow this honour upon Androclus, the
son of Codrus king of Athens, who was the chief of
the Ionians that settled in Asia. But, in matters of so
early a date, it is impossible to come at the truth, and
therefore not worth our while to dwell on such fruit-
less inquiries. What we know for certain is, that
the city, which in the Roman times was the metrop-
olis of all Asia, acknowledged Lydiaschus for its
founder; for that prince, having caused the ancient
city to be entirely demolished, rebuilt, at a vast ex-
pense, a new one, in a place more convenient, and
nearer the temple. Strabo tells us, that, as the in-
habitants showed a great reluctance to quit their an-
cient habitations, Lydiaschus caused all the drains
that conveyed the water into the neighbouring fens
and the Cayster to be privately stopped up; whereby
the city, being on the first violent rains in great
part laid under water, and many of the inhabitants
drowned, they were glad to abandon the ancient and
retire.
The new Ephesus was greatly damaged by an earthquake in the reign of Tiberius, and the emperor repaired and adorned it with several public buildings, of which there are now but few ruins to be seen, and scarce any thing worthy of ancient Ephesus. The aqueduct, part of which is still standing, is generally believed to have been the work of the Greek emperors; the pillars which support the arches are of fine marble, and higher or lower as the level of the water required. This aqueduct served to convey water into the city from the spring of Halite, mentioned by Pausanias. The gate, now called by the inhabitants, for what reason we know not, the Gate of Persecution, is remarkable for three bas-reliefs on the mould, of an exquisite taste. The port, of which so many medals have been struck, is at present but an open road, and not much frequented. The Causter was formerly navigable, and afforded a safe place for ships to ride in, but is now almost choked up with sand.

But the chief ornament of Ephesus was the temple of Diana, built at the common charge of all the states in Asia, and for its structure, size, and ornament, accounted among the wonders of the world. This great edifice was situated at the foot of a mountain, and at the head of a marsh; which place they chose, if we believe Pliny, as the least subject to earthquakes. This site doubled the charges; for they were obliged to be at a vast expense in making drains to convey the water that came down the hill into the morass and the Causter. Philo Byzantinus tells us, that in this work they used such a quantity of stone, as almost exhausted all the quarries in the country; and these drains or vaults are what the present inhabitants take for a labyrinth. To secure the foundations of the conduits or sewers, which were to bear a building of such a prodigious weight, they laid beds of charcoal, says Pliny, well rammed, and upon them other stones of wood. Two hundred and twenty years, Pliny says 400, were spent in building this wonderful temple by all Asia. It was 423 feet in length, and 200 in breadth, supported by 127 marble pillars, 70 feet high, of which 27 were most curiously carved, and the rest polished. These pillars were the works of so many kings, and the bas-reliefs of one were done by Scopas, the most famous sculptor of antiquity; the altar was almost wholly the work of Praxiteles. Cheirormocrates, who built the city of Alexandria, and offered to form Mount Atlas into a statue of Alexander, was the architect employed on this occasion. The temple enjoyed the privilege of an asylum, which at first extended to a lustral, was afterwards enlarged by Mithridates to a bow-shot, and doubled by Mark Antony, so that it took in part of the city: but Tiberius, to put a stop to the many abuses and disorders that attend privileges of this kind, revoked them all, and declared, that no man guilty of any wicked or dishonest action should escape justice, though he fled to the altar itself.

The priests who officiated in this temple were held in great esteem, and trusted with the care of sacred virgins, or priestesses; but not till they were made empress. They were called Estiatures and Eunuchen, had a particular diet, and were not allowed by their constitutions to go into any private house. They were maintained with the profuse accruing from the lake Belus, and another that fell into it, which must have been very considerable, since they exercised a golden statue to one Artemisiana, who being sent to Rome, recovered them after they had been seized by the farmers of the public revenues. As the Ionians resorted yearly to Ephesus with their wives and children, where they solemnized the festival of Diana with great pomp and magnificence, making on that occasion rich offerings to the goddess, and valuable presents to her priests. The asiarch was, mentioned by St Luke, were, according to Beza, these priests whose peculiar province it was to regulate the public sports that were annually performed at Ephesus in honour of Diana; they were maintained with the collections made during the sports, for all Asia flocked to see them. The great Diana of the Ephesians, as she was styled by her blind adorers, was, according to Pliny, a small statue of ebony, made by one Canitius, though commonly believed to have been sent down from heaven by Jupiter. This statue was first placed in a niche, which, as we are told, the Amazons caused to be made in the trunk of an elm. Such was the first rise of the veneration that was paid to Diana in this place. In process of time the veneration for the goddess daily increasing among the inhabitants of Asia, a most stately and magnificent temple was built near the place where the elm stood, and the statue of the goddess placed in it. This was the first temple; but not quite so magnificent as that which we have described, though reared, as well as the second, among the wonders of the world. The second, being that above described, was remaining in Pliny's time and in Strabo's; and is supposed to have been destroyed in the reign of Constantine, pursuant to the edict by which that emperor commanded all the temples of the heathens to be thrown down and demolished: the former was burnt the same day that Alexander was born, by one Erostratus, who owned on the rock, that the only thing which had prompted him to destroy so excellent a work, was the desire of transmitting his name to future ages. Whereupon the common council of Asia made a decree, forbidding any one to name him; but this prohibition served only to make his name more memorable, such a remarkable extravagance, or rather madness, being taken notice of by all the historians who have written of those times. Alexander offered to rebuild the temple at his own expense, provided the Ephesians would agree to put his name on the front; but they rejected his offer in such a manner as prevented the resentment of that wretched prince, telling him, that "it was not fit one god should build a temple to another." The pillars, and other materials that had been saved out of the flames, were sold, and also the jewels of the Ephesian women, who on that occasion willingly parted with them; and the sum raised from thence served for the carrying on of the work till other contributions came in, which in a short time amounted to an immense treasure. This is the temple which Strabo, Pliny, and other Roman writers speak of. It stood between the city and the port, and was built, or rather finished, as Livy tells us, in the reign of King Servius. Of this wonderful structure there is nothing at present remaining but some ruins, and a few broken pillars.

The Ionians first settled at Ephesus under the conduct of Andreolus, who drove out the Carians and Lycians, by whom these places were possessed at his arrival,
The city, whether built by him, as Strabo affirms, or by Croesus or Ephesus, long before the Ionic migration, as others maintain, became soon the metropolis of Ionia. It was at first governed by Androclus, and his descendants, who assumed the royal title, and exercised the regal authority over the new colony: whence, even in Strabo’s time, the posterity of Androclus were styled kings, and allowed to wear a scarlet robe, with a sceptre, and all the emblems of the royal dignity. In process of time, a new form of government was introduced, and a senate established; but when, or on what occasion, this change happened, we know not. This kind of government continued till the time of Pythagoras, who lived before Cyrus the Great, and was one of the most cruel and inhuman tyrants we read of in history; for having driven out the senate, and taken all the power into his own hands, he filled the city with blood and rapine, not sparing even those who fled to the temple of Diana for shelter. Pythagoras was succeeded by Pindarus, who bore the same name in the city; but treated the citizens with more humanity. In his time Ephesus being besieged by Croesus king of Lydia, he advised the inhabitants to devote their city to Diana, and fasten the wall, by a rope, to the pillars of her temple. They followed his advice, and were, from reverence to the goddess, not only treated with great kindness by Croesus, but restored to their former liberty. Pindarus being obliged to resign his power, retired to Peloponnesus. He was, according to Aelian, grandson to Alyattes king of Lydia, and Croesus’s nephew. The other tyrants of Ephesus mentioned in history, are, Athenagoras, Comes Aristarchus, and Hegesias; of whom the last was expelled by Alexander, who coming to Ephesus, after having defeated the Persians on the banks of the Grason, bestowed upon Diana all the tributes which the Ephesians had paid to the Persians, and established a democracy in the city. In the war between Mithridates and the Romans, they sided with the former, and, by his directions, massacred all the Romans that resided in their city; for which barbarity they were severely fined, and reduced almost to beggary by Sulla, but afterwards treated kindly, and suffered to live according to their own laws, as is plain from several ancient inscriptions and medals. The Ephesians were much addicted to superstition, sorcery, and curious arts, as the scripture styles them: whence came the proverb “Ephesian letters,” signifying all sorts of spells or charms.

In the time of the apostle Paul, Ephesus retained a great deal of its ancient grandeur. But it was a ruinous place, when the emperor Justinian filled Constantinople with its statues, and raised his church of St Sophias upon its columns. Since then it has been almost quite exhausted. Towards the end of the 11th century, a Turkish pirate, named Turgrenzer, settled there. But the Greek admiral, John Ducas, defeated him in a bloody battle, and pursued the flying Turks up the Meander. In 1306, it was among the places which suffered from the exactions of the grand duke Roger; and two years after, it surrendered to Sultan Sâyasan, who, to prevent future insurrection, removed most of the inhabitants to Tigris, where they were massacred. Ephesus appears to have subsisted as an inconsiderable place for some time. But now, the Ephesians are only a few Greek peasants, living in extreme wretchedness, dependence, and insensibility; the representatives of an illustrious people, and inhabiting the wreck of their greatness; some, the substractions of the glorious edifices which they raised; some, beneath the vaults of the stadium, once the crowded scene of their diversions; and some, by the abrupt precipice, in the sepulchres which received their ashes.

EPHESUS, from whence, “I send forth”), in antiquity, a sort of magistrates among the Athenians, instituted by King Demophon, to take cognizance of murder, manslaughter, and chance-medley.

Their number was 100, whereof 50 were Athenians, and 50 Argians: they were not admitted to the post till upwards of 50 years of age. Draco new-modelled it, excluded the Argians out of it, and made it to consist of 51 Athenians, each above 58 years of age: Ubu Emmon de Rep. Athen. says, he transferred to them part of the jurisdiction of the Arreopagites. See AEDEAGUS.

EPIHOD, in Jewish antiquity, one part of the priestly habit; being a kind of girdle, which, brought from behind the neck over the two shoulders, and hanging down before, was put across the stomach, then carried round the waist, and made use of as a girdle to the tunic.—There were two sorts of ephors, one of plain linen for the priests, and the other embroidered for the high-priest.

EPIHORI, in Greek antiquity, magistrates established in ancient Sparta, to balance the regal power. The authority of the ephori was very great. They sometimes expelled, and even put to death the kings, and abolished or suspended the power of the other magistrates, calling them to account at pleasure. There were five of them, others say nine. They presided in the public shows and festivals. They were entrusted with the public treasure; made war and peace; and were so absolute, that Aristotle makes their government equal to the prerogative of a monarchy. They were established by Lycurgus, according to the generality of authors: though this is denied by others, who date their origin 130 years after the time of that legislator. Thus Plutarch, in his Life of Cleomenes, ascribes their institution to Theopompus king of Sparta; which is also confirmed by the authority of Aristotle.

EPIHORUS, an orator and historian of Cumae, in Æolia, about 352 years before Christ. He was disciple to Isocrates, by whose advice he wrote a history which gave an account of all the actions and battles that had happened between the Greeks and barbarians for 750 years. It was greatly esteemed by the ancients; but is now lost.

EPIRMAH, in Ancient Geography, one of the divisions of Palestine by tribes: Ephraim and the half tribe of Manasséh are blended together by the sacred writer, and it only appears that Ephraim occupied the more southern, and the half tribe of Manasséh the more northern parts, but both seem to have extended from the Jordan to the sea. Ephraim also denotes a kingdom, on the separation of the 10 tribes from the house of David, called also the kingdom of Israel and Samaria.

EPHRATA,
EPHRAITH, a small town of Pennsylvania in America, and the principal settlement of the religious sect called Dunkards or Tunkers. See TUNKERS.

EPHEREM SYRUS, an ancient Christian writer, in the fourth century, deacon of Edessa, was born at Nisibis in Syria. He was greatly esteemed by St Basil, St Gregory Nyssen, and other great men. He wrote against the opinions of Sabellius, Arius, Apollinaris, the Manichees, &c. and acquired such reputation by his virtue and his works, that he was called the doctor and the prophet of the Syrians. He died in 378. The best editions of his works are, that of Oxford, in 1708, in folio, and that of Rome, from 1732 to 1738, in Syria, Greek, and Latin, 6 vols folio.

EPHYDOR, in antiquity, an officer in the Athenian courts of justice, who was to provide the plaintiff and defendant with equal water-bowl glasses. When the glass was run out, they were not permitted to speak any farther; and, therefore, we find them very careful not to lose or mispend one drop of their water. Whilst the laws quoted by them were reciting, or if any other business happened to intervene, they gave orders that the glass should be stopped.

EPIBATJE, Eρίαδε, among the Greeks, marines, or soldiers who served on board the ships of war. They were armed in the same manner as the land-forces, only that more of them wore full or heavy armour.

EPIBATERION, a poetical composition, in use among the ancient Greeks. When any person of condition and quality returned home after a long absence or journey into another country, he called together his friends and fellow-citizens, and made them a speech, or rehearsed them a copy of verses, wherein he returned solemn thanks to the immortal gods for his happy return; and ended with an address by way of compliment to his fellow-citizens. These verses made what the Greeks call αποβατερία, epibaterium, of επίβατος, "I go abroad." At going away they had another, called αποβατερία.

EPIBATERIUM, a genus of plants belonging to the monocæa class. See BOTANY INDEX.

EPIC, or Heroic, Poem, a poem expressed in narration, formed upon a story partly real, and partly feigned; representing, in a sublime style, some signal and fortunate action, distinguished by a variety of great events, to form the morals, and affect the mind with the love of heroic virtue.

We may distinguish three parts of the definition, namely, the matter, the form, and the end. The matter includes the action of the tale, under which are ranged the incidents, episodes, characters, morals, and machinery. The form comprehends the way or manner of the narration, whether by the poet himself, or by any persons introduced, whose discourses are related: to this branch likewise belong the moving of the passions, the descriptions, discourses, sentiments, thoughts, style, and versification; and besides these, the similes, tropes, figures, &c., in short, all the ornaments and decorations of the poem. The end is to improve our morals and increase our virtue. See POETRY.

EPICODEN (formed of ἐπι, upon, and κός, kós, funeral), in the Greek and Latin poetry, a poem, or poetical composition, on the death of a person. At the obsequies of any man of figure, there were three kinds of discourses usually made; that rehearsed at his bustum or funeral pile, was called nemia; that engraven on his tombstone, epitaph; and that spoken in the ceremony of his funeral, episcisis. We have two beautiful episcisis in Virgil, that of Euryalus and that of Pallas.

EPICEMIUM, in ancient poetry, a poem rehearsed during the funeral solemnity of persons of distinction.

EPICHARMUS, an ancient poet and philosopher, born in Sicily, was a scholar of Pythagoras. He is said to have introduced comedy at Syracuse in the reign of Hiero. Horace commends Plato for imitating him, in following the chase of the inrige so closely as not to give the readers or spectators time to trouble themselves with doubts concerning the discovery. He wrote likewise treatises concerning philosophy and medicine; but none of his works have been preserved. He died aged 50, according to Lactantius, who has preserved four verses inscribed on his statue.

EPICHIROTONIA, among the Athenians. It was ordained by Solon, that once every year the laws should be carefully revised and examined; and if any of them were found unserviceable to the present state of affairs, they should be repealed. This was called τῶν νόμων ἐπιχίροτον, from the manner of giving their suffrages by holding up their hands. See a further account of this custom in Pott. Archæol. Grec. lib. 1. cap. 26. tom. i. p. 242.

EPICOENE, in Grammar, a term applied to nouns, which, under the same gender and termination, mark indifferently the male and female species. Such in Latin is aquila, spectabilis, &c., which signify equally a male or female eagle or bat.

Grammarians distinguish between epicoene and common. A noun is said to be common of two kinds, when it may be joined either with a masculine or a feminine article; and epicoene, when it is always joined to some of the two articles, and yet signifies both genders.

EPICETUS, a celebrated Stoic philosopher, born at Hierapolis in Phrygia, in the first century, was the slave of Epaphroditus, a freedman and one of Nero's guard. Domitian banishing all philosophers from Rome, about the year 94, Epictetus retired to Nicopolis in Epirus, where he died in a very advanced age; and after his death, the earthen lamp he made use of sold for 3000 drachmas. He was a man of great modesty, which was eminent in his own practice, as well as in his recommendation to others: hence he used to say, "That there is no need of adorning a man's house with rich hangings or paintings, since the most graceful furniture is temperance and modesty, which are lasting ornaments, and will never be the worse for wearing." Of all the ancient philosophers, he seems to have made the nearest approaches to the Christian morality, and to have had the most just ideas of God and providence. He always possessed a cool and serene mind, unruffled by passion; and was used to say, that the whole of moral philosophy was included in these words, support and abstain. One day, his master Epaphroditus strove in a frolic to wrench his leg; when Epictetus said, with a smile, and free from any emotion, "If you go on, you will certainly break my leg: but the former redoubling his effort, and striking it with all his strength, he at last broke the bones; when all the return Epictetus made was, Did
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"Did not I tell you, Sir, that you would break my

Epicurean leg?" No man was more expert at reducing the rigour of the maxims of the Stoics into practice. He conformed himself strictly, both in his discourse and behaviour, to the manners of Socrates and Zeno. He waged continual war with fancy and fortune; and it is an excellence peculiar to himself, that he admitted all the severity of the Stoics without their sorness, and reformed Stoicism as well as professed it; and besides his vindicating the impiety of the soul as strenuously as Socrates or any Stoic of them all, he declared openly against self-murder, the lawfulness of which was maintained by the rest of the sect. Arrian, his disciple, wrote a large account of his life and death, which is lost; and preserved four books of his discourses and his Enchiridion, of which there have been several editions in Greek and Latin; and in 1758, a translation of them into English was published by the learned and ingenious Miss Carter.

EPICURÉAN PHILOSOPHY, the doctrine or system of philosophy maintained by Epicurus and his followers.

His philosophy consisted of three parts; canonical, physical, and ethereal. The first was about the canons or rules of judging. The censure which Tully passes upon him for his despising logic, will hold true only with regard to the logic of the Stoics, which he could not approve of, as being too full of nicety and quirk. Epicurus was not acquainted with the analytical method of division and argumentation, nor was he so curious in modes and formation as the Stoics. Soundness and simplicity of sense, assisted with some natural reflections, was all his art. His search after truth proceeded only by the senses; to the evidence of which he gave so great a certainty, that he considered them as an infallible rule of truth, and termed them the first natural light of mankind.

In the second part of this philosophy he laid down atoms, space, and gravity, as the first principles of all things: he did not deny the existence of God, but thought it beneath his majesty to concern himself with human affairs: he held him a blessed immortal Being, having no affairs of his own to take care of, and above meddling with those of others.

As to his ethics, he made the supreme good of man to consist in pleasure, and consequently supreme evil in pain. Nature itself, says he, teaches us this truth; and prompts us from our birth to procure whatever gives us pleasure, and avoid what gives us pain. To this end he proposes a remedy against the sharpness of pain: this was to divert the mind from it, by turning our whole attention upon the pleasures we have formerly enjoyed. He held that the wise man must be happy as long as he is wise; the pain, not depriving him of his wisdom, cannot deprive him of his happiness.

There is a saying that has a fairer show of honesty than the secular doctrine of Epicurus. Gassendus pretends, that the pleasure in which this philosopher has fixed the sovereign good, was nothing else but the highest tranquillity of mind, in conjunction with the most perfect health of body: but Tully, Horace, and Plutarch, as well as almost all the fathers of the church, gives us a very different account of it: indeed the nature of this pleasure, in which the chief happiness is supposed to be seated, is a grand problem in the mo-

EPI

Epicurus

Epidaurus, in Ancient Geography, a town of Dalmatia, on the Adriatic, built the same year, as is said, with Dyrrachium, 430 years after the destruction of Troy: a considerable town formerly, but now reduced to a small village, called Ragusa Vechio; distant six miles from the modern Ragus. E. Long. 19°. Lat. 42°. 20'.

Epidaurus, in Ancient Geography, a town of Ithaca, Argolis,
EPI

[250]

EPI

Epidaurus

Argolis, in Peloponnesus, on the Saronic bay, to the
south of the promontory Sporenum; called sacred, be-
cause of the religious veneration paid to Æsculapius,
whose temple stood at the distance of five miles from
the town. The Romans, during a pestilence, being
advised to convey the god to Rome, sent a ship with a
solemn embassy, for its conveyance; but while the Epi-
daurusians were in suspense to part with him, a huge ser-
pent sailed to the ship; and being taken for the god,
was carried to Rome in great solemnity. Epidaurus
stood in a recess of the bay, fronting the east; and was
fortified by nature, being inclosed by high mountains
reaching to the sea, and rendering it difficult of access.
It had several temples, and in the acropolis or citadel
was a remarkable statue of Minerva. The site is now
called Epidauros. The traces are indistinct, and it
has probably been long deserted. The harbour of
Epidaurus is long. Its peripus or circuit was 15
stadia or near two miles. The entrance is between
mountains, and on a small rocky peninsula on the left
hand are ruins of a modern fortress. This, it seems,
was the point on which a temple of Juno stood. It is
frequented by vessels for wood or corn. The grove of
Æsculapius was inclosed by mountains, within
which all the sacrifices as well of the Epidaurians as
of strangers were consumed. One was called Titthion;
and on this the god when an infant was said to have
been exposed, and to have been suckled by a she-goat.
He was a great physician, and his temple was always
crowded with sick persons. Beyond it was the dormi-
tory of the suppliants; and near it, a circular edifice
called the Tholoe, built by Polycletus, of white marble,
worth seeing. The grove, besides other temples, was
adorned with a portico, and a fountain remarkable for
its roof and decorations. The bath of Æsculapius was
one of the benefactions of Antoninus Pius, while a Ro-
man senator; as was also a house for the reception of
pregnant women and dying persons, who before were
removed out of the inclosure, to be delivered or to expire
in the open air. The remains are heaps of stones,
pieces of brick wall, and scattered fragments of marble;
besides some churches, or rather piles of rubbish
mislaid, being destitute of doors, roofs, or any kind
of ornament. The statue of Æsculapius was half as
big as that of Jupiter Olympius at Athens. It was
made of ivory and gold, and, as the inscription proved,
by Thrasymedes son of Arignotus of Paros. He was
represented sitting, holding his staff, with one hand on
the head of a serpent, and a dog lying by him. Two
Argive heroes, Bellerophon combating with the mon-
ster Chimera, and Perseus severing the head of Medusa,
were carved on the throne. Many tablets described
the curés performed by the deity, yet he had not es-
saped contumely and robbery. Dionysius deprived
him of his golden beard, affirming that it was unseem-
ly in him to appear in that manner when his father
Apollo was always seen with his face smooth. Sylla
amassed the precious offerings belonging to him and to
Apollo and Jupiter at Delphi and Olympia, to pay
his army before Athens. The marks in the walls tes-
tified that a great number had been plucked down.
A few fragments of white marble exquisitely carved
occurred in the heap of the temple. The inclosure of
the temple once abounded in inscriptions. In the second
century six marbles remained, on which were written
Epidaurus

Epidauros

in the Doric dialect the names of men and women who
had been patients of the god, with the distemper each
had laboured under, and the remedies he had directed.
Dr Chandler found only a couple of votive inscriptions,
and two pedestals of statues, one of which represented a
Roman, and was erected by the city of the Epidaur-
ians. The stadium was near the temple. It was of
earth, as most in Greece were. At the upper and two
seats of stone, but these were continued along the sides
only a few yards. A vaulted passage leading under
neath into the area, now choked up, was a private way
by which the agonothete or president with the priests
and persons of distinction entered. Two large cisterns
or reservoirs remain, made by Antoninus for the recep-
tion of rain water. Beyond them is a dry water-
course; and in the mountain-side on the right hand are
the marble seats of the theatre, overgrown with bushes.
The springs and wells by the ruins are now supposed to
possess many excellent properties. To these and a
good air, Dr Chandler thinks, with the recreations of
the theatre and of the stadium, and to the medicinal
knowledge and experience of the priests, may be at-
tributed both the recovery of the sick and the reputa-
tion of Æsculapius.

EPI

Epidaurus, with the surname Limera, to distinguish
it from the Epidaurus of Argalia; called so, either from
its meadows or its commodious harbours (Stephanus,
Apollodorus): a town of Laconia, on the Iouian sea,
to the south of the Sinus Argolicus, situated where
now Malvasia stands, in the Morea. E. Long. 29. 30.
Lat. 35. 40.

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EPIDEMIA, in Grecian antiquity, festivals kept in
honour of Apollo and Diana, at the stated seasons,
when those deities, who could not be present every-
where, were supposed to visit different places, in order
to receive the vows of their adorers.

EPIDEMIC, among physicians, an epithet of dis-
eases which at certain times are popular, attracting
great numbers at or near the same time.

EPIDENDRUM, a genus of plants, belonging to
the gymnandria class; and in the natural method ranking
under the seventh order, Orchideae. See Botany In-
dex.—This is the plant which produces the fruit called
vamilla, and which is used in perfuming chocolate, to-
acco, and snuff.

EPIDERMIS, in Anatomy, the cuticle or scar-IA.
See Anatomy Index. The word is formed of the Greek
ευρια, on, over; and δέρμη, skin.

EPIDICASIA, among the Athenians. Daugh-
ters inheriting their parents estate were obliged to
marry their nearest relation; which gave occasion to
persons of the same family to go to law with one an-
other, each pretending to be more nearly allied to the
heiress than the rest. The suit was called μηνιαία
σημα:

EPIDIDYMIS, in Anatomy, a little round body, on
the back of each testicle; called also parastata. See
Anatomy Index.

EPIGAEA, a genus of plants, belonging to the de-
candaria class; and in the natural method ranking un-
der the 18th order, Bicorneae. See Botany Index.

EPIDOTÆ, certain deities who presided over the
growth.
growth of children. They were worshipped by the La-
cedemonians, and chiefly invoked by those who were
persecuted by the ghosts of the dead, &c.

EPIGASTRIC REGION, a part or subdivision of the
abdomen. See Anatomy Index.

EPIGHLOTTIS, in Anatomy, one of the cartilages of
the larynx or windpipe. See Anatomy Index.

EPIGONI, the sons and descendants of the Grecian
heroes who were killed in the first Theban war. The
war of the Epigon is famous in ancient history. It
was undertaken ten years after the first. The sons of
those who had perished in the first war, resolved to
avenge the death of their fathers, and marched against
Thebes, under the command of Thersander; or, accor-
ding to others, of Acmoon the son of Amphiarus,
about 1307 years before Christ. The Argives were
assisted by the Corinthians, the people of Messenia,
Arcadia, and Megara. The Thebans had engaged all
their neighbours in their quarrel, as in one common
cause. These two hostile armies met and engaged on
the banks of the Gissata. The fight was obstinate and
bloody, but victory declared for the Epigon, and some
of the Thebans fled to Lyricum with Leocedes, their
general, while others retired into Thebes, where they
were soon besieged, and forced to surrender. In this
war Epigoneus was the only one who was killed,
and his father Adrastus was the only one who escaped
alive in the first war. This whole war, as Pausanias ob-
serves, was written in verse; and Callinus, who quotes
some of the verses, ascribes them to Homer, which
opinion has been adopted by many writers. "For my
part (continues the geographer), I own, that next to
the Iliad and Odyssey of Homer, I have never seen a
finer poem." The descendants of the veteran Maced-
opians, who served under Alexander the Great, and
who had children by Asiatic women, were also called
Epigon (Justin).

EPIGRAM, in Poetry, a short poem in verse, treat-
ing only of one thing, and ending with some lively,
ingenious, and natural thought or point. The word is
formed of επίγραμμα inscription, of επηγράφω to inscribe
or write upon.

Epigrams, then, originally signify inscriptions; and
they derive their origin from those inscriptions placed
by the ancients on their tombs, statues, temples, triumps,
shal arches, &c. These, at first, were only simple
monograms: afterwards, increasing their length, they
made them in verse, to be the more easily retained:
Heredotus and others have transmitted to us several
of them. Such little poems retained the name of ep-
grams, even after the design of their first institution
was varied, and people began to use them for the rela-
tion of little facts and accidents, the characterising of
persons, &c. The point or turn is a quality much ins-
isted on by the critics, who require the epigram con-
stantly to close with something poignant and unexpect-
ed, to which all the rest of the composition is only pre-
paratory; whilst others, on the contrary, exclude the
point, and require the thought to be equally diffused
throughout the poem, without laying the whole stress
on the close: the former is usually Martial’s practice,
and the latter that of Catullus.

The Greek epigrams have scarce any thing of the
point or briskness of the Latin one: those collected
in the Anthology have most of them a remarkable air
of ease and simplicity, attended with something just and
witty; such as we find in a sensible peasant, or a child
that has wit. They have nothing that bites, but some-
thing that tickles. Though they want the salt of Mar-
tial, yet to a good taste they are not insipid; except a
few of them, which are quite flat and spiritless. How-
ever, the general faintness and delicacy of the peasant-
try in them has given occasion for a Greek epigram, or
epigram à la Grecque, to denote, among the French, an
epigram void of salt or sharpness.

The epigram admits of great variety of subjects:
some are made to praise, and others to satirize; which
last are much the easiest, ill-nature serving instead of
point and wit. Boileau’s epigrams are all satires on
one or another; those of Des Beaux are all made in
honour of his friends; and those of Mad. Scudery are
so many eulogies. The epigram being only a single
thought, it would be ridiculous to express it in a great
number of verses.

EPIGRAPHÉ, among antiquarians, denotes the
inscription of a building, pointing out the time when
the persons by whom, the uses, and the like, for which
it was erected.

EPILEPSY, in Medicine, the same with what is
otherwise called the falling-sickness, from the patient’s
falling suddenly on the ground. See Medicine Index.

EPILOBIOUM, the Willow Herb; a genus of
plants belonging to the octandria class; and in the
natural method ranking under the 17th order, Calycan-
theme. See Botany Index.

EPILOGUE, in Oratory, the end or conclusion of
a discourse, ordinarily containing a recapitulation of
the principal matters delivered.

Epilogue, in dramatic poetry, a speech addressed
to the audience, after the play is over, by one of the
principal actors therein; usually containing some reflec-
tions on certain incidents in the play, especially those
in the part of the person that speaks it; and having
somewhat of pleasantry, intended to compose the pas-
sion raised in the course of the representation: A prac-
tice which is ridiculed by the Spectator; and com-
pared to a merry jigg upon the organ after a good sermon,
to wipe away any impressions that might have been
made thereby, and send the people away just as they
came.

EPIMEDEU, BAREN-WORT; a genus of plants,
belonging to the tetrandria class; and in the natural
method ranking under the 24th order, Corydalis. See
Botany Index.

EPIMENIDES, an ancient poet and philosopher,
was born at Gnossus in Crete. Contrary to the custom
of his country, he always wore his hair long; which,
according to some, was because he was ashamed of
being thought a Cretan: and indeed he does not seem
to have had a high opinion of his countrymen, if that
verse cited by St Paul be, as it is generally believed
to be, his; “The Cretans are always liars, evil beasts,
slow belters.” Many stories are related of him, too
wonderful to merit attention; however, his reputation
was so great over all Greece, that he was there esteem-
ed a favourite of the gods. The Athenians being af-
fected with the plague, and commanded by the oracle
to make a solemn illustration of the city, sent Nicias,
the son of Niceratus, with a ship to Crete, to desire
Epimenides to come to them. He accepted their in-
ivitation,
Epimenides vocation, accompanied the messengers to Athens, performed the restoration of the city, and the plague ceased. Here he contracted an acquaintance with Solon, whom he privately instructed in the proper methods for the regulation of the Athenian commonwealth. Having finished his business at Athens, the citizens offered him many valuable presents and high honours, and appointed a ship to carry him back to Crete; but he returned their presents, and would accept of nothing except a little branch of the sacred olive preserved in the citadel; and desired the Athenians to enter into an alliance with the Gnossians. Having obtained this, he returned to Crete; where he died soon after, aged 157 years: or as the Cretans, consistently with their character, pretended, 299. He was a great poet, and wrote 5000 verses on "the genealogy of the gods," 6500 "on the building of the ship Argo and Jason's expedition to Colchis," and 4000 "concerning Minos and Rhadamantus." He wrote also in prose, "Concerning sacrifices and the commonwealth of Crete." St Jerome likewise mentions his "book of oracles and responses." The Lacedaemonians procured his body, and preserved it among them by the advice of an oracle; and Plutarch tells us, that he was reckoned the seventh wise man by those who refused to admit Heriander into the number.

EPIMETHEUS, a son of Japetus and Clymene, one of the Oceanides, who inconsiderately married Pandora, by whom he had Pyrrha, the wife of Deucalion. He had the curiosity to open the box which Pandora had brought with her, and from thence issued a train of evils, which from that moment have never ceased to afflict the human race. Hope was the only one which remained at the bottom of the box, not having a sufficient time to escape, and it is she alone who comforts men under misfortunes. Epimetheus was changed into a monkey by the gods, and sent into the island Pithecusa.

EPIPHANIUS, St, an ancient father of the church, born at Besanducan, a village in Palestine, about the year 332. He founded a monastery near the place of his birth, and presided over it. He was afterwards elected bishop of Salamis; when he sided with Paulinus against Meletius, and ordained in Palestine Paulinian the brother of St Jerome; on which a contest arose between him and John bishop of Jerusalem. He afterwards called a council in the island of Cyprus, in which he procured a prohibition of the reading of Origen's writings; and made use of all his endeavours to prevail on Theophilus bishop of Alexandria to engage St Chrysostom to declare in favour of that decree; but not meeting with success, he went himself to Constantinople, where he would not have any conversation with St Chrysostom; and formed the design of entering the church of the apostles to publish his condemnation of Origen; but being informed of the danger to which he would be exposed, he resolved to return to Cyprus; but died at sea in the year 403. His works were printed in Greek, at Basil, in 1544, in folio; and were afterwards translated into Latin, in which language they have been often reprinted. Petavius revised and corrected the Greek text by two manuscripts, and published it together with a new translation at Paris in 1622. This edition was reprinted at Cologne in 1682.

EPHANY, a Christian festival, otherwise called Epiphany; the Manifestation of Christ to the Gentiles, observed on the sixth of January, in honour of the appearance of our Saviour to the three magi or wise men, who came to adore him and bring him presents. The feast of epiphany was not originally a distinct festival; but made a part of that of the nativity of Christ, which being celebrated 12 days, the first and last of which were high or chief days of solemnity, either of these might properly be called epiphany, as that word signifies the appearance of Christ in the world.

The word in the original Greek, ἑπίφανες, signifies appearance or apparition; and was applied, as some critics will have it, to this feast, on account of the star which appeared to the magi.—St Jerome and St Chrysostom take the epiphany for the day of our Saviour's baptism, when he was declared to men by the voice, Hic est filius meus dilectus, in quo mithi complacui: "This is my beloved Son, in whom I am well pleased." And accordingly it is still observed by the Coptic and Ethiopians in that view. Others contend, that the feast of Christmas, or the nativity of our Saviour, was held in divers churches on this day; which had the denomination epiphany or appearance, by reason of our Saviour's first appearance on earth at that time; and it must be allowed, that the word is used among the ancient Greek fathers, not for the appearance of the star to the magi, but for that of our Saviour to the world: In which sense St Paul uses the word epiphania in his second epistle to Timothy, i. 10.

EPYPHONEMA. See Oratory, No. 96.

EPIPHORA, in Medicine, a preternatural discharge of the eyes, when they continually discharge a sharp, sour, and bitter humour, which excoriate the cheeks. See Medicine Index.

EPIPHYSIS, in Anatomy. See Anatomy Index.

EPIPLOCELE, in Medicine, is a kind of hernia or rupture, in which the omentum subsides into the scrotum.

EPIPOOMPHALON, in Medicine, an hernia umbilicalis, proceeding from the omentum falling into the region of the umbilicus or navel.

EPIPLAN. See Omentum, Anatomy Index.

EPIUS, a district of ancient Greece, bounded on the east by Etolia, on the west by the Adriatic, on the north by Tessaly and Macedonia, and on the south by the Ionian sea. This country was anciently governed by its own princes, in which state it made a very considerable figure. The country, according to Josephus, was first peopled by Dodanim the son of Javan and grandson of Japhet. The people were very warlike; but they continued in their savage state long after their neighbours were civilized; whence the islanders used to threaten their offenders with transportation to Epirus. Their horses were in great request among the ancients, as well as the dogs produced in one of the divisions called Molossus; and hence these dogs were called by the Romans Molossi.

The History of Epirus commences with the reign of Pyrrhus the son of Achilles by Deidamia the daughter of Lycomedes king of Scyros. He is said to have behaved with great bravery at the siege of Troy; but it would appear that he behaved with no less barbarity. After the city was taken, he is said to have killed old King Priam with his own hand; to have thrown Astyanax the son of
of Hector and Andromache headlong from a high tower; and sacrificed Polyxena the daughter of Priam on the tomb of his father. He carried Andromache with him into Epirus, where he settled by the advice of the famous soothsayer Helenus, one of Priam’s sons, who had served during the Trojan war both under his father and himself. The only remarkable period of the history of Epirus is the reign of Ibarus II, who made war on the Romans. He was invited into Italy by the Tarentines; and embarked about 280 B.C. After having escaped many dangers by sea, he landed in that country, and with great difficulty gained a victory over the Romans; but he was afterwards utterly defeated by them, and obliged to return into his own country. To retrieve his honour, he then undertook an expedition against Macedon; where he overthrew Antigonus, and at last made himself master of the whole kingdom. He then formed a design of subduing all the other Grecian states; but met with such an obstinate resistance at Lacedaemon, that he was obliged to drop the enterprise; and was soon after killed at the siege of Argos by a woman, who from the wall threw a tile upon his head. Deidamina, the grand-daughter of Pyrrhus, was the last that sat on the throne of Epirus. She is said to have been murdered after a short reign; upon which the Epirots formed themselves into a republic.

Under the new form of government Epirus never made any considerable figure, but seems rather to have been dependent on the kingdom of Macedon. The Romans having conquered Philip king of that country, restored the Epirots to their ancient liberty; but they, forgetful of this favour, soon after took up arms in favour of Perseus. As a punishment for this ingratitude, the Romans gave orders to Paulus Emilius, after the reduction of Macedon, to plunder the cities of Epirus, and level them with the ground. This was punitively executed throughout the whole country on the same day and at the same hour. The booty was sold, and each foot-soldier had 200 denarii, that is, six pounds nine shillings and two pence, and each of the horse the double of the sum. An hundred and fifty thousand men were made slaves, and sold to the best bidder for the benefit of the republic. Nor did the vengeance of Rome stop here; all the cities of Epirus, to the number of 70, were dismantled, and the chief men of the country carried to Rome, where they were tried, and most of them condemned to perpetual imprisonment. After this terrible blow, Epirus never recovered its ancient splendour. Upon the dissolution of the Achaean league, it was made part of the province of Macedon; but when Macedon became a diocese, Epirus was made a province of itself, called the province of Old Epirus, to distinguish it from New Epirus, another province lying to the east of it. On the division of the empire, it fell to the emperors of the east, and continued under them till the taking of Constantinople by the Latins, when Michael Angelus, a prince nearly related to the Greek emperor, seized on Epirus and Lefkada, of which he declared himself despot or prince; and was succeeded by his brother Theodorus, who took several towns from the Latins, and so far enlarged his dominions, that, disdaining the title of despot, he assumed that of emperor, and was crowned by Demetrius archbishop of Bulgaria. Charles, the last prince of this family, dying without lawful issue, bequeathed Epirus and Acarnania to his natural sons, who were driven out by Amurath the second. Great part of Epirus was afterwards held by the noble family of the Castriots; who, though they were masters of Albania, yet styled themselves princes of Epirus. Upon the death of the famous George Castriot, surnamed Scanderbeg, Epirus fell to the Venetians, who were soon dispossessed of it by the Turks; in whose hands it still continues, being now known by the name of Albania, which comprehends the Albania of the ancients, all Epirus, and that part of Dalmatia which is subject to the Turks.

**EPI**

EPI, that name of church-government, in which diocesan bishops are established as distinct from and superior to priests or presbyters. We have already observed, that it is a long time since the ministers of religion have been distinguished into different orders, and that it has been much controverted whether the distinction be of divine or human right; whether it was settled in the apostolic age or afterwards (See Bishop). This controversy commenced soon after the Reformation; and has been agitated with great warmth, but between the Episcopalians on the one side, and the Presbyterians and Independents on the other. Among the Protestant churches abroad, those which were reformed by Luther and his associates were in general episcopal; whilst such as follow the doctrines of Calvin have for the most part thrown off the order of bishops as one of the corruptions of popery. In England, however, the controversy has been considered as of greater importance than on the Continent; for it has there been strenuously maintained by one party, that the episcopal order is essential to the constitution of the church; and by others, that it is a pernicious encroachment on the rights of men, for which there is no authority in scripture. Though the question has for some time lain almost dormant, and though we have no desire to revive it; yet as a work of this kind might perhaps be deemed defective, did it contain no account whatever of a controversy which has employed some of the ablest writers of the past and present centuries, we shall give a fair view of the chief arguments by which the advocates of each contending party have endeavoured to support their own cause, leaving our readers to judge for themselves where the truth lies. See Independents and Presbyterians.

The Independent maintains, that under the gospel dispensation there is nothing which bears the smallest resemblance to an exclusive priesthood; that Christ and the apostles constituted no permanent order of ministers in the church; but that any man who has a firm belief in revelation, a principle of sincere and unaffected piety, a capacity for leading devotion and communicating instruction, and a serious inclination to engage in the important employment of promoting the everlasting salvation of mankind is to all intents and purposes a regular minister of the New Testament, especially if he have an invitation to the pastoral office from some particular society of Christians.

Against this scheme, which supposes the rights of Christians all equal and common, and acknowledges no authority in the church except what may be derived from the election of her members, the Protestant Episcopalians reason in the following manner. They admit, as an undoubted truth, that our blessed Lord gave to arguments none against it.
none of his immediate followers authority or jurisdiction of such a nature as could interfere with the rights of the civil magistrate, for all such authority was disclaiming by himself: “My kingdom (said he to Pilate) is not of this world!” and to a certain person who asked him to decide a question of property between him and his brother, he replied, “Man, who made me a judge or a divider over you?” But when it is considered, that Christ came into this world to “turn men from darkness to light, and from the power of Satan to the living God; that he gave himself for us, that he might redeem us from all iniquity, and purify to himself a peculiar people zealous of good works; that of these works many are such as regenerate humanity has no inclination to perform, and that the doctrines which he revealed are such as human reason could never have discovered; the advocate for episcopacy thinks it was extremely expedient, if not absolutely necessary, that, when he ascended into heaven, he should establish upon some earth some authority to illustrate the revelation which he had given, and to enforce obedience to the laws which he had enacted. There is nothing, continues he, more strictly required of Christians, than that they live together in unity, professing the same faith, joining in the same worship, and practising the same virtues. But as men have very different passions, prejudices, and pursuits, such unity would be impossible, were they not linked together in one society under the government of persons authorised to watch over the purity of the faith, to prescribe the forms of public worship, and to explain the nature, and inculcate the necessity of the several virtues. The Society of Christians, in respect of its unity and organization, is compared to the human body: for as we have many members in one body, and all members have not the same office; so we being many are one body in Christ, and every one members one of another.” (Rom. xii. 4, 5.) It is called the church, the kingdom of heaven, and the kingdom of God; and its affairs, like those of every other kingdom, are administered by proper officers in subordination to the one Lord, who, “when he ascended up on high, and led captivity captive, gave some apostles, and some prophets, and some pastors and teachers, for the perfecting of the saints, for the work of the ministry, for the edifying of the body of Christ:” (Ephes. iv. 8—13.) That those various orders of ministers were vested with real authority in the church might be inferred from principles of reason as well as from the dictates of revelation. A society without some sort of government, government without laws, or laws without an executive power, is a direct absurdity. Where there are laws, some must govern, and others be governed; some must command, and others obey; some must direct, and others submit to direction. This is the voice of nature; it is likewise the language of scripture. “Obey them (says the inspired author of the epistle to the Hebrews) who have the rule over you, and submit yourselves; for they watch for your souls as they that must give account.” A text which shows that the authority of the ministers of religion was distinct from that of the civil magistrate, whose duty it is to watch, not for the souls, but for the lives and properties, of his subjects.

Of the society thus constituted, it was not, as of a philosophical sect, left to every man’s choice whether or not he would become a member. All who embrace the faith of the Redeemer of the world are required to be baptized, under the pain of forfeiting the benefits of redemption; but one great purpose for which baptism was instituted, is to be the rite of initiation into the church of Christ; for by one spirit are we all baptized into one body, whether we be Jews or Gentiles, be members of the one, or of the other.” (x Cor. xii. 13.) Of church, baptism, whatever be the importance, it is evident, that to receive it, is not, like the practice of justice, or the veneration of the Supreme Being, a duty resulting from the relations of man to his Creator and fellow-creatures; that its whole efficacy, which in scripture is said to be nothing less than the remission of sins, is derived from positive institution; and therefore, that the external rite can be of no avail, but when it is administered in the manner prescribed, and by a person authorized to administer it. That all Christians are not vested with this authority, as one of the common privileges of the faith, appears from the commission which our Saviour gave to his apostles after his resurrection: “All Christian that period, we are assured that the number of his followers was not less than five hundred; yet we find, that to the eleven disciples only did he say, ‘be and teach the same, speaking, saying, All power is given unto me in heaven and in earth; go ye, therefore, and teach all nations, baptizing them in the name of the Father, and of the Son, and of the Holy Ghost.”

Of the five hundred disciples there is surely no reason to believe that there were not many well qualified to instruct either a Jew or a Gentile in the doctrines of the gospel; and it is certain, that any one of them could have washed his convert with water in the name of the Holy Trinity as well as St. Peter or St. John; but such an unauthorized washing would not have been Christian baptism, nor of equal validity with it, any more than the opinion of a lawyer at the bar is the judgment of a court of justice, or of equal obligation. It is the commission of the sovereign which gives force to the judgement of the court; it is the commission of Christ which gives validity to baptism. The same reasoning is applicable to the Lord’s supper, which, if it be not administered by those who have authority for such administration, cannot be deemed a sacrament of Christ’s institution.

These two rites are the external badges of our profession. By the one, we are incorporated into that society of which our Redeemer is the head and sovereign, in the celebration of the other, we have a right to join, whilst of that society we continue members. But if by an open and scandalous disregard of the precepts of the gospel, we should prove ourselves unworthy of its privileges, the same persons who are authorised to admit us into the church, are likewise vested with authority to cast us out of it: for to them were given “the keys of the kingdom of heaven (or the church), with assurance, that whatsoever they should bind on earth, should be bound in heaven; and whatsoever they should loose on earth should be loosed in heaven.” (Mat. xvii. 18.) As baptism is to be administered so long as there shall be persons to be enlisted under the banners of Christ, and the Lord’s Supper to be celebrated so long as it shall be the duty of soldiers to adhere to the standard of their leader and their head; and as it is likewise to be feared that there will never come a time when
when all Christians shall “walk worthy of the vocation whereunto they are called;” it follows, that this power of keys, which was originally given to the apostles, must continue in the church through all ages, even unto the end of the world. But as we have seen, that it was not at first intrusted to all the disciples in common, as one of the privileges inseparable from their profession, and as no body of men could possibly transfer an authority of which they themselves were never possessed; it is certain, that even now it cannot, by the election of one class of Christians, be delegated to another, but must, by some mode of succession, be derived from the apostles, who were sent by Christ as he was sent by his Father. To argue from the origin of civil to that of ecclesiastical government, although not very uncommon, the Episcopalian deems extremely fallacious. Of the various nations of the world, many of the sovereigns may indeed derive their authority from the suffrages of their subjects; because in a state of nature every man has an inherent right to defend his life, liberty, and property; and what he possessed in his own person, he may for the good of society transfer to another: but no man is by nature, or can make himself, a member of the Christian church; and therefore authority to govern that society can be derived only from him by whom it was founded, and who died that he might “gather together in one all the children of God.”

Against such reasoning as this it hath been urged, that to make institutions, which like baptism and the Lord’s supper are generally necessary to the salvation of all Christians, depend for their efficacy upon the authority or commission of a particular order, appears inconsistent with the wisdom and goodness of God; as by such an economy an intolerable domination would be established over the souls of men, and the purpose for which the behaviour of the world died might be in some degree defeated by the caprice of an ignorant and arbitrary priesthood. The objection is certainly insensible; but the Episcopalian affirms, that either it has no weight, or militates with equal force against the wisdom of Providence in the government of this world. In every thing, he observes, relating to their temporal and to their spiritual interests, mankind are all subjected to mutual dependence. The rich depend upon the poor, and the poor upon the rich. An infant neglected from the birth would barely cry and cease to live; nor is it easily to be conceived, that in the more rigid climates of the earth a full-grown man could provide even the necessaries of mere animal life. Of religious, it is certain that in such a state nothing could be known; for there is not the smallest reason to imagine that any individual of the human race—an Aristotle, a Bacon, or a Newton, had he been left alone from his infancy, without culture and without education, could ever, by the native vigour of his own mind, have discovered the existence of a God, or that such speculations as lead to this discovery would have employed any portion of his time or his thoughts. Even in civilized society it would be impossible, in the present age, for any man, without the assistance of others, to understand the very first principles of our common Christianity; for the scriptures, which alone contain those principles, are written in languages which are now nowhere vernacular. In the fidelity of translators, therefore, every illiterate disciple of Jesus must confide, for the truth of those doctrines which constitute the foundation of all his hopes; and as no man ever pretended that the Christian sacraments are more necessary to salvation than the Christian faith, the Episcopalian sees no impropriety or inconsistency in making those persons receive baptism and the Lord’s supper by the ministration of others, who by such ministration must of necessity receive the truths of the gospel.

By such arguments as these does the Episcopalian endeavour to prove that Christ constituted some permanent order of ministers in the church, to whom in the externals of religion the great body of Christians are commanded to pay obedience; and thus far the Presbyterian agrees with him; but here their agreement ends. They band in hand against the Independent with the same weapons, and then proceed to attack each other. The one maintains, that originally the officers of the Christian church were all presbyters or elders of one order, and vested with equal powers; whilst the other holds, that Christ and his apostles appointed divers orders of ministers in the church; that of these orders the highest alone was empowered to ordain others; and that therefore obedience, as to those who watch for our souls, can be due only to such as are episcopally ordained.

In behalf of the Presbyterian plea it is urged, that the Presbytery, being in the New Testament, was constituted indifferently given to the same persons, cannot plea. be the titles of distinct ecclesiastical officers, which appears still more evident from the ordination of Timothy, who, although he was the first bishop of Ephesus, received his episcopal character by the imposition of the hands of the presbytery.—That one and the same man is, in the New Testament, styled sometimes a bishop and sometimes a presbyter, cannot be denied; but although every apostolic bishop was therefore undoubtedly a presbyter, it does not of course follow, says the Episcopalian, that every presbyter was likewise a bishop. In the Old Testament, Aaron and his sons are without any discrimination of order frequently styled priests; and in the New, both St Peter and St John call themselves presbyters, as St Paul, upon one occasion, styles himself a deacon—σάλλωμα (Eph. iii. 7.): yet no man ever supposed those apostles to have been such ecclesiastical officers as modern presbyters and deacons; and it is universally known, that in the Jewish priesthood there were different orders, and that Aaron was of an order superior to his sons. This being the case, the presbyters, by the laying on of whose hands Timothy was made a bishop, may have been of the same order with arguments St Peter and St John; and if so, it follows that his ordination was Episcopal. At all events, we are certain, continues the advocate for Episcopacy, that it was not, in the modern sense of the word, Presbyterian; for the gift, which in the first epistle is said to have been “given by prophecy with the laying on of the hands of the presbytery,” is in the second said to have been “in him by the putting on of the hands of St Paul,” and here it is worthy of observation, that the proposition under the former case is πέμα, which signifies concurrence rather than instrumentality; but that in the latter is unction, which, as every Greek scholar knows, is prefixed to the instrumental cause by which any thing is effected: so that whatever may have been the order of the presbyters.
byters who consecrated, St Paul appears to have been the sole ordainer. But by the confession of all parties, St Paul was a bishop in the highest sense in which that word is ever used; and the powers of the episcopate not being parcelled out among various partners, of whom each possesses only a share, the imposition of his hands was sufficient for every purpose which could have been effected by the hands of the whole college of apostles.

It appears, therefore, that from the promiscuous use of the titles bishop and presbyter, and from the ordination of Timothy, nothing can with certainty be concluded on either side of this celebrated question. But if, instead of resting on mere words, which when taken alone and without regard to the context, are almost all of ambiguous signification, we attend to some important facts recorded in the New Testament, the Episcopalian thinks we shall in them discover sufficient evidence that the government of the primitive church was presbyterian.

During our Saviour's stay upon earth, it is undeniable that he had under him two distinct orders of ministers—the twelve, and the seventy; and after his ascension, immediately before which he had enlarged the powers of the twelve, we read of apostles, presbyters, and deacons, in the church. That the presbyters were superior to the deacons, and the apostles superior to both, is universally acknowledged; but it has been said, that in Scripture we find no intimation that the apostolic order was designed for permanence. A Quaker uses the same thing of water-baptism; and the Episcopalian observes, that it would be difficult to point out what passage of Scripture, or what mode of reasoning, those who upon this plea reject the apostolic order of Christian ministers, could overthrow the principles upon which the disciples of George Fox reject the use of that rite which our Saviour instituted for the initiation of mankind into his church.

They were the twelve alone to whom Christ said, "Go ye therefore and teach all nations, baptising them in the name of the Father, and of the Son, and of the Holy Ghost:" and therefore, although we frequently find presbyters and deacons administering the sacrament of baptism, we must conclude, that as a judge administers justice by authority derived from his sovereign, so those inferior officers of the church administered baptism by authority derived from the apostles. Indeed, had they pretended to act by any other authority, it is not easily to be conceived how their baptism could have been the baptism instituted by Christ; for it was not with the external washing by whomsoever performed, but with the twelve, and their successors, that he promised to be "always, even unto the end of the world."

That the twelve did not consider this promise, or the commission with which it was given, as terminating with their lives, is evident from their admitting others into their own order; for which they had competent authority, as having been sent by Christ as he was sent by his father. When St Paul, to magnify his office and procure to it from the Galatians due reverence, styles himself, "an apostle not of men, neither by man, but by Jesus Christ and God the Father," he must have known some who derived their apostolic mission by man; otherwise he could with no propriety have claimed particular respect, as he evidently does, from what was in his own apostleship no particular distinction. At that very early period, therefore, there must have been in the church secondary apostles, if they may be so called, upon whom, by imposition of hands, or by some other significant ceremony, the eleven had conferred that authority which was given to them by their Divine Master. Such were Matthias and Barnabas; such likewise were Titus, Timothy, Titus, and the angels of the seven churches in Asia, with many others whose names and offices are mentioned in the New Testament.

That Matthias and Barnabas were of the apostolic order, has never been controverted; and that Timothy and Titus were superior to modern presbyters, is evident from the offices assigned them. Timothy was, by St Paul, empowered to preside over the presbyters of Ephesus, to receive accusations against them, to exhort, to charge, and even to rebuke them; and Titus, was, by the same apostle, left in Crete for the express purpose of setting things in order, and ordaining presbyters in every city. To exhort, to charge, and with authority to rebuke one's equal, is certainly incongruous; and therefore the Episcopalian thinks the powers conferred on Timothy altogether inconsistent with that parity of order and of office for which his antagonists so strenuously plead. Even the commission given to Titus appears in his eyes by much too extensive for a Presbyterian minister, who, after having ordained in one city, could not have proceeded to ordain in another without the consent and assistance of his brother and fellow-labourer. With respect to the angels of the Asiatic churches, he observes, that in the Old Testament the title of angel is sometimes given to the Jewish high-priest, and particularly by the prophet Malachi, who calls him "the messenger (apostolos) of the Lord of Hosts;" and that the angels of the churches mentioned by St John, were Christian high-priests, or bishops presiding over more than one congregation, as it is affirmed by all the ancient writers, cannot, he thinks, be denied by any man who will take the trouble to compare Scripture with Scripture. We read (Acts xix. 10. and 20.), that "in the space of two years all they who dwelt in Asia heard from St Paul the word of the Lord Jesus, both Jews and Greeks; and that there the word of God grew mightily and prevailed:" but with what truth or propriety could this have been said, if at the time of St John's writing the Apocalypse, which was 30 years after St Paul's death, all the Christians of one and the same Asia were comprised in seven congregations, which assembled, each with its proper pastor, to perform, in one place, the duties of public worship? In a word, the advocate for Episcopacy insists, that no man, who reads without prejudice the acts of the apostles, the epistles of St Paul, and the Apocalypse of St John, can seriously believe that Timothy, Titus, Ephesians, Philemon, and Silvanus, with the angels of the seven churches in Asia, were mere presbyters, or that the government of the church was, in those days, by a college of elders.

When from the inspired penmen of the New Testament he proceeds to examine the succeeding writers of the Christian church, the Episcopalian finds such multiplied and concurring evidence of the apostolic institution of episcopacy, as he thinks it impossible to resist without
Episcopacy. The worship of the fathers indeed is at present very low; but should they be allowed to be as faithful and as good as the rest of their sects, they would dare to strike from the other, and would be witness to the constitution of the church in their own times; for of their integrity there can be no doubt: and what the Episcopalian wants of them is only their testimony to matters of fact which fell under the cognizance of their own senses, and which therefore they could not be deceived. It is here indeed chiefly that he triumphs over his antagonists. In the second and third centuries there was no general council, nor any Christian sovereign. A presbytery therefore, he urges, could not have been universally introduced, during that period, either by a concert among the clergy, or by the authority of the civil magistrate. Yet that even then there was no church under heaven, of which the government was not episcopal, has been confessed by some of the most learned writers among the Presbyterians themselves; whence he concludes that episcopacy is of divine institution.

The candid Episcopalian, however, allows, that in the apostolic age there may have been some churches which at first had only bishops and deacons to perform the offices of religion; for when the number of disciples in any place was so small that they could all meet in one assembly, there was no necessity for any other order of ministers: but it appears that, from the very beginning, bishops, presbyters, and deacons, were settled in all the larger cities of the Roman empire; and it was in those days an allowed maxim, that without a bishop there could be no church. The better to understand the original state and institution of episcopacy, it is necessary to observe, that the empire, which contained almost all the known part of the Christian world, was by Augustus Caesar divided into provinces, subjected each to the authority of one chief magistrate, who was commonly a praetor or procenius, and who resided in the metropolis or chief city of the province. A province comprehended the cities of a whole region; and in the age of the apostles, each city was under the immediate government of certain magistrates within its own body, known by the name of presbium or senatorius, ordo and curia, "the states and court of the city." Those magistrates were subordinate to the praetor or procenius, but among them there was one superior to the rest, called sometimes dictator and sometimes defensor civitatis, whose jurisdiction extended not only over the city itself, but likewise over all the adjacent territory. That territory was denominat ed province, or the suburbs, and often reached to the distance of 10 or 12 miles round the city, and sometimes much farther, containing within it many villages and small towns under the government of the city magistrates. From some passages in the New Testament, and from the preceding evidence of the earliest writers of the church, it appears to have been the purpose of the apostles to settle a bishop in every city where there was a civil magistracy: but as they could not be personally present in all places at once, it was natural for them to enter upon the great work of converting the nations by first preaching the gospel in that city of each province which was the ordinary residence of the governor; because to it there must have been the greatest resort of people, who would carry the glad tidings with them into the country when they returned. Accordingly, having dispersed themselves over the empire, and made numbers of proselytes in the principal cities, they fixed in each, where they saw it necessary, a bishop, with a college of presbyters and deacons; and gave to those bishops, who were at first called apostles, a commission, as the other cities of the province should be converted, to fix in them bishops also.

In some of the smaller cities, it is extremely probable that a bishop and a deacon were for a short time the only ecclesiastical officers, till the number of Christians increased so much as to make it impossible for them all to assemble in one house for the purposes of public worship. The bishop then ordained presbyters to officiate in those congregations where he himself could not be present, and to assist him in other parts of his pastoral office; but in all their ministrations the presbyters were subordinate to him, who was the chief pastor within the city, who composed the prayers which were offered up in public; and to whom all the other officers of religion were accountable for their conduct. So long as the number of the faithful was confined within the walls of the city, it was the business of the bishop with his presbyters and deacons to live together as in a college; that divine service was every Lord's day, or oftener, performed in what was afterwards called the cathedral or mother-church, by the bishop himself, assisted by some of his clergy; and that the congregations which met in other churches, having no fixed pastors, were supplied by such presbyters as the bishop chose to send to them from his own church. Whilst matters continued in this state, the clergy had no other revenues than what arose from the voluntary oblations of the people; which were indeed so large as not to support them with decency, but likewise to answer other ends of charity and munificence. They were commonly divided into four equal parts, of which one was allotted to the bishop, a second to the inferior clergy, a third to the poor, and a fourth to keep the churches in repair; and it was considered as a part of the bishop's duty to take care that the offerings should be faithfully applied to these purposes.

When converts increased in number, and churches were built in the suburbs, each of these churches had of its own a fixed pastor similar to a parish-priest among us; but still those pastors, as well as the city-clergy, ministered in subordination to the bishop, whose authority extended as far as the civil authority of the Roman magistrate, within which district or diocese it was supreme over all orders of Christians. This every man knows who is acquainted with ecclesiastical history; for the bishop alone could ordain priests and deacons, administer the rite of confirmation, absolve penitents who were under church censure, and exclude from communion heretics and notorious offenders; and from his sentence there lay no appeal but to a synod of comovincial bishops.

Such synods were in each province convened by the

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bishop
bishop of the chief city; for the apostles having been
careful to place in those cities men of the most emi-
inent gifts and abilities, the other bishops of the pro-
vinces applied to them for advice upon every emerg-
ency, and paid a particular deference to them upon every
occasion. So that though all bishops were of equal
authority as bishops, yet when they met to consecrate a
new bishop, or to deliberate upon the affairs of the
church, they yielded a precedence to the bishop of the
metropolis, who called them together, and who sat as
president or moderator of the synod. Hence the origin
of metropolitans or archbishops; whose authority was so
considerable, that though there is no doubt but the
election of bishops was anciently placed in the clergy
and people of the vacant diocese, yet the bishop elect
could not be consecrated without the consent of the
archbishop of the province.

In consequence of the extensive powers with which
the primitive bishops were vested, they are commonly
styled in the writings of those times presidents, provosts,
or inspectors of the church, chief priests, princes of the
clergy, and even princes of the people; but their author-
ity was wholly spiritual. Those prelates, imitating
the example of their Divine Master when on earth,
neither possessed nor assumed to themselves any juris-
diction over the proprieties or civil rights of men. In
consequence of St Paul’s having reprimanded the Co-
rinthians for going to law before the unbelievers, they
were indeed often chosen as arbiters of such civil dis-
putes as arose between individuals under their episco-
pal government; but on these occasions they could not
act unless the submission was voluntarily made by both
the contending parties, and then their decision was fi-
nal. When the empire became Christian, this privi-
lege was confirmed to them by law; for any civil
cause depending before a court of justice could be
withdrawn, and by the mutual consent of parties be
submitted to the arbitration of the bishop, whose
award, which in former times could be enforced only
by the terror of church-censures, was then enforced by
the secular magistrate. In criminal causes, where the
trial might be for life or death, they were prohibited
both by the canons of the church and by the laws of
the state from acting as judges; and therefore they
never suffered such causes to come before them, except
when it was necessary that the person accused, if found
guilty, should be excluded from the communion of the
faithful. But they had so many civil causes flowing
in upon them, that they were soon obliged to devolve
part of that care upon other persons, in whose know-
ledge, prudence, and integrity, they could fully con-
fide: and as the persons employed to act in the bish-

The probable origin of spiritual courts.
op's stead were often laymen, it has been conjectured
that they gave rise to the office of lay-chancellor in
the church, and to all that train of spiritual judges and
spiritual courts against which such numbers are dis-
posed to clamour.

Be this as it may, it is certain that, through the piety
and munificence of the Christian emperors, the
bispholds enjoyed large revenues and many valuable
privileges; but it does not appear that they had any rank
or authority, as barons or temporal princes, till the Go-
thic nations, which subverted the Roman empire, had
embraced the Christian faith. As Christianity incapac-
itated the leaders of those tribes from officiating as
chief priests at the religious rites which were usually
celebrated at the opening of their public assemblies,
the bishops came naturally to discharge that duty on
such occasions, when they must have shared in the rank
by sharing in the functions of the chief. The situ-
ations in which they thus appeared at the opening of all
political conventions, would enable them to join with
the other version of the Roman empire and
the councils of the Gothic na-

On


Episcopacy.

On complicated questions (says a late apologist for the episcopal church in Scotland), men will always differ in opinion; but conscious each of the weakness of his own understanding, and sensible of the bias which the strongest minds are apt to receive from thinking long in the same tract, they ought to differ with charity and meekness. Thus unhappily there are still so many subjects of debate among those who name the name of Christ; it is doubtless every man's duty, after divesting himself as much as possible of prejudice, to investigate those subjects with accuracy, and to adhere to that side of each disputed question which, after such investigation, appears to him to be the truth; but he transgresses the favourite precept of his divine master, when he casts injurious reflections, or denounces anathemas, upon those who, with equal sincerity, may view the matter in a different light; and by his want of charity does more harm to the religion of the Prince of Peace, than he possibly could do good, were he able to convert all mankind to his own orthodox opinions."

The following is a short history of the episcopal church of Scotland, extracted from a more detailed account by a member of that church.

The real tenets of the Scotch episcopalians, or members of what was at one period the established church of Scotland, he observes, appear to be imperfectly understood. About the time of the reformation from popery, the want of order and decency in the worship of the reformed church was abolished in the reign of James VI. by the establishment of episcopacy on very liberal principles. This mode of worship obtained the sanction of the most respectable part of the nation, and continued to flourish under the auspices of government, till it was overthrown by the sticklers for the national covenant. Its restoration was effected in the year 1662, and twenty-seven years afterwards it was again abolished by the advocates of the prince of Orange.

It may be proper to observe, that the Scotch episcopal church had no public liturgy during her legal establishment. It is indeed true, that the English book of common prayer was used by the first reformers, and there is reason to believe that John Knox himself was by no means impecunious to set forms of prayer nor in clerical subordination; but his successor, Andrew Melvil, a man much inferior to him in point of erudition, introduced an equality among the clergy, and excised the odium of the people against the liturgy to such a degree, that an attempt to modify the prayer book for the use of the church of Scotland, was productive of the solemn league and covenant, and the subsequent ruin of the unfortunate Charles.

During the reign of William III. the episcopalians were treated with some degree of severity, because they could not transfer that allegiance to him which they had sworn to King James. It is said that they were prohibited from offering up on the sabbath day, except "in their own hired houses, where they received such friends as chuse to come in unto them." In this manner was their worship conducted, praying either externally, or from presanctification, till the accession of Queen Anne, when the English liturgy was introduced by degrees into Scotland, under the sanction of an act of parliament, passed on the 3d of March 1712, "to prevent the disturbing of those of the episcopal communion in that part of Great Britain called Scotland, in the exercise of their religious worship, and in the use of the liturgy of the church of England." But as their attachment to the house of Stuart was well known, they were, at the rebellion in 1715, laid under some restraints, yet neither severe in their nature, nor of any long continuance, since in 1720 their places of worship were as numerous as before, and frequented by numbers both of rank and respectability, many of whom held places under government.

In England, Dr Sanerofch, archbishop of Canterbury, with five other bishops, were deprived of their sees for refusing their allegiance to King William, which occasioned a schism in the church, as they were extremely popular. Different opinions were entertained respecting the nature and design of the Lord's Supper, and the controversy infected the episcopalians of Scotland. The introduction of prayers into public worship in behalf of departed friends, was at least a very impolitic step at such a critical period, when every thing savouring of popery was held in the utmost abhorrence. On the death of Dr Rose, the presbyter of Edinburgh, the diocesan form of church government was opposed by such of the presbyters as had been raised to the episcopal dignity, and it was proposed to govern the whole church by a college of bishops. This plan, for the adoption of which no precedent could be found in the annals of history, was successfully opposed by many of the most enlightened bishops, and it was of consequence abandoned.

The Scotch episcopalians, it is well known, were always charged with an undue attachment to the Stuart family, which was even considered as their most distinguishing tenet; yet there is some reason to believe that the public opinion of this matter was rather exagerrated. They have invariably maintained that the Almighty, and not the people, is the ruler of princes, which fairly places them beyond the imputation of a republican or levelling spirit. The several restraints laid on Scotch episcopalians from time to time, with a view to eradicate their attachment to the Stuart family, were happily removed in the year 1792, and they enjoyed a free toleration like the rest of dissenters. It was about this time that the clergy of this church, with a very few exceptions, took the oaths of abjuration and allegiance.

It is well known, it is added by the same writer, from whose account the above is taken, that in Scotland there are chapels quite distinct from the Scotch episcopal church, where clergymen who have been ordained either in England or Ireland, make use of the liturgy of the church of England; but as each of these is strictly and properly independent of the rest, and under the guardianship of no bishop whatever, those who attend them have, in every sense of the word, a much better claim to the appellation of congregationalists than to that of episcopalians.

**EPISCOPAL,** something belonging to Bishops.

**EPISCOPALIANS,** in church history, an appellation given to those who prefer the episcopal government and discipline to all others. See **EPISCOPACY.**

By the test act, none but episcopalians, or members of the church of England, are qualified to enjoy any office civil or military.

**EPISCOPIUS, Simon,** one of the most learned men
Epistolary, something belonging to an epistle.

See Epistle.

Epistolarie Compositions. See Letter; and the article Poetry.

Epistrophe. See Oratory.

Epistyle, in the ancient architecture, a term used by the Greeks for what we call architrave, viz. a massive piece of stone or wood, laid immediately over the capital of a column.

Epitaph (from εἰπεῖν, upon, and εἰπεῖτο sepulchre,) a monumental inscription, in honour or memory of a person deceased. It has been disputed whether the ancient Jews inscribed epitaphs on the monuments of the dead; but be this as it will, epitaphs, it is certain, of very ancient date, are found among them.—The Athenians, by way of epitaph, put only the name of the dead, with the epithet γερος, signifying "good," or σως, "hero," and the word γενος, signifying their good wishes: the name of the deceased's father and his tribe were frequently added.—The Laconians allowed epitaphs to none but those who had died in battle. The Romans inscribed their epitaphs to the names δίω, διά μανιουs; and frequently introduced the dead by way of propositio, speaking to the living, of which we have a fine instance, worthy the Augustan age, whereon the dead wife thus bespeaks her surviving husband:

Immatura peri; sed tu, felicior, annos
Vive tuo, conjun, optime, vive meos.

The epitaphs of the present day are generally cramped with fulsome compliments which were never merited, characters which human nature in its best state could scarce lay claim to, and expressions of respect which were never paid in the life-time of the deceased. Hence the proverb: "He lies like an epitaph." 

Epitaph is also applied to certain ologies, either in prose or in verse, composed without any intent to be engraved on tombs; as, that of Alexander,

Sufficit hujus tumulus, cui non sufficere orbit.

and that of Newton.
EPITHEM, in Pharmacy, a kind of fomentation, or remedy of a spirituous or aromatic kind, applied externally to the regions of the heart, liver, &c. to strengthen and comfort the same, or to correct some intemperance thereof.

EPITHET, in Poetry and Rhetoric, an adjective expressing some quality of a substantive to which it is joined; or such an adjective as is annexed to substantives by way of ornament and illustration, not to make up an essential part of the description. Nothing, says Aristotle, tires the reader more than too great a redundancy of epithets, or epithets placed improperly; and yet nothing is so essential in poetry as a proper use of them. The writings of the best poets are full of them.

EPITOME, in literary history, the same with ABREVIAMENTUM.

EPITRITUS, in prosody, a foot consisting of three long syllables and one short. Of these, grammarians reckon four kinds: the first consisting of an iambus and spondee, as αἰκλίσσανα; the second, of a trochee and spondee, as ἀκούει; the third, of a spondee and an iambus, as κοκύλης; and the fourth, of a spondee and trochee, as ὅμονει. See the articles Spondee, Trocheus, &c.

EPITROPE. See ORATORY, No 83.

EPITROPUS, a kind of judge, or rather an arbitrator, which the Greek Christians, under the dominion of the Turks, elect in the several cities, to terminate the differences that arise among them, and avoid carrying them before the Turkish magistrates. See ARBITRATOR.

Anciently the Greeks used the term συλπορεία, in the same sense as the Latins did procurator, viz. for a commissioner or intendant. Thus the commissioners of provisions in the Persian army are called by Herodotus and

Xenophon επιστροφεῖ. In the New Testament, συλπορεία Epistresus denotes the steward of a household, rendered in the vulgate procurator.

EPIZEUXIS. See ORATORY, No 68.

EPOCHA, in Chronology, a term or fixed point of time whence the succeeding years are numbered or counted. See ΑΣΧΟΛΙΑ.

EPODE, in lyric poetry, the third or last part of the ode, the ancient ode being divided into strophe, antistrophe, and epode. See ODE, &c.

The epode was sung by the priests, standing still before the altar, after all the turns and returns of the strophe and antistrophe, and was not confined to any precise number or kind of verses.

The epode is now a general name for all kinds of little verses that follow one or more great ones, of what kind soever they be, and in this sense a pentameter is an epode after an hexameter. And as every little verse, which, being put after another, closes the period, is called epode; hence the sixth book of Horace's odes is intitled liber epodon, "book of epodes," because the verses are all alternately long and short, and the short ones generally, though not always, close the sense of the long one.

EPOPOEIA, in Poetry, the history, action, or fable, which makes the subject of an epic poem. The word is derived from the Greek ποιεῖν, "to make," and εποποιέω, "I make."

In the common use of the word, however, epopoeia is the same with cypis, or epic poem itself. See the article POETRY.

EPOPS, or HOOPES. See UPUPA, ORNITHOLOGY.

EPSON, a town of Surry, about 16 miles south-west from London, long famous for its mineral waters. These were discovered in 1618; and though not in such repute as formerly, yet they are not impaired in virtue, and the salt made from them is famous all over Europe, for gently cleansing and cooling the body. The hall, galleries, and other public apartments, are now run to decay; and there remains only one house on the spot, which is inhabited by a countryman and his wife, who carry the waters in bottles to the adjacent places, and supply the demands of dealers in London. On the neighbouring downs are annually horse-races; but the inns, shops, and bowling-greens are not near so much frequented as formerly. The market is on Friday, fair, July 25. The town is about one mile and a half in semicircle, from the church to the palace at Durdans, which was burnt down some years since, but has been rebuilt. It was once inhabited by the late king's father. In Hudson's Lane here was Epsom Court, an ancient Saxon seat, long since converted into a farm. Here are so many fields, meadows, orchards, gardens, and the like, that a stranger would imagine that the town was built in a wood. The population in 1811 was 2755.

Epsom water is easily imitated by art; i.e. by only dissolving half an ounce of Epsom salt in a quart of pure water, made somewhat brisk or quick by adding a little sulphuric acid and potash, so as to let the alkali prevail.

EPULARES, in antiquity, an epithet given to those who were admitted to the sacred eplum or entertainments.
EQUATORIAL INSTRUMENT. See Astronomy Equatorial.

EQUERIE, or EURY, a grand stable or lodge for horses, furnished with all the conveniences thereof; as stalle, manger, rack, &c. The word is formed from the French escuier, which signifies the same thing. Some again derive escuir from the Latin servus, which not only denotes a place for beasts to be put up in, but also a groom or barn. But a more probable derivation is from escuir, "a stable for horses," of eque, "horse." Some hold that the word stable, in propriety, relates only to bullocks, cows, sheep, dogs, &c. and equery, to horses, mules, &c.

A simple equery is that provided for one row of horses; a double equery that provided for two, with a passage in the middle, or two passages; the horses being placed head to head, as in the little equery at Versailles.

Under equery are sometimes also comprehended the lodgings and apartments of the equerries, grooms, pages, &c.

EQUERIE (escuirer), is also an officer who has the care and management of the horses of a king or prince.

EQUERIES, or Equeriers, popularly called Querries, are particularly used among us for officers of the king's stables, under the master of the horse; seven in number, who, when his majesty goes abroad, ride in the leading coach, are in waiting one at a time monthly, and have a table with the gentlemen stablemen during the time, and a salary of 300l. a-year each. They used to ride on horseback by the coach side when the king travelled; but that being more expensive to them than necessary to the sovereign, it has been discontinued.

Equerries of the Crown Stable have that appellation, as being employed in managing and breaking the saddle-horses, and preparing them for the king's riding. These are two in number; the first having an annual salary of 25l. and the second 200l. without one is, or always should be, in close waiting at court; and when his majesty rides, holds the stirrup, while the master of the horse, or one of the equerries in his absence, assists in mounting him: and when his majesty rides, they usually attend him.

EQUES, in antiquity. See Equestrian Order and Equites.

Eques Aureus is used to signify a knight-bachelor, called auratus, q. d. gold, because anciently none but knights might gild or beautify their armor or other habiliments of war with gold. In law this term is not used, but instead of it strikes, and sometimes charioteer.

EQUESTRIA, among the Romans, a place in the theatre where the equites or knights sat.

Equestrian (eques), a term chiefly used in the phrase equestrian statue, which signifies a statue representing a person mounted on horseback. The word is formed of the Latin equus, "horse," and equus, "horse.

Equestrian Games, among the Romans; Horse-races, of which there were five kinds, the praetorians or plain horse-race, the chariot-race, the decurians-race about funeral piles, the ludi scelerati, and the ludi numenales.

Equestrian Order, among the Romans, signified their
EQUATION their knights or equites; as also their troopers or horsemen in the field; the first of which orders stood in contradistinction to the senators; as the last did to the foot military, or infantry. Each of these distinctions was introduced into the state by Romulus.

EQUIANGULAR, in Geometry, an epithet given to figures whose angles are all equal: such are a square, an equilateral triangle, &c.

EQUIDISTANT, an appellation given to things placed at equal distances from some fixed point or place to which they are referred.

EQUILATERAL, in general, something that hath equal sides; as an equilateral triangle.

EQUILIBRIUM, in Mechanics, is when the two ends of a lever or balance hang so exactly even and level, that neither doth ascend or descend, but both keep in a position parallel to the horizon; which is occasioned by their being both charged with an equal weight.

EQUIMULTIPLES, in Arithmetic and Geometry, are numbers or quantities multiplied by one and the same number or quantity. Hence, equimultiples are always in the same ratio to each other as the simple quantities before multiplication, thus, if 6 and 8 are multiplied by 4, the equimultiples 24 and 32 will be to each other as 6 to 8.

EQUINOCTIAL, or ÆQUINOCTIAL, in Astronomy, a great and immovable circle of the sphere, under which the equator moves in its diurnal motion. The equinoctial or equinoctial line is ordinarily confounded with the equator; but there is a difference; the equator being moveable, and the equinoctial immoveable; and the equator being drawn about the convex surface of the sphere, but the equinoctial on the concave surface of the magnus orbis.

Whenever the sun in his progress through the ecliptic comes to this circle, it makes equal days and nights all round the globe; as then rising due east and setting due west, which be never does at any other time of the year. And hence the denomination from æquus and noct, " night;" quia æquar diem nocti.

The equinoctial then is the circle which the sun describes, or appears to describe, at the time of the equinoxes; that is, when the length of the day is everywhere equal to that of night, which happens twice a-year. See Équinox.

EQUINOCTIAL, in Geography, See Equator.

The shadows of those who live under this circle are cast to the southward of them for one half of the year, and to the northward of them during the other half; and twice in a year, viz. at the equinoxes, the sun at noon casts no shadow, being in their zenith.

From this circle is the declination or latitude of places accounted in the degrees of the meridians.

EQUINOCTIAL Points, are the two points wherein the equator and ecliptic intersect each other; one being in the first point of Aries, called the vernal point or æquinox; and the other in the first point of Libra, the autumnal point or æquinox.

EQUINOCTIAL Dial, is that whose plane lies parallel to the equinoctial. See Dial.

EQUINOX, or ÆQUINOX, in Astronomy, the time when the sun enters one of the equinoctial points.

The equinoxes happen when the sun is in the equinoctial circle; when of consequence the days are equal to the night throughout the world, which is the case twice a-year, viz. about the 20th of March and the 23rd of September, the first of which is the vernal and the second the autumnal æquinox.

It is found by observation, that the equinoctial points, and all the other points of the ecliptic, are continually moving backwards, or in retrogradation; that is, westward. This retrograde motion of the equinoctial points, is that famous and difficult phenomenon called the progression of the æquinoxes. See Astronomy Index.

EQUIPAGE, in the military art, denotes all sorts of utensils, artillery, &c. necessary for commencing and prosecuting with ease and success any military operations. Camp and field equipage consists of tents, kitchen-furniture, saddle-horses, baggage-waggons, batteaux, &c.

To EQUIP, in naval language, a term borrowed from the French marine, and frequently applied to the business of fitting a ship for sea, or arming her for war.

EQUIPOLLENCE, in Logic, is when there is an equivalence between any two or more terms or propositions; i.e. when they signify one and the same thing, though they express it differently. Such propositions, &c. are said to be equipollent.

EQUIRIA, in antiquity, a festival instituted by Romulus, and celebrated on the 29th of February, in honour of Mars, at which there were horse-races.

EQUISETUM, Horse-tail; a genus of plants belonging to the cryptogramia class; and in the natural method ranking under the 51st order, Coniferae. See Botany Index.

EQUITES, amongst the Romans, were persons of the second degree of nobility, immediately succeeding the senators in point of rank. The équites or knights were required to be possessed of 400 sextertia before they could be admitted into that order; and when the knights were so reduced as to fall short of the prescribed revenue, they were expelled out of the equestrian list. The equestrian revenue just mentioned amounted to about 10,000 crowns.

Part of the ceremony whereby the honour of knighthood was conferred amongst the Romans was the giving of a horse; for every éques or knight had a horse kept at the public charge: he received also the stipend of a horseman to serve in the wars, and wore a ring which was given him by the state. The équites composed a large body of men, and constituted the Roman-cavalry; for there was always a sufficient number of them in the city, and nothing but a review was requisite to fit them for service.

The knights at last grew too powerful, were a balance for the senate and people, neglected the exercises of war, and betook themselves to civil employments. The équites were liable to be punished by the censors, and to suffer degradation. They were degraded by taking from them the horse which was kept for each of them at the public charge; this was called équam aliens.

EQUITY, in a general sense, the virtue of treating all other men according to reason and justice, or as we would be gladly treated ourselves when we understand aright what is our due. See Justice.

EQUITY, in jurisprudence, is defined a correction or qualification of the law, generally made in that part wherein it faileth or is too severe. It likewise signifies the
the extension of the words of the law to cases unexpressed, yet having the same reason; so that where one thing is enacted by statute, all other things are enacted that are of the same degree. For example, the statute of Gloucest gives action of waste against him that holds lands for life or years; and by the equity thereof, a man shall have action of waste against a tenant that holds but for one year, or one half-year, which is without the words of the act, but within the meaning of it; and the words that enact the one, by equity enact the other. So that equity is of two kinds. The one abridges and takes from the letter of the law; the other enlarges and adds to it; and statutes may be construed according to equity, especially where they give remedy for wrong, or are for expedition of justice. Equity seems to be the interposing law of reason, exercised by the lord chancellor in extraordinary matters to do equal justice; and by supplying the defects of the law, gives remedy in all cases. See CHANCERY.

Equity, in Mythology, sometimes confounded with Justice, a goddess among the Greeks and Romans, represented with a sword in one hand and a balance in the other.

Equivalent, is understood of something that is equal in value, force, or effect, to another.

Equivalence is of various kinds; in propositions, in terms, and in things.

Equivalent Propositions. See Equifolience.

Equivalent Terms, are where several words that differ in sound have yet one and the same signification; as everybody was there, and nobody was absent, nihil non, and omne.

Equivalent Things, are either moral, physical, or statistical. Moral, as when we say that the commanding or advising a murder is a guilt equivalent to that of the murderer. Physical, as when a man who has the strength of two men is said to be equivalent to two men. Statistical, whereby a less weight becomes of equal force with a greater, by having its distance from the centre increased.

EquiVocal Terms or Words, among logicians, are those which have a doubtful or double meaning.

According to Mr. Locke, the doubtfulness or uncertainty of words has its cause more in the ideas themselves, than in any incapacity of the words to signify them; and might be avoided, would people always use the same term to denote the same idea or collection of ideas: but, adds he, it is hard to find a discourse on any subject where this is the case; a practice which can only be imputed to folly or great dishonesty; since a man, in making up his accounts, might with as much fairness use the numerical characters sometimes for one sometimes for another collection of units.

EquiVocal Generation, the production of animals without the intercourse between the sexes, by the influence of the sun or stars, &c.

This kind of generation is now quite exploded by the learned.

EquiVocation, the using a term or expression that has a double signification. Equivocations are expedients to save telling the truth, and yet without telling a falsity. The fathers are great patrons of equivocations and mental reservations, holding that the use of such shifts and ambiguities is in many cases allowable.

EQUULEUS, or ECOULEUS, in antiquity, a kind of rack used for extorting a confession; at first chiefly practised on slaves, but afterwards made use of against the Christians.

The equuleus was made of wood, having holes at certain distances, with a screw by which the criminal was stretched to the third, sometimes to the fourth or fifth holes, his arms and legs being fastened on the equuleus with cords; and thus was hoisted aloft, and extended in such a manner, that all his bones were dislocated. In this state red-hot plates were applied to his body, and he was gashed in the sides with an instrument called an ungula.

EQUULEUS, EQUICULUS, and EQUUS Minor, the horse's head, in Astronomy, a constellation of the northern hemisphere, whose stars in Ptolemy's catalogue are four, in Tycho's four, in Hevelius's six, and in Mr. Flamstead's ten.

EQUUS, a genus of quadrupeds belonging to the class mammalia, and order of bellers. See MAMMALIA Index. And for the diseases of the horse, see Farriery Index.

ERA, in Chronology. See AERA.

ERANARCHA, a public officer among the ancient Greeks, whose business was to preside over and direct the alms and provisions made for the poor. Cornelius Nepos, in his life of Esamandros, describes his office thus: When any person was reduced to poverty, taken captive, or had a daughter to marry, which he could not effect for want of money, &c. the eranarcha called an assembly of friends and neighbours, and taxed each according to his means and estate, to contribute towards his relief.

ERANTHEMUM, a genus of plants belonging to the diandria class. See Botany Index.

ERASISTRATUS, a celebrated physician, grandson to the philosopher Aristotle. He discovered by the motion of the pulse the love which Antiochus had conceived for his mother-in-law Stratonic, and was rewarded with 100 talents for the cure by the father of Antiochus. He was a great enemy to bleeding and violent physic.

ERASMUS, DESIDERIUS, born at Rotterdam in 1467. He lost his father and mother at 14 years of age; and was committed to the care of certain guardians, who would force him to be an ecclesiastic, which he refused for a long time. However, he was obliged to assume the religious habit among the canons regular in the monastery of Stevin near Tergou; but afterwards obtained a dispensation from his vows. He was the most learned man of the age in which he lived; and contributed, by his example and his writings, to the restoration of learning in the several countries in which he occasionally resided, viz. Italy, Switzerland, Holland, France, and England: with the last, he was most satisfied; and found the greatest encouragement from Henry VIII. Sir Thomas More, and all the learned Englishmen of those days. He published a great many books; and died at Basel in 1536. He was buried honourably, and his memory is still held in veneration. He had, however, many enemies; and as he did not embrace the reformation, and yet censured many things in popery, he hath been treated injuriously both by the Catholics and Protestants. The works of Erasmus in 10 vols. folio were published at Leyden in
There is also an erection of the clitoris, which is performed by muscles for that purpose.

EREIT. See HERMIT.

EREBRIA, in Ancient Geography, a town of Euboea, situated on the Euripus, in the south-west of the island. A very ancient city, and the largest of the island, after Chalcis. After being demolished by the Persians, it was restored on an adjoining spot, according to Strabo, who mentions a school of Eretrian philosophers there. The Abantes of Homer were of Euboea.

ERFORT, a town of Germany, in the circle of Upper Saxony, the capital of Thuringia, and subject to the elector of Mentz. It is defended by good ramparts; and has a castle on an eminence, which commands the town. Its inhabitants are almost all Lutherans, but its principal churches belong to the Catholics. There are several handsome structures, both public and private; but the houses in general are but indifferently built. E. Long. 13. 14. N. Lat. 50. 49.

ERGASTULUM, among the Romans, was a prison, work-house, or house of correction, where slaves by the private authority of their masters were confined and kept for their offences to hard labour. The Greeks had a place of confinement of this sort called Σκοπανήμακα.

ERGOT, in Farriery, is a stub, like a piece of soft born, about the bigness of a chestnut, placed behind and below the pastern joint, and commonly bid under the tuft of the fetlock. See Farriery Index.

ERICA, HEATH, a genus of plants belonging to the octandria class, and in the natural method ranking under the 28th order, Bicones. See Botany Index.

ERIDANUS, in Ancient Geography, a river of Attica, falling into the Ilissus.—Another Eridanus, the more ancient name of the Padoan, an appellation ascribed by Pliny to the Greeks; followed in this by Virgil. It rises in Mount Vesulus, in the Alpes Cotiae, and dividing the Cisalpine Gaul into the Cispadana and Transpadana, and swelled on each hand with no inconsiderable rivers from the other Alps and the Apennines, falls by seven mouths into the Adriatic. Famous in mythology, from the story of Phaeton; whose sisters, the Heliaeides, were here changed into poplars, according to Ovid.

ERIDANUS, in Astronomy, a constellation of the southern hemisphere, in form of a river.—The stars in the constellation Eridanus, in Ptolemy's catalogue, are 34; in Tycho's, 19; and in the British catalogue, 84.

ERIE, a vast lake to the westward of Pennsylvania, in North America, situated between 80° and 87° W. Long. and between 41° and 42° N. Lat.

ERIGENA, or SCOTUS, JOHN, a famous scholastic divine, born about the beginning of the ninth century; but where, is a matter of dispute among authors. Bale and Pitts say he was born at St David's in Wales; Dampier, Mackenzie, and Henry, that he was born at Ayr in Scotland; which they infer from his names Erigena and Scotus, by the latter of which he was generally distinguished by his contemporary writers. But Dr Pin and Sir James Ware assert that he was by birth an Irishman; Ireland being in those days called Scotia,
ERIGERON, FLEA-BANE, a genus of plants, belonging to the syn genomia class; and in the natural method ranking under the 45th order, Composite. See BOTANY Index.

ERIGONE, in fabulous history, daughter to Icarus, died of grief for her father's death, was translated into heaven, and makes the sign Virgo. See ERINACEUS, or HEDGE-HOG, a genus of quadrupeds belonging to the order of ferme, in the class mammalia. See MAMMALIA Index.

ERINO. See EXTHYGIUM, BOTANY Index.

ERINUS, a genus of plants belonging to the dynameia class; and in the natural method ranking under the 40th order, Personae. See BOTANY Index.

ERIOCAULON, a genus of plants belonging to the triandria class; and in the natural method ranking with the sixth order, Enotes. See BOTANY Index.

ERIOCEPHALUS, a genus of plants, belonging to the syn genomia class; and in the natural method ranking under the 45th order, Composite. See BOTANY Index.

ERIOPHORUM, a genus of plants, belonging to the triandria class; and in the natural method ranking under the third order, Calematia. See BOTANY Index.

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

ERIVAN, a city of Persia, in Asia, and capital of Persian Armenia. It is a large, dirty, ill-looking place, in which are no handsome buildings, the houses being very mean, and raised with earth or mud; but it is full of gardens and vineyards. It is situated in a plain which is surrounded on all sides with mountains. Two rivers pass near it, the Zengi to the north-west; and the Quer Boulac to the south-west. The fortress may pass for a town of itself; it is of an oval form, and is four miles in circumference, containing about 300 houses. It is inhabited by none but the native Persians. The Armenians have shops in it, where they work and trade in the day time, but at night return to their habitations in the city. The fortress is surrounded with three walls, made with bricks dried in the sun, which have battlements, and are flanked with towers, and defended with rams. On the north-east there is a dreadful precipice, above 200 yards in depth, at the bottom of which the river runs. The garrison usually consisted of 3000 men; but how many there are since the revolution is hard to say. The palace of the governor of the province is within the fortress. The city is
INTRODUCTION.

ERPETOLOGY.

ERETHIS, in Aesop's folk-tales, is the god of the land of Eriu, a country far from the real world. He is the god of the earth, of the land, of the fields, of the forests, of the mountains, of the seas, of the rivers, of the fountains, of the springs, of the wells, of the brooks, of the streams, of the lakes, of the pools, of the seas, of the oceans, of the gulfs, of the bays, of the harbors, of the ports, of the havens, of the coasts, of the islands, of the continents, of the planets, of the sun, of the moon, of the stars, of the constellations, of the quasars, of the galaxies, of the universes, of the cosmos, of the multiverse, of the beyond.

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E R P E T O L O G Y.

The word reptile, by which this order of animals has been distinguished by Linnaeus, seems not to be liable to much objection. All the individuals of which it is composed have short legs, and these are placed at a great distance from each other, and so weak, that they are unable to support the weight of the body. The gray lizard, for instance, which is one of the most active of the tribe, is obliged to support itself on its belly, as soon as its progressive motion is greatly diminished; so that it employs its limbs rather for the purpose of crawling than that of walking. And indeed all the animals of the order, from the peculiar structure and disposition of their limbs, when their motions are slow, must drag the body along on the belly, other modifications of their locomotive powers depending only on the great length and relation of the instruments of motion. In this view, therefore, the Linnean name of the order is not improperly applied to almost all the individuals which it comprehends.

The term reptology, which we have given to this creative upon the order reptilia, was formerly employed by the Swedish naturalist Klein, in a more extensive sense. Under this title he included the order serpentes, as well as that of reptilia, thus comprehending the whole class of amphibia. Here we have adopted it in a more limited acceptance, and confined its meaning to the last order, pursuing the plan of M. Bonnettere, in his arrangement of the same order of animals in the Encyclopædia Methodique.

Linnaeus has adopted as a mark of distinction of this order of animals, the peculiar structure of the heart, which in the language of the anatomist is said to be unicellular, or furnished only with one ventricle or cavity. This doctrine has been admitted by eminent anatomists, as well as by some of the greatest physiologists, such as Boerhaave, Haller, and some others; and called in question only when some exceptions have occurred, of animals belonging to this tribe, which have exhibited somewhat of a different structure. One instance of this is quoted in the heart of an Indian inland tortoise, which was examined by the French academicians of the 17th century, and in which they discovered three ventricles instead of one. But other physiologists are of opinion, that the heart of this order of animal is really furnished with two ventricles, having an intermediate communication between them; they must therefore be considered as having a double heart.

The lungs of the order of reptilia, are, in their appearance and structure, widely different from those of other animals. They are in general composed of two lateral bladders, or membranous bags, which, in the different species, are divided into a greater or smaller number of cancelli, or subdivisions; among which are distributed the pulmonarv blood-vessels. These bear but a small proportion to the vesicular part through which the ramifications are carried; in this respect differing greatly from the lungs of the higher order of quadrupeds, or mammalia, in which the proportion of the blood-vessels is so much greater than that of the air-cells, that the lungs have more of a flabby than of a membranous appearance. In this order of animals, therefore, in which the blood is cold, the vesicular system far overbalances the vascular; but in the class mammalia, which are warm-blooded animals, the vascular system prevails over the vesicular.

Of all the animals which occupy the surface of the earth, and which the Almighty creator has dispersed throughout his works, to fill up the void space, and to produce motion, the tribe of reptiles seems at first sight to have been least the objects of beneficence and wisdom. In their structure, habits, and modes of life, when compared with other orders of animals, they exhibit marks of degradation and neglect. The body in general presents only a rude inactive mass; their senses are extremely obtuse; their instincts are limited to the grossest sensations, and the extent of their enjoyments reaches only to the gratifications of appetite. On the boundaries of land and water, in those vast morasses, which are remarkable only for immense depositions of mud, few or scarcely any possess the graces or elegance of other terrestrial animals; like the latter they enjoy not the pleasure of associating together for amusement or defence; or of indulging in sportive tricks on the land or in the air. On the contrary, they crawl on the earth, on the margin of extensive lakes, surrounded with unwholesome vapours; or they live in the cavities of the rocks, or in the midst of barren deserts, disturbed by other animals, and far retired from the habitations of man. Some delight in exposing themselves to the rays of the sun; while others retire during the day to shady, moist, and sequestered places, proceeding from their retreats only during the night, as it were to conceal their deformity, and to spare man those feelings of fear, disgust, and horror, with which their presence inspires him. But as the study of every part of the long chain of beings is worthy of our attentive consideration and regard, these animals, in the eyes of the careful observer of nature, are far from being wanting in exciting his interest and curiosity. He cannot fail to be highly gratified with contemplating the resources which they derive from the peculiar structure of their external form, as well as from the nature of their functions. Their manners, their habits, and the relations which they bear to beings of a higher order, on the one hand, and the distance to which they are removed from brute matter on the other, are objects worthy of the contemplation of the naturalist. This study, properly directed and applied, unveils to our eyes the beneficial design.
design and riches of creation, and raises our admiration to the wonderful and extensive variety of animated beings.

The uses of some of the animals belonging to this class, as valuable articles of food in those regions where they abound, or as furnishing the tables of the luxurious in other countries with a rich delicacy; the peculiarities of external form, and of internal structure, as well as of several of their functions, such as circulation and respiration; their great length of life; the reproductive power of some, and the long abstinence which others can undergo, give additional interest and importance to the natural history of these animals.

In the following treatise, we propose to lay before our readers a brief but comprehensive view of the natural history of this order of animals; and for the sake of perspicuity we shall treat this subject under two general heads. We shall first consider the classification and natural history of the order reptilia; and secondly, we shall give a short sketch of their anatomy, with the principal facts connected with their physiology. These will form the subjects of the two following chapters.

**CHAP. I. OF THE CLASSIFICATION AND NATURAL HISTORY OF REPTILES.**

In the Linnean arrangement, the order reptilia is divided into four genera. Other naturalists have adopted a different arrangement. De la Cepede, in his history of oviparous quadrupeds, has divided this order into two great classes. The first class includes those animals which are furnished with a tail, and the second comprehends those which have no tail. The following table exhibits a view of the classification of this eminent naturalist.

**Class I. Animals furnished with a tail.**

**Genus 1. Testudines,** having the body covered with a bony shield.
Division 1. The fingers very unequal, and lengthened out in the form of fans.
Division 2. The fingers very short, and almost equal.

**Genus 2. Lizards:** the body having no bony covering.
Division 1. The tail flattened; five fingers on the fore feet.
Division 2. The tail round; five fingers on each foot, and elevated scales on the back.
Division 3. The tail round; five fingers on the fore feet; scaly bands under the belly.
Division 4. The tail round; five fingers on the fore feet, without scaly bands under the belly.
Division 5. The fingers furnished underneath with large scales, covering each other, like the slates on the roof of a house.
Division 6. Three fingers on the fore and the hind feet.
Division 7. Membranes in the form of wings.
Division 8. Three or four fingers on the fore feet; four or five fingers on the hind feet.

**Class II. Animals which have no tail.**

**Genus 1. Frogs:** the head and the body lengthened out, and the one or the other angular.

**Genus 2. Tree Frogs:** the body long, with soft viscous tubercles under the toes.

**Genus 3. Toads:** the body thick and round.

**Appendix. Biped reptiles.**
Division 1. Two fore feet.
Division 2. Two hind feet.

Of this arrangement it may be observed, that, although it exhibits much minuteness and ingenuity, the distinctive characters upon which some parts of it are founded, are not always constant and fixed; for it has been found that these characters vary in the different individuals in which they have been observed. This variety, it has been conjectured, arises from the difference of age, and peculiarities in their food and modes of life.

M. Bonnière has adopted a different arrangement. He has also divided the whole order of reptiles into two classes, as will appear from the following table.

**Class I. Reptiles which have no tail.**

**Genus 1. Frog.**
**Genus 2. Tree Frog.**
**Genus 3. Toad.**

**Class II. Reptiles which are furnished with a tail.**

**Genus 1. Tortoise.**
**Genus 2. Chameleon.**
**Genus 3. Crocodile.**
**Genus 4. Lizard.**
**Genus 5. Flying dragon.**
**Genus 6. Salamander.**
**Genus 7. Chaetis.**

This arrangement is undoubtedly, in many cases, convenient and proper; yet, as there seems to be in others an unnecessary multiplication of genera, we shall still adhere to the Linnean classification, which, though more simple, will in general be found not to be much less accurate; and the objects which it comprehends not being very numerous, it is sufficiently distinct. Linnaeus divided this order into four genera. The following are the characters of the genera, of which we give a translation, for the accommodation of the English reader.

**GENERIC CHARACTERS.**

**Genus I. Testudine.** Corpus caudatum; loricæ ossæ aut coriaceæ superæ et inferæ, vel squamis superæ obtectum. Oris mandibula superior inferiorem pyxidum instar claudens.

**Genus II.**
E RPETOLOGY:

Genus II. FROG. Body four-footed, naked, generally without tail; the hinder foot longest; and without any integument but the skin.

Genus III. DRAGON. Body four-footed, furnished with a tail, and on each side with an expanded wing-like skin.

Genus IV. LIZARD. Body four-footed, elongated, furnished with a tail, without any additional integument; legs equal.

I. TESTUDO, or TURTLE.

From the great similarity which prevails among several species, and the variety in size, colour, and other circumstances, according to the different periods of their age, considerable difficulties have arisen in discriminating them with precision. The observations of later naturalists have shown, that the specific characters of Linnaeus are not sufficient for the purpose of accurate distinction; nor have the descriptions of the Count de la Cépède been more useful in furnishing proper characteristic marks. The set of characters, which have been usually employed for this purpose, has been observed by Mr. Schepel, ought not to be trusted. They are derived from the number of claws on the feet of marine tortoises, or turtles. These, however, are found to vary so much, that they are not to be considered as affording uniform and constant characters of distinction. As a proof of this observation, if different individuals of the common green turtle (testudo midas), be compared together, it will appear that some have only a single claw on each foot; while others are furnished with two, and sometimes three; sometimes with two on the fore feet, and with one on the hind feet. Similar variations have also been observed in the number of claws of land tortoises, and particularly in those of the common tortoise, (testudo græca); in some individuals of which the fore feet have four, and in others five claws. Avoiding, therefore, these uncertain and varying characters, the shape, pattern, colours of the shell, and form of the head, Dr. Shaw observes, furnish the most accurate marks of distinction.

Some of the species belonging to this genus are natives of the ocean; some are confined to the land, or to fresh water. This affords a natural division into land and sea tortoises. In following out this division, we shall treat of them in two sections, including under the first those that frequent fresh waters.

SECT. I. Land and Fresh-water Tortoises.


Specific Char. — The shell is hemispherical, and of a black and yellow colour, and having a bunch behind; the pieces of which the disk is composed are uneven, and the sides are obtuse.

Description — The length of the common tortoise is about six inches, and rarely exceeds eight; when full grown, it is about forty-eight ounces weight. The shell is composed of thirteen middle pieces, and about twenty-five marginal ones; is of an oval form, and very convex above. The middle pieces, or those which constitute the disk of the shield, are mostly of a square form, somewhat oblong; their colour is blackish or dark brown, each having a broad yellow band running along one side, which is continued half way along the upper part. The colors vary in different individuals, and the shape of the piece is also subject to occasional variations. The sulci or furrows which appear on the surface of young animals are obliterated as they grow old. The belly part of the shell is of a pale yellow colour; the head is rather small, the upper part covered with irregular tough scales, and the neck with smaller pieces, which resemble in color of the rest of the head; the eye is small and black, and the mouth does not extend beyond the eyes. The legs are short; and the feet, which are moderately broad, are covered with strong ovate scales. The feet have usually four stout claws, but their number is fixed to vary in different circumstances. The tail is rather shorter than the legs, is covered with small scales, and terminates in a naked, horned, pointed tip.

The land tortoise is a native of almost all the countries round the Mediterranean; but it has been supposed to be more frequent in Greece, from whence it derived its specific name. It is also found in the islands of the Archipelago, in Corsica, Sardinia, and in many parts of Africa. From the account of the Danish naturalist Ferska, it is employed in Greece for the purpose of food. "The inhabitants," he says, "often swallow the blood raw, and eat the eggs boiled, which are about the size of those of a pigeon, four or five in number, and of a white colour. In September the animal hides itself under ground, and again emerges in February; laying its eggs in June, in a small hole, which it scratches in some sunny spots, out of which, after the first rains of September, the young are hatched, which are about the size of a walnut. The males of this species are said to fight often, butting at each other with such force, as to be heard at a considerable distance."

The land tortoise, when it is kept in gardens in Italy and Germany, is commonly observed to conceal itself in October, and to reappear in April. The period of retirement in England is about the end of October, and the time of its appearance is about the middle of April; but it ought to be added, that these periods vary in different countries, and according to the temperature of the season.

The land tortoise lives to a very great age. In several instances which seem to be well authenticated, it has considerably exceeded the extraordinary period of two hundred years. One instance, which is perhaps not the least remarkable, is recorded of a tortoise which was introduced into the archbishop's garden at Lambeth,
bath, about the year 1635, and lived till the year 1753; the shell of which is still preserved in the library of the palace at Lambeth. Another remarkable circumstance respecting this individual is, that it was of a larger size than usual. The shell measured 10 inches in length, and six and a half in breadth.

Very tenacious of life, the tortoise. The experiments of Redi afford a remarkable proof of this fact. In the beginning of November he made a large opening in the skull of a land tortoise, extracted the whole of the brain, washed out the cavity, that no part might remain; and having left the hole open, let the animal go. It walked off seemingly uninjured, excepting that it closed its eyes, which never afterwards opened. At the end of three days, during which time the hole of the skull began to close, the wound was covered with a complete skin; and thus without brain it walked about as usual, and lived for six months. The same naturalist cut off the head of another tortoise, which lived for the space of twenty-three days afterwards.

Abstinence. This animal is not less remarkable for its abstinence. Bioues kept an individual of this species for ten months, during which time it resisted every kind of food. One day it died at the end of that time, but this was ascribed to the severity of the seasons, rather than to the want of food; for the intestines being examined, they were found full of excrement of the natural colour.

Mr White, in his Natural History of Selborne, has given so full and distinct an account of the natural history of the land tortoise, founded on facts drawn from his own observation, that we shall lay it before our readers in his own words.

"A land tortoise (says he), which has been kept for thirty years in a little walled court belonging to the house where I now am visiting, retires under ground about the middle of November, and comes forth again about the middle of April. When it first appears in the spring it discovers very little inclination towards food; but in the height of summer grows voracious; and then as the summer declines, its appetite declines; and so that for the last six weeks in autumn, it hardly eats at all. Millet plants, such as nettles, dandelions, sow-thistles, are its usual diet. In a neighbouring village one was kept, till by tradition it was supposed to be an hundred years old. An instance of vast longevity in such a poor reptile!"

"On the 10th of November, I remarked that it began first to dig the ground in order to the forming its hybernaculum, which it had fixed on just beside a great trunk of hepatice. It scrambles out the ground with its fore-feet, and throws it up over its back with its hind; but the motion of its legs is ridiculously slow, little exceeding the hour-hand of a clock; and suitable to the composure of an animal said to be a whole month in performing one foot of copulation. Nothing can be more tenacious than this creature night and day in scooping the earth, and forcing its great body into the cavity; but, as the nights of that season proved unusually warm and sunny, it was continuously interrupted, and called forth by the heat in the middle of the day; and though I continued there till the thirteenth of November, yet the work remained unfinished. Hereafter winters, and frosty mornings, would have quickened its operations. No part of its behaviour over struck me more than the extreme timidity it always expressed with regard to rain; for though it has a shell that would resist it against the wheel of a loaded cart, yet does it discover its natural solicitude about rain as a lady dressed in all her best attire, shuffling away on the first sprinklings, and running its head up in a corner. If attended to, it becomes an excellent weather-glass; for as sure as it walks erect, and as it were on tiptoe, feeding with great earnestness in the morning, so sure will it rain before night. It is totally a diurnal animal, and never pretends to stir after it becomes dark. The tortoise, like other reptiles, has an arbitrary stomach as well as lungs; and can refrain from eating as well as breathing for a great part of the year. When first awakened it eats nothing; nor again in the autumn before it returns through the height of the summer it feeds voraciously, devouring all the food that comes in its way. I was much taken with its sagacity in discerning those that do it kind offices; for, as soon as the good old lady comes in sight who has waited on it for more than thirty years, it hobbleth towards its benefactress with awkward slowness, but remains insatiable to strangers. Thus another new quality is added to its "knight's errant," but the most object, reserv'd and spirited of beings, distinguishes the hand that feeds it, and is touched with the feelings of gratitude!"

"The old Sussex tortoise (he adds), that I have mentioned so often, is become my property. I dug it out of its winter couch at the last, when it was enough awakened to express its resentment by hissing; and packing it in a box with earth, carried it eighty miles in post-chaises. The rattle and hurry of the journey so perfectly roused it, that when I turned it out on a border, it walked twice down to the bottom of my garden; however, in the evening, the weather being cold, it buried itself in the loose mould, and continues still concealed."

"As it will be under my eye, I shall now have an opportunity of enlarging my observations on its mode of life and propensities; and perceive already that, towards the time of coming forth, it opens a breathing-place in the ground near its head, requiring, I conclude, a new respiration as it becomes warmer. This creature not only goes under the earth from the middle of November to the middle of April, but sleeps great part of the summer; for it goes to bed in the longest days at four in the afternoon, and often does not stir in the morning till late. Besides, it retires to rest for every shower; and does not move at all in wet days."

"When one reflects on the state of this strange being, it is a matter of wonder to find that Providence should bestow such a profusion of days, such a seeming waste of longevity, on a reptile that appears to refresh it so little as to squander more than two-thirds of its existence in a joyless stupor, and be lost to all sensation for months together in the profoundest slumber."

"While I was writing, a moist and warm afternoon, with the thermometer at 50, brought forth troops of shell-snails; and at the same moment, the tortoise heaved up the mould, and put out its head; and the next morning came forth, as it were raised from the dead, and walked about till four in the afternoon. This was a curious coincidence! a very amazing occurrence! to
ERPETOLOGY.

Because we call this creature an abject reptile, we are too apt to undervalue his abilities, and to depreciate his powers of instinct. Yet he is, as Mr. Pope says of his lord,

"Much too wise to walk into a well!"

and has so much discernment as not to fall down a haba; but to stop and withdraw from the brink with the readiest precaution.

"Though he loves warm weather, he avoids the hot sun; because his thick shell, when once heated, would, as the poet says of solid armour, "scald with safety." He therefore spends the more sultry hours under the umbrella of a large cabbage-leaf, or amidst the waving forests of an asparagus-bed.

"But as he avoids heat in the summer, so, in the decline of the year, he improves the faint autumnal beams, by getting within the reflection of a fruit-wall; and, though he has no power that planes inclining to the horizon receive a greater share of warmth, he inclines his shell, by tilting it against the wall, to collect and admit every feeble ray.

"Pitable seems the condition of this poor embarrassed reptile: to be cared in a suit of ponderous armour, which he cannot lay aside; to be imprisoned, as it were, within his own shell, must preclude, we should suppose, all activity and disposition for enterprise. Yet there is a season of the year (usually the beginning of June) when his exertions are remarkable. He then walks on tiptoe, and is stirring by five in the morning; and, traversing the garden, examines every wicket and interspace in the fences, through which he will escape if possible: and often has eluded the care of the gardener, and wandered to some distant field. The motives that impel him to undertake these rambles seem to be of the amorous kind: his fancy then becomes intent on sexual attachments, which transport him beyond his usual gravity, and induce him to forget for a time his ordinary solemn deportment."

3. TESTUDO GEOMETRICA, Geometrical Tortoise.

Specific Char.—The shell is black and ovate; the scutellae elevated, and radiated with yellow.

The number of pieces of which the disk is composed, is subject to variation. Instead of thirteen, fourteen pieces have been observed in different specimens. These pieces are very prominent, striated distinctly with numerous lines on their sides, and terminated by a yellowish coloured, flat, hexagonal, roughened space; from which proceed, in a radiated direction, some well defined yellow streaks towards the edge; in this forming on the black ground colour, something like geometrical figures. The marginal pieces are commonly 24, but sometimes 26. They also are streaked with yellow. As in other species, the brightness of the colour is subject to variation, but their regular distribution is never entirely obliterated.

This species, it is said, is a native of Asia, Africa, and also of America; but this seems not to be fully ascertained, which is rather surprising, as its shell is often met with in Europe than that of any other species. Thunberg says that it is a native of the Cape of Good Hope, where it frequents shrubby places. It is said also that it is found on the coast of the Fire islands, between the continent of America and Cuba, where they frequent moist and marshy places in the forests. They are very easily taken, and are sought after as food. It is usual for the natives to put a mark on the shell, and then allow them to go about in the woods, finding them again almost as readily as any domesticated animal, when they transport them to Cuba. This species
ERPETOLOGY.

Leverian museum, is described by Dr. Shaw. The co- 
four is dark brown, or black, thickly mottled with small —-
confluent spots of pale yellow, which are largest on the 1 Corn. 
sides of the shell. The form of the shell is long and 
Ov. oval, dilated or widened behind; the depth or convexp. 18. 
ity is very considerable. The three middle divisions of 
the row of scutella on the back are somewhat panduri-
form, or fiddle-shaped. The upper piece resembles the 
outline of a pitcher; the lowest approaches to a hexa-
genial form. The number of the side pieces is four, of 
the usual form; that of the marginal pieces is twenty-
five, the upper one very small. A carina or ridge runs 
down the dorsal row; the upper surface of the shell is 
strongly wrinkled. The under shell is smooth, and of 
a yellowish white colour, mottled with black. The 
length of the shell is nine and a half inches; width 
in the middle five inches. Its native country is un-
known.

Var. A variety of this species is also described, con-
sisting chiefly in the colours of the shell, and owing, it 
is supposed, to a sexual difference.

7. TESTUDO EUROPEA, Speckled Tortoise.

Specif. Char.—Shell oval, flatish, smooth, dark brown; 
marked with numerous yellow specks and streaks. 
Testudo orbicularis, Lin.

This species is from four to five inches long; the 
colour is blackish or olive brown; the shell flatish, 
but slightly convex, marked with numerous, oblong, 
yellow specks, disposed in a radiated form on each divi-
sion of the shell. The skin of the neck and breast is 
similarly spotted. The disk consists of thirteen, 
and the margin of twenty-five pieces. The under shell is 
of a whitish yellow, tinged with brown at the joints. 
The head is ovate, somewhat convex above, flatish on 
the sides and beneath. The skin of the neck is wrink-
led and loose. The legs are short, and covered with 
scutes. The feet are webbed, the fore feet having five 
toes, the hind only four. The claws are sharp pointed 
and crooked; the tail is nearly half the length of the 
body, and is thin and compressed.

This species is a native of Italy, Sardinia, France, 
Hungary, and Prussia, as well as other parts of Europe. 
It inhabits lakes and muddy waters, feeding on small 
fish, insects, snails, and aquatic plants. The flesh is 
eteemed and employed as food, and in some places 
brought to market for sale. It is sometimes kept in 
ponds for the purpose, and fed with lettuce leaves, 
bread, &c. It may be kept in a cellar, and fed with 
oats scattered on the floor, which it eats as soon as 
they begin to germinate. In the beginning of spring it 
deposits its eggs in sandy places, exposed to the sun; 
and it has been said, that these are not batched till the 
spring following. The growth of this animal is ex-
tremely slow, and it varies somewhat in colour, accord-
ing to the climate where it is found.

9. TESTUDO LUTARIA, Mud Tortoise.

Specif. Char.—The shell is flatish, and the tail is half 
the length of the body.

The length of this species does not exceed seven or 
eight inches from the tip of the nose to the end of the tail. 
The breadth is about three or four inches. The disk 
is composed of 15 pieces, which are striated and have

*Specif. Char.*—Feet digitated; shell gibbose; four first dorsal scutella carinated; sternum entire.

The shell of this species does not exceed three inches in length. The form is broad, and somewhat orbicular; the colour is brown, and each scutellum is marked with a pale zone of confluent spots, which surround the centre part, the edges of each being surrounded with three or four distinctly marked fuscums. Marginal pieces 25 in number, including the uppermost, which is very small. Its native country is unknown.


*Specif. Char.*—Shell blackish, irregularly spotted with yellow; dorsal carina obtuse; under shell hivalve, completely enclosing the upper shell.

This species is thus described by Edwards. "The head is furnished with a hard or shelly covering of a dark brown colour on the top; on the sides and throat it is yellow, with small black or dusky spots; its nostrils are near together, a little above the end of the beak; the eyes are of a yellowish colour; the neck is covered with a loose skin of a dark purple flesh colour, which partly covers the head when it is not fully extended; the hinder legs and parts about the vent are covered with a skin of the same dull flesh colour as the neck; the fore-legs and feet are covered with yellow hard scales; it hath five toes on each foot forwards, and four on each of the hinder feet, all armed with pretty strong claws; the shell above rises pretty much, and is round, divided into separate scales of the horny substance called tortoise shell; each scale is engraven, as it were, with rings round its extremities, which lessen inwards to its centre; the shell above is of a dusky brown colour, with yellowish spots of various forms; underneath it is flatish, and of a yellow colour, with black clouds and spots; it has only the rudiment of a tail, on which the vent is placed; the lower shell is divided across the middle of the belly, and joined to the upper shell by a tough though flexible skin, by which means it can, when it draws in its head and legs, close up its shell as firmly as an oyster." From this peculiarity in its structure, this species has derived its name; and this proves so strong a defence to the little animal, that it seems not only not to receive any injury, from having a weight of five or six hundred pounds laid upon it, but to walk under the load without any inconvenience.

The length of this species seldom exceeds four or five inches. It is a native of North America, and is chiefly found in marshy situations; but it also sometimes appears in dry and warm places. It lives both on vegetation and animals. Of the latter, beetles, mice, and sometimes serpents, are its prey. These it seizes, draws them into its shell, and crushes them to death. It is much in request on account of its eggs, which are esteemed a great delicacy. They are about the size of a pigeon's egg.


*Specif. Char.*—Shell brown, ovate; scutella furrowed, and yellow on each side.

This species exceeds a foot in length, from the tip of the nose to the end of the tail; so that it is one of the larger of the land tortoises. The shell is very convex. The disk is composed of 13 pieces, which are five and six-sided; and each is transversely and strongly furrowed from the lower edge to the upper area; across these run three impressed lines in an opposite direction; the marginal pieces are furrowed in the same manner. The colour of the shell is in general a dull yellow; but both the shield and marginal pieces have a brown and yellowish division. The head is large and covered with six-sided scales of different sizes. The fore and hind legs are also scaly; on the former are five claws, on the latter only four. The tail is very short.

This species is a native of the West Indies; and it is supposed to be the same with the *Hicarte* described by Browne in his History of Jamaica.


*Specif. Char.*—Shell brown, oblong, gibbose; scutella of the disc rectangular and furrowed, having yellowish coloured centres.

The shape and size of the pieces of which the disc is composed, are more uniform than in any other belonging to this genus. This seems to be the principal mark of discrimination. Each piece is slightly convex, and in general six-sided, excepting some of the pieces towards the sides, which are five-sided. The central part of each piece is large, and slightly granulated, and the sides are distinctly sutured. The whole has a kind of flattened or tabular appearance; the colour is a yellowish chestnut; it is paler on the centre of each division; the legs are thick, and spotted with red; the number of pieces on the disc is 13, that of the margin 23. The length of the shell is from five to six inches. It is supposed to be a native of Africa; but according to some, it has been found in Brazil.
**Testudo Concentrica, Lin.**

**Concentrica Tortoise.**

*Specific Char.*—Shell somewhat depressed, slightly ridged, oval, of a yellow colour; having the scutella marked with brown concentric zones.

The shell of this species is flatter than that of others; in some of the larger specimens nearly smooth; the middle row of pieces, of which the disc is composed, are five in number; they are more elevated than those of the sides, are six-sided, and project behind into an obtuse carina. There are four side-pieces on each side, which are pentagonal. The ground colour of the whole is pale, and marked with brown zones and centres. The shell is from four to six inches long.

This tortoise is a native of North America, and is met with in the markets at Philadelphia, where it is sold under the name of terrapin. It is also a native of Jamaica, where it is very common. It is said by Browne, who seems first to have described it, to be a wholesome and delicate food. In that island, it grows to the length of eight or nine inches.

**Testudo Picta, Lin.**

*Picta Tortoise.*

*Specific Char.*—The shell is oblong, and slightly convex, smooth, and of a brown colour; the scutella are bordered with yellow.

This species is well distinguished from all others, by the remarkable colours of the shield, which consists of 13 segments nearly square, and deeply edged with pale yellow. The marginal pieces are 25 in number. The shell is from four to six inches long.

The painted tortoise frequents fresh waters, and in particular, is found in the slow and deep rivers of North America. In bright sunshine weather they leave the water in great numbers, and bask themselves on stones, pieces of wood, and the banks of the streams, suddenly retreating into the water, when they are disturbed. They walk very slowly, but swim with great rapidity. They can remain for many hours together under the water, but live only a few days in the open air. They are extremely voracious, and are known to destroy young aquatic fowls, seizing them by the feet, and dragging them under water. Sometimes they are employed for the purpose of food.

**Testudo Guttata, Lin.**

*Guttata Tortoise.*

*Specific Char.*—Shell oblong, slightly convex, smooth, and of a brown colour, with scattered yellow spots.

This species is also sufficiently distinguished by its remarkable colour. The pieces both of the disc and margin being marked with a few distantly placed round yellow spots. These spots vary, as well as the ground, in different individuals. The young of this species, which itself is small, are not larger than a pigeon's egg, are very black, and beautifully spotted with gold colour.

This tortoise is a native of North America, frequenting lakes and rivers.

**Testudo Elegans, Lin.**

*Elegans Tortoise.*

*Specific Char.*—The shell is round, convex, and of a yellow colour, with transverse, oval, brown spots.

This is a very small species, only about two inches long; the shell is of a bright yellow colour, the surface apparently smooth. At each of the joinings which compose the disc, there is a large, leaf-shaped, dark brown transverse spot. The marginal pieces are marked with a transverse black zone; the head is short and thick.

Nothing particular is known of its natural history, or to what country it belongs.

**Testudo AREOLATA, Lin.**

*Areolata Tortoise.*

*Specific Char.*—The shell is slightly convex; the scutella are nearly four-sided, elevated, deeply furrowed, and are furnished with depressed rough areoles.

The length of this species is from three to four inches. The scutella, which are nearly four-sided, are broader than long, with a pretty large, depressed, central part, which is of a yellow colour, roughish, and surrounded by a pale zone. The margin is composed of 25 pieces; the disc, in some individuals, of 15, and in others of 14.

This tortoise, according to some, is a native of Brazil, according to others, of the East Indies.

**Testudo Serrata, Lin.**

*Serrata Tortoise.*

*Specific Char.*—Shell depressed, of a yellow colour, and minutely freckled with dusky specks. The scutella of the disc are all ridged; the hinder margin of the shell serrated.

This tortoise is considered and described by Dr Shaw as a new species; it is small, only about three quarters of an inch long, and about two inches and a half broad. It is of an oval form, and slightly convex. The colour is of a yellowish brown, and when closely examined, appears thickly marked with minute, confluent, dusky spots. The under shell is blackish, with a yellow margin.

The native country of this species is unknown.

**Testudo Pusilla, Lin.**

*Pusilla Tortoise.*

*Specific Char.*—Shell hemispherical, with convex, trapezoidal scutella, striated on the margin, and dotted on the disc. Feet subdigitated.

The shell of this species measures only about four inches in length. The whole animal, from the tip of the nose to the end of the tail, does not exceed six. This species has a considerable resemblance to the common tortoise, *Testudo graeca*. It is particularly described by Edwards, who kept two of them which he received from West Barbary for two years in the garden of the college of physicians in London; but of its natural history, nothing farther is known.

**Testudo Tricarinata, Lin.**

*Tricarinata Tortoise.*

*Specific Char.*—Shell oval, slightly convex; margin entire; all the scutella of the disc carinated.

This species resembles a good deal the *Testudo orbitaria*, Lin. In size it scarcely exceeds that of a large walnut; the colour is blackish; the shell is composed of
Tortoises of 13 scutella; the number of the marginal pieces is 23. Each scutella is marked in the middle with a longitudinal ridge, and wrinkled on the sides with several furrows and roughish points.

Its native place, and its natural history, are unknown.

21. TESTUDO SCABRA, Rough Tortoise.

Specif. Char.—Shell flattish, the intermediate scutella elevated on the back; feet palmated.

This tortoise is about two inches and a half in length, and nearly two in breadth. Its form is somewhat cor- dated, of a light reddish colour, finely variegated on the head and shell, with waved white lines and spots. The feet, each of which is furnished with five toes, with sharp claws, are marked with red spots. The head is prominent, and the eyes are small.

It is considered by some naturalists as a native of Ambonya.

22. TESTUDO SCRIPTA, Letter'd Tortoise. Testudo Scabra of Thunberg.

Specif. Char.—Shell depressed, orbicular; scutella marked with various figured characters; marginal pieces spotted underneath.

This species is either very small, or the specimen from which the descriptions have been taken were very young, as it did not exceed the size of a half-crown piece. It is flattish, of a round form, and whitish colour tinged with yellow. The upper surface is marked with various figures, having somewhat the appearance of written characters. The pieces of the margin, which are 23 in number, are marked with similar characters as those of the scutella. The feet are large, webbed, and have five toes furnished with sharp claws.

It is not mentioned to what country it belongs.

23. TESTUDO GALEATA, Galeated Tortoise.

Specif. Char.—Shell depressed, oval; the three middle scutella sharply ridged; marginal pieces 24.

This is a small species, not exceeding two inches and a half long, and about two broad. The colour of the shell is pale brown, and the disc is composed of 13 scutella, of which the middle row is very broad, and strongly ridged in the middle. Marginal pieces 24 in number, and similar in colour to the disc, but having white edges. The head is smooth, furnished with a kind of shield, from whence it derives its specific name.

Its native place is unknown; but an individual of this species, brought from India, lived two years. It was kept in fresh water, and could occasionally remain for a few hours in the open air. Its food was bread and flies. It continued in a kind of dormant state during the winter, taking no food from the beginning of October till the middle of May, and scarcely ever raising its head above the surface of the water.

24. TESTUDO DENTICULATA, Denticulated Tortoise.

Specif. Char.—Shell roundish, and heart-shaped; marginal segments denticulated; feet subdigitated.

This species is about four inches long and three broad. The shell is of a pale yellowish brown colour; the disc is composed of broad five and six-sided scutella. They are flattish, and have a large distinct space in the middle, granulated with small tubercles. The other part of the scutellum is marked with five furrows; the marginal pieces are 23 in number, and project in a serrated form.

It is supposed to be a native of North America.


Specif. Char.—Shell brown, smooth, ellipctic; back flattish; the middle row of scutella somewhat rhomboidal and imbricated. The first is subtriangular.

This is a small tortoise; the length of the shell, at its full growth, does not exceed three or four inches. In this species, the middle row of dorsal pieces are longer than in others, and are so arranged as to overlap each other at the tips. The marginal pieces are 23 in number, the upper one being very small. The edges of the shell are tinged with dull yellow. In the jointing of the pieces, this species resembles the structure of the common tortoise, so that the animal has the power of coiling itself almost entirely, by closing up its shell.

It is a native of North America, and is particularly found in Pennsylvania, where it frequents muddy waters, and hence its trivial name of mud tortoise. When alive, it is said that it gives out a strong musk smell.

Several varieties of this species have been noticed by naturalists.

26. TESTUDO LONGICOLLIS, Long-necked Tortoise.

Specif. Char.—Smooth, ovate; neck very long.

This species is about five inches and a half long, and four and a half broad. The shell is of an oval form, of a dark olive brown colour, resembling in some parts of it the grain of common black leather. The disc is composed of 13, and the margin of 25 pieces. The under shell is of a yellowish colour, marked with black brown at the jointings. The edges on the feet, which are four in number, are like those of birds.

It is a native of New Holland.

27. TESTUDO CASPICA, Caspian Tortoise.

Specif. Char.—Shell orbicular, head scaly, tail naked; five claws on the fore feet, four on the hind.

This species of tortoises grows to such a size, that several men can stand together on its shell. The pieces of which the disc is composed are nearly four-sided, and square; those of the margin are in the form of a parallelogram. The colour is variegated with black and green; the under shell is blackish, spotted with white.

It is a native of Hyrcania, and frequents fresh waters.

28. TESTUDO FEROX, Fierce Tortoise.

Specif. Char.—Shell ovate, cartilaginous; three claws on the feet, which are tubular; nictitans prominent.
Chap. I.

**ERPETOLOGY.**

This species is about one foot and a half in length, and about 15 inches in breadth. The shield, which is hard or casaneous in the middle only, while the edges become gradually flexible and coriaceous, is a sufficiently characteristic mark of distinction. The head is small, and somewhat trigonal, with the snout much elongated. The colour of this species is brownish; olive above; and on the under parts white.

This species is a native of Pennsylvania, Carolina, and other parts of America. It is extremely vigorous and swift in its motions, and when it is disturbed or attacked, it springs forward towards its enemy with great fierceness. Some which have been found in the rivers and lakes of East Florida, weighed from 30 to 40 lbs.; and it is said that they even grow to such a size as to weigh 70 lbs.

A species described by Thunberg, under the name of *Testudo rostrata*, is supposed by Dr Shaw to be an individual belonging to the above, not yet arrived at its full growth. The *Testudo triangula* of Forskal seems also to be a variety of this species.


Specif. Char.—Shell granulated, orbicular, flattish; border cartilaginous.

The shield of this species measures about 34 inches in length, and 35 in breadth. It appears as if it were composed of two shields, the upper of which is the smallest and shortest. This is of a bony substance, roughened all over like the surface of shagreen. It is composed of 23 pieces, eight of which are placed on each side. The borders of this shield are cartilaginous and somewhat transparent, through which may be seen the ribs of the animal.

This species is said to be a native of India; but of its habits and natural history nothing is known.


Specif. Char.—Shell oval, a little convex, and having a triple ridge; neck embriasted on each side; snout cylindrical, and feet subdigitated.

The length of the shell of this species is above 15 inches, and the breadth 7½. The length of the animal, from the tip of the nose to the end of the tail, is two feet three inches. The head is large and flat, edged on the sides with wrinkled membraneous appendages, and covered behind with a three-lobed prominence. The nose is cylindrical, and somewhat resembles a proboscis. It is 20 lines long, truncated, and pierced by the tip by the nostrils. The disc of the shell is a little convex, and composed of 13 semicircular pieces, which are nearly conical. They are all wrinkled, and irregularly notched at the hinder part. The marginal pieces are 21 in number, nearly square, radiated on the surface with oblique wrinkles, and toothed on the inner edge. The colour is brown, and somewhat paler beneath.

This species is said to be a native of Guiana, and was once common in the rivers of Cayenne; but it is now rarely met with, having been much sought after as a nourishing food. Its food is aquatic plants; and it is said that it leaves the river, and wanders about in the night, to some distance from the banks, in search of pasture. The individual from which the description is taken by M. Bruguiere, was brought to him alive, and lived for some time on herbs, bread, and some other substances. It laid several eggs, one of which produced a young tortoise in the box where it was kept.


Specif. Char.—Shell ovate, depressed, triply carinated, and sharp scaled; rounded and acutely serrated at the posterior margin.

This species grows to the weight of 15 or 20 lbs. The general colour is of a dull chestnut brown, but lighter or paler underneath. The head is large, triangular, and covered with a warty skin. The neck is also covered with scaly warts. The toes, which are five in number on the fore feet, and four on the hind feet, are all distinct, but connected by means of a web. They are armed with long claws. The tail is straight, two-thirds the length of the shell, compressed, and covered on the upper part with sharp bony scales, pointed backwards.

This species is a native of North America; inhabiting stagnant waters, where it preys on fish, ducklings, &c. seizing its prey with great force. And indeed, whatever it seizes with its mouth, it holds with such force, that it will suffer itself to be raised out of the water rather than quit its hold. The more easily to catch its prey, it is said too, that it conceals itself in muddy waters, leaving out only part of its back, which has the appearance of a stone.

32. **Testudo Squamata**, Scaly Tortoise.

Specif. Char.—Body ovate, smooth beneath; but the upper part, with the neck, feet, and tail, covered with numerous scales.

The head of this species is small, resembling that of a snake; the eyes are small and moveable, the teeth sharp. All the upper part of the body is covered with scales; the under parts are soft, smooth, and tender; the tail is pretty long.

It is said to be a native of China and Java. The flesh is accounted a great delicacy, and the scales, powdered and dissolved in water, are given by the Chinese as a remedy in cases of dysentery and coffee.

**SECT. II. Turtles, or Sea Turtles.**

The large and long fin-shaped feet, which inclose the bones of the toes, are the most obvious characteristic marks of distinction between the sea-turtles, and the species included under the preceding section. In the sea tortoises the shield is also composed of a strong bony covering, which is coated externally with hard bony plates, which in some of the species are much thicker and stronger than those of the land tortoises.

33. **Testudo Coriacea**, Coriaceous Turtle.

Specif. Char.—Colour brown, paler beneath; shell coriaceous, marked with five longitudinal, tuberculated ribs.

This species, in the form of its body, which is proportionally longer, and in its outer covering, which is not
Sir Hans Sloane, the inhabitants of Port Royal in Jamaica employed 40 sloops for the purpose of catching them. The markets were at that time, as they are at present, supplied with turtle in the same way as those of Europe are with butcher's meat. Many of them, according to Catesby, are carried from the Bahamas islands to Carolina, where they are esteemed as a great delicacy. "They feed," he adds, "on a kind of grass, growing at the bottom of the sea, commonly called turtle grass. The inhabitants of the Bahamas islands, by frequent practice, are very expert in catching them, especially the green turtle. In April they go in boats to Cuba, and other little neighbouring islands, where in the evening, especially on moon-light nights, they watch the going and returning of the turtle, to and from their nests, at which time they turn them on their backs, where they leave them, and proceed on, turning all they meet, for they cannot get on their feet again once turned. Some are so large, that it requires three men to turn one of them (A). The way Mode of by which the turtle is most commonly taken at the Bahnas islands, is by striking them with a small iron peg of two inches long, put in a socket at the end of a staff of 12 feet long. Two men usually set out for this work in a little light boat or canoe, one to row and gently steer the boat, while the other stands at the head of it with his striker. The turtle are sometimes dis covered by their swimming with their head and back out of the water; but they are oftenest found lying at the bottom, a fathom or more deep. If a turtle pursues he is discovered, he starts up to make his escape; the men in the boat pursuing him, endeavour to keep sight of him, which they often lose, and recover again, by the turtle putting his nose out of the water to breathe. Thus they pursue him, one paddling or rowing, while the other stands ready with his striker. It is sometimes half an hour before he is tire; then he sinks at once to the bottom, which gives him an opportunity of striking him, which is by piercing him with an iron peg, slipping out of the socket, but is fastened with a string to the pole. If he is spent and tired by being long pursued, he tamely submits when struck, to be taken into the boat, or hauled ashore. There are men who, by diving, will get on their backs, and by pressing down their hind parts, and raising the fore part of them by force, bring them to the top of the water, while another slips a noose about their necks.

"The turtle never go on shore, except to lay their eggs, which is in the month of April. They then crawl up from the sea above high-water mark, where they dig a hole two feet deep in the sand, into which in a little night they drop above 100 eggs. At this time they are so little liable to be disturbed, that they have been known to drop their eggs into a boat held by a person under them. If, however, they happen to be disturbed before they begin to lay, they forsake the place, and seek another. They lay their eggs at three times and sometimes at four different times, a period of four hatched by ten days elapsing between each time. When they the sun have laid their complement of eggs, they fill the hole

(A) We have seen the same mode of watching and turning the turtle practised in Jamaica, and the phrase there is not to take or seize the turtle, but to turn it.
ERPETOLOGY.

with sand, and leave them to be hatched by the heat of the sun. This is usually accomplished in about three weeks. The eggs are round, white, covered with a smooth parchment-like skin, and about the size of tennis balls.

Although the green turtle be a native of the seas within the torrid zone, it is sometimes found on the coasts of Europe, where it has probably been driven by storms, or was driven on board from ships from the West Indies. A turtle of this kind, of the enormous size of six feet long, by four broad, and of the weight of 800 or 900 pounds, was taken at Dieppe in France in 1752; and two years afterwards, another still larger was taken on the same coast.

The flesh of the green turtle is not only highly esteemed in those countries of which it is a native, but also much sought after in Europe, that the importation of it now forms a considerable article of trade; few ships returning from the West Indies without bringing some turtle. But the turtle which now forms a dish, by no means uncommon at the tables of the luxurious, seems to have been little known in Britain previous to the middle of the 18th century; and indeed it was so rare an occurrence, that when one was eaten, it was announced to the public as a piece of news. This appears from the following articles of intelligence.

"Friday, August 31. A turtle weighing 350 pounds was eaten at the King's Arms tavern, Pall-mall; the mouth of an oven was taken down to admit the part to be baked." Gent. Mag. for 1753. "Saturday, September 29. The Tartler, Capt. Croydon, lately arrived from the island of Ascension, has brought in several turtles of above 300 pounds weight, which have been sold at a very high price. It may be noted, that what is common in the West Indies, is luxury here." Ibid. 1753. "Saturday, July 15th. The Right Honourable Lord Anson made a present to the gentlemen of White's chocolate house, of a turtle which weighed 300 pounds weight, and which laid five eggs since it was in their possession. Its shell was four feet three inches long, and about three feet wide. When its head was cut off, at least five gallons of blood issued from it, and so full was it of life, that the mouth opened and shut for an hour after it was cut off." Ibid. 1754.

35. TESTUDO CARETTA, Loggerhead Turtle.

Specif. Char.—Variegated, and having thirteen imbricated scales on the disk.

In this species the outline of the shell exhibits more of a cordated form than any other; and the termination of the shell is more acute. Each of the middle row of scales on the back is also of a sharpened form at the tip, and a ridge runs down the middle. The head is proportionally smaller than in other turtles; and the neck is longer, narrower, and more curved, thus resembling the bill of a hawk; hence deriving its trivial name. The specific name of imbricata is taken from the peculiarity in the disposition of its scales, which overlap each other at the extremities like the tiles on the roof of a house.

The length of this species is about three feet from the tip of the bill to the end of the shell; but some individuals have been found which measured five feet in length, and weighed from five to six hundred pounds; and it is said that some have been met with in the Indian ocean, of enormous magnitude.

The hawksbill turtle is a native both of the American
Cesar, the magazines or warehouses were so full of this article, that he proposed to have made it the principal ornament of his triumph, as he did ivory afterwards, when triumphing for having happily finished the African war. This too, in more modern times, was a great article in the trade to China, and I have always been exceedingly surprised, since near the whole of the Arabian gulf is comprehended in the charter of the East India Company, that they do not make an experiment of fishing both pearls and tortoises, the former of which being so long abandoned, must now be in great plenty and excellence; and a few fishermen put on board each ship trading to Jidda, might surely find very lucrative employment, with a long-boat or pinnace, at the time the vessels were selling their cargo in the port; and, while busied in this gainful occupation, the coasts of the Red sea might be fully explored."

37. Testudo ——, Green-shelled Turtle. La Tor-""tue Ecaille Verte de Cepede.

Specific Char.—Shell green and variegated.

This species, in general, resembles the common green turtle, both in appearance and manners; but is distinguished from it in having a small rounded head, and never growing to so large a size. It derives its name from the colour of the shell, which is of a fine green, beautifully transparent, and although it is thin, may be applied to many ornamental purposes.

The green-shelled turtle is a native of the South seas, and is found near the American rivers within the torrid zone. It is found particularly in great abundance near Cape Blanco in New Spain. The flesh is in great estimation, and is even preferred by some to that of the green turtle.

38. Trunk Turtle.

This species is mentioned by Catesby, who says that he never saw it; but from information he has described the upper shell as being more convex than in any other species. It is said that it grows to a very large size.—The flesh is rank; but it yields a great quantity of oil, on which account only it is valued.


This species also bears a strong resemblance to the common turtle; but it is distinguished from it in having a large soft tubercle on the tip of the snout, and this is placed the nostrils.

This turtle is said to be a native of the American seas, within the torrid zone, and is eaten in the same way as the common turtle.

II. RANA, FROG.

This genus has been divided by some naturalists into three genera; and undoubtedly there is some foundation for this distinction, both from the form and structure of their bodies, and from their manners and habits. 1. The *ranes* or *frogs*, properly so called, and by the French *grenouilles*, have light active bodies, and are furnished with strong limbs, which enable them to perform their motions by leaping. 2. The *apies*, in French *rainettes*, or tree-frogs have slender limbs, and have soft tubercules on the toes, by which they can adhere to smooth surfaces,
ERPTOLOGY.

3. The toads or bufons, in French crapauds, which constitute the third genus or division, have large heavy bodies, thick short limbs, and a slow crawling motion. But without multiplying genera, we shall consider the whole under one, distributing them into three sections, according to the division which we have just mentioned.

Sect. I. Ranidae, or Frogs.

1. Rana Temporaria, Common Frog.

Specif. Char.—Colour yellowish brown, spotted with black; a lengthened brown patch beneath the eyes.

Of all the European species this is the most common. The general colour is of an olive brown, variegated on the upper parts of the body, with irregular blackish spots. The patch beneath each eye, which reaches to the setting on of the fore legs, seems to constitute one of the principal specific distinctions. The under part of the body is of a pale greenish colour, and but obscurely spotted. But it ought to be observed, that the colour of the frog varies at different seasons of the year, and perhaps in different places. Towards the end of summer, for instance, the colours are much brighter; and as this species frequently casts its skin, the cuticle falling off irregularly from different parts of the body, produces considerable variations in the intensity of the colours.

The frog has a light elegant form, and a lively appearance; the limbs are well calculated for its peculiar motions, and the hind feet being strongly webbed, enable it to swim well. The frog, it is said, does not reach its full size till it is five years old, and it lives from 12 to 15 years. It retires during the heat of summer to the water, and in winter it becomes torpid, and is generally found in the soft mud at the bottom of stagnant waters, or in the cavities beneath their banks, where it remains till the beginning of spring.

The frog, as well as many other of the reptile tribe, is extremely tenacious of life. It survives for a considerable time, the loss even of some of its essential organs, and it has been found to exist for several days when entirely confined under water.

The frog deposits its spawn in the month of March. This is composed of a gelatinous transparent mass, including the ova or eggs, in each of which is imbedded the embryo or tadpole, which has then the appearance of a round black globule. The period of hatching varies according to the temperature of the season, but it is commonly about a month or five weeks. In its progress the egg becomes gradually larger, and before the tadpole is exhausted, it is seen in motion within the surrounding glutin. When they are first hatched, their only food is the remains of the glutin in which they were excluded. A few days afterwards, if they are minutely examined, a pair of ramified branchiae, or temporary organs, may be observed on each side of the head, which after a short time disappear. The tadpole, which is so extremely unlike the animal in its perfect state, seems to consist only of a head and tail. The head is large, black, and roundish; the tail is slender, and margined with a broad transparent fin. The motions of the tadpole are very lively. Its food consists of duckweed and other small water plants, with different kinds of animalcula. The mouth is furnished with very minute teeth, and when the tadpole has reached a certain size, it may sometimes be heard gnawing the edges of the leaves on which it feeds. By means of a sucker placed between the lower jaw, with which the animal in this state is furnished, it can attach itself at pleasure to the under surface of aquatic plants. When it is very young, it sometimes hangs from this part by means of a glutinous thread, similar to some small algae.

The internal structure of the organs of the tadpole is very different from that of the future animal. In and concerning this subject is this difference greater than in the disposition of the intestines, which are coiled in the form of a flat spiral like a cable. The first change which appears on the tadpole is at the end of five or six weeks after it is hatched. It is about this time that the hind legs first appear; and gradually increasing in length and size, they are succeeded about two weeks afterwards by the fore legs. These latter, indeed, are formed at an earlier period beneath the skin, and are sometimes protruded and again drawn back by the animal, through a small hole on each side of the breast, before their complete evolution. The tail now gradually decreases, and afterwards more rapidly, so that in the space of a day or two it is quite obliterated. After this change, the animal leaves the water, and covers the banks in myriads. The sudden appearance of such multitudes of young frogs, has probably induced the groundless but popular belief of their having fallen from the clouds in showers. The frog having now arrived at its perfect form, it changes entirely the nature of its food. It lived formerly on vegetables, now it depends solely for its existence on animal food. It lives chiefly on small snails, worms, and insects. To seize its prey, the structure and position of the tongue are remarkably well fitted. It is of considerable length, and it is attached to the fore part of the mouth, and when at rest it lies backwards. The extremity is bifid, and secretes a glutinous matter, so that in this way it can secure its prey, by darting out its tongue with great celerity, and to some distance from the mouth. This it does with so instantaneous a motion, that it is scarcely perceptible to the eye.

2. Rana Esculenta, Green Frog, or Edible Frog of Pennant.

Specif. Char.—Olive colour, spotted with black, with three yellowish lines on the back; abdomen whitish.

This is the largest species of the European frogs. The general appearance resembles that of the preceding; but it is larger in size, and of an olive-green colour, strongly marked on the upper part of the body with roundish black spots. The limbs are of a greenish hue, marked with transverse bands of the same colour. Three distinct pale yellow stripes run from the tip of the nose down the whole length of the back, the middle one being slightly depressed; but the two lateral ones are considerably elevated. The head is proportionally larger than that of the common frog.

The green frog is rare in England, but is very common in France, Italy, and Germany, where it is employed as an article of food.

This species, it is observed by naturalists, does not

Vol. VIII. Part I. 

leave
leaves its winter retirement till a much later period than the common frog; and in those countries where it is used for food, it is worth while to attend to this fact, for if they are pretended to be brought to market at an earlier period, the common frog, and sometimes even toads, must be substituted. During the breeding season, the croaking of the male is so loud, that it may be heard at a great distance; and in those places where they are numerous, it becomes so intolerable to those who are unaccustomed to hear them, that they are often deprived of sleep. At this time, too, a large inflated globular vesicle is protruded from each side of the head of the male. The globules of spawn in the green frog are proportionally smaller than in the former species. They have somewhat of a yellowish cast. The progress of the tadpole, towards the evolution of the perfect animal, is considerably slower in this species. The fore legs do not appear before October, and the animal does not assume its perfect shape till the beginning of November. The tail at this time begins to decrease, and in the space of four days entirely disappears.

This species is extremely voracious, seizing it is said, on young birds of different kinds, mice, and even ducklings, and, as it does with the rest of its prey, swallowing them whole. At the age of four years it has reached its full growth. It begins to breed the year following, and the period of its life is sometimes extended to sixteen years.

3. Rana Pipiens, Piping Frog.

Specific. Char.—Olive-coloured, with ovate black spots, edged with yellow.

This species is smaller than the green frog, but in its general habit bears a considerable resemblance to that animal. From the nose to the tips of the hind feet, it measures only five or six inches. The body and limbs are of a dusky green, spotted with black. Two yellow lines run from the eyes to the rump, and two white lines from each eye to the nose. In the living animal the ears have a bright golden colour.

It is a native of North America. It frequents rivulets and ditches of water, and is so strong and vigorous, that it is said it can leap to the distance of five or six yards. In the spring and beginning of summer, it is supposed to indicate the approach of rain, by a peculiar sound which it emits.

4. Rana Catesbeiana, Bull Frog.

Specific. Char.—Olive brown, spotted with black; large ocellated spots near the ears; hind feet palmed.

This species grows to a very large size, measuring, it is said, more than 18 inches from the tip of the nose to the end of the hind feet. The upper part of the body is brownish, and somewhat irregularly marked with numerous spots of a deeper brown. The under parts are of a whitish cast, with a shade of yellowish green. They are also marked with numerous spots; but these are less bright than those of the upper part.

The bull frog is a native of many parts of North America. It derives its name from the sound of its voice, which resembles the distant lowing of cattle. It usually frequents springs; and in Virginia, where these abound in the sides of the hills, a pair of these frogs are usually seen sitting on the edge of the small pond formed by the running of the water from the spring; and when they happen to be surprised, they retreat to the mouth of the spring, and, entering it, find themselves in safety. In Virginia, too, a popular opinion prevails, that they are useful in purifying the water of the spring. This opinion is greatly in their favour, and saves them from that persecution with which the frog and other reptiles are wantonly and unnecessarily harassed in other countries. But the bull frog being extremely voracious, and sometimes devouring young ducks and goslings, is occasionally devoted to destruction.

5. Rana Ocellata, Argus Frog.

Specific. Char.—Feet having each five toes, and unwebbed; toes tuberculated beneath; back fasciated, and sides ocellated.

This is one of the largest of the genus, exceeding, perhaps, the bull frog in the size of its body, but having limbs proportionally thicker and stronger. It has sometimes been confounded with the bull frog; but it is distinguished from it in its general appearance, and particularly in the form of the feet.

This frog is a native of Pennsylvania, Carolina, and other parts of North America, frequenting moist places in the vicinity of springs and rivulets. In its manners and habits it is supposed to be nearly the same with the bull frog.

6. Rana Virginica, Lineated Frog.

Specific. Char.—Cinereous, spotted with red; beneath yellowish; back angular, and marked with five pale stripes.

This species, in shape, size, and structure of the feet, resembles the common frog. It is greenish above, and paler beneath. The back and limbs are variegated with dark-brown marks of different sizes.

It is a native of Virginia.

7. Rana Ovalis, Oval Frog.

Specific. Char.—Colour brownish, beneath yellowish; the head beaked, and scarcely distinct from the globose body.

The snout projecting beyond the lower jaw, constitutes the specific character. The hind legs are short, the feet unwebbed, and there is a callos at the base of the inner toe. Its native country is unknown.

8. Rana Cyanophlyctis, Studded Frog.

Specific. Char.—Brownish blue, having a tuberculated line on each side; beneath whitish, spotted with brown.

In this species the legs are branded with blackish blue and white. In the upper jaw there is a row of thickest conical teeth, ressembling those of lizards. The hind feet are webbed, and furnished with a callos like a sixth toe.

It is a native of India.

9. Rana Spinipes, Spiny-footed Frog.

Specific. Char.—Brown, beneath bluish; sides speckled;
ERPETOLOGY.

15. RANA IGNEA, Fire Frog. Rana Bombina, Lin.

Specif. Char.—Olive brown, orange colour beneath, spotted with blue.

This is the smallest of the European frogs, and is not equal even to the tree frog in size. It derives its name from the peculiar colour of the under surface of the body; but this is subject to considerable variation.

It is a native of Germany, Italy, and other parts of Europe, but has not been found in England. It frequents turbid stagnant waters, and scarcely ever appears on land. It breeds at the age of three years, and may therefore be supposed to live about ten. It deposits its spawn in the month of June, and the ova are proportionally larger than those of others. The tadpoles, which are of a pale yellowish brown colour, are hatched towards the end of June. When young, they have been frequently observed to hang from the surface of leaves by means of a glutinous mucus issuing from the small tube near the lower lip. About the end of September they are at their full size. At that time the tail appears more fleshy and muscular, and therefore proportionally stronger than in other tadpoles. In the beginning of October they assume their perfect form.

This is one of the most active and lively of the whole genus. It leaps and swims even with greater celerity than the common frog. When it is surprised on the land, and finds that it cannot escape, it squats down close to the ground, turning back its head and limbs in a singular manner. If it be further disturbed, it emits from the hinder part of the thigh a frothy kind of fluid which has no disagreeable smell, but some degree of acrimony when it comes in contact with the eyes and nostrils. The sound emitted by the male of this species is sharper than that of other frogs, and somewhat resembles a kind of laugh, or, according to some, the note of a cuckoo or the tone of a bell. Hence the Linnaean specific name, rana bombina.

16. RANA SALSA, Saline Frog.

Specif. Char.—Colour olive brown, whitish beneath, with dusky variegations; all the toes are unwebbed.

When this species is first taken out of the water, the brown colour has a shade of blue; the back is beset with tubercles; the legs are furnished with brown, and the insides of the feet are yellow.

It is a native of the salt marshes of some parts of Germany.

17. RANA PARADOXA, Paradoxical Frog.

Specif. Char.—Yellowish and olive-coloured; variegated with rufous bands; hind legs obliquely striated.

This species resembles in its general form the common frog. The oblique longitudinal stripes on the hind legs constitute the principal mark of distinction. There are four toes on the fore feet, and they are unwebbed. The hind feet have five toes, and are deeply palmed to the very ends of the toes. Near the shortest toe there is an oblong callosus, forming a conspicuous one. The upper jaw is beset with a row of small denticulations.
This species is a native of South America, and is more common in Surinam than in other places.

Naturalists have been extremely puzzled with regard to the real nature of what has been taken for the tadpole of this frog. At one time it was considered by Linnaeus as a species of lizard, and therefore arranged by him under the genus Lacerta. At another time he placed it under the present genus, with the specific name piecis. It was described by Edwards under the denomination of the frog fish of Surinam. The structure of the animal, which has been the subject of so much discussion, shows clearly that it is the larva or tadpole of a frog; and it is supposed, with no small degree of probability, that the differences in the accounts given of this animal by naturalists have arisen from the different stages of its progress in which it has been found. But as this tadpole is so much larger in size, in proportion to the perfect animal, than any other species yet known, it may be the larva or tadpole of some of the larger species, and not that of the rana paradox, which is but a small frog.

Sect. II. Tree Frogs.

Tree frogs have slender bodies, long limbs, and the tips of the toes are flat, orbicular, and dilated. The species included under this section have been formed, according to the arrangement of some naturalists, into a separate genus, under the name of Hyla; and no doubt the peculiar structure of the toes, which enables them to adhere to smooth bodies, affords a very striking character, and in some measure warrants the arrangement.

Specif. Char.—Yellowish and rufous, spotted and fasciated with brown. There are double bands on the legs, and the feet are palmated.

This species is the largest of the whole of this section, measuring about five inches from the nose to the end of the body. The colour is an elegant, pale, rufous brown, beautifully marked on the back and limbs, and even to the very ends of the toes, with transverse chestnut-coloured bands. The head is large, the eyes protuberant, and the mouth wide. The fore feet have four toes, and the hind ones five.

It is a native of Carolina and Virginia.

Two other species have been described by naturalists, which more accurate observation has shown to be nearly allied to the preceding. The first is the rana boops, Linn., in which the difference is so slight, that as Dr. Shaw observes, it may depend on a sexual distinction. The other is the rana vemula, which is supposed to be the same animal as the zebra frog, before it has arrived at its full size.

Specif. Char.—Colour blue, ochreous beneath; feet unwebbed; toes flattened and orbicular.

This elegant species is of a moderate size; it measures more than four inches in length. The whole of the upper surface is of a beautiful blue, while the under parts are of a pale orange or ochre colour. The head is large, the mouth wide, and the tip of the nose truncate. All the toes are furnished with a large orbicular tip; and beneath each of the joints there is a process or tubercle. The upper parts of the female have a deeper shade of violet than those of the male.

It is supposed to be a native of Surinam.

20. Rana Leucophyllata, White-Leaf Frog.
Specif. Char.—Colour rufous, variegated above, with snow-white spots of different shapes.

The variegated spots on the body and limbs are milk-white, and are observed to vary greatly in different individuals, in number, form, and disposition. The toes of the fore feet are slightly webbed at the base.

It is a native of America.

Specif. Char.—Colour blue, having a double, longitudinal, yellow line on each side of the body.

This species bears a near resemblance to the preceding; but the blue colour above, and the double yellow line, which runs along each side of the body, from the eyes to the vent, sufficiently distinguish it.

Its native country is unknown.

22. Rana Castanea, Chestnut Frog.
Specif. Char.—Chestnut-coloured and granulated; whitish beneath, with a white line on each side of the body.

In this species, the whole of the upper surface, both of body and limbs, is scattered over with minute warts or tubercles. On each shoulder there is a large, long, white spot; the fore arms, hind legs, and thighs, are barred transversely with white; the feet are unwebbed, the toes rounded, and all the joints tuberculated beneath.

It is supposed to be a native of Surinam.

23. Rana Fasciata, Fasciata Frog.
Specif. Char.—Colour rufescence, with whitish transverse bands.

In this species the colour is pale rufous; the head, body, and upper parts of the limbs, are marked with pale transverse bands; the eyes are blue, with a silvery lustre; the outside of the arms and legs are of a blackish brown colour.

Its native place is unknown.

Specif. Char.—Colour green, whitish beneath, with a blackish lateral line and granulated abdomen; feet unwebbed.

This species is of a smaller size than any other of the European frogs. The colour of the upper part of the body is green; the abdomen is whitish, and marked with numerous granules. The under surface of the limb is reddish, and on each side of the body there is a longitudinal blackish or violet-coloured streak, which separates the green of the upper parts from the white of the lower. The lower edge of the dark lateral stripe is shaded with yellow. The hind legs are long and slender. There are four toes on the fore feet, and five on the
Erpetology.

The bind feet. All of the toes terminate in flat, round, and dilated tips. It is by means of this peculiar structure that the animal is enabled to hang from the leaves of trees, or from any smooth substance; for the under surfaces of these tips or tubercles on the toes is soft and glutinous. There is a similar structure on the skin of the abdomen.

The tree-frog is a native of France, Germany, Italy, and other parts of Europe. It has never been found in the British isles. During the summer months, it chiefly frequents the upper parts of trees, and wandering among the leaves in search of insects, it seizes them with extreme celerity. It steals softly towards its prey, and when it has reached the proper distance, it makes a sudden spring of more than a foot in height. For this it is peculiarly fitted, from its nimble and active movements. It conceals itself beneath the shade of the leaves, by attaching itself to their under surface by means of the feet, or abdomen.

On the approach of winter, the tree-frog leaves the woods, and retires to the waters, where it buries itself in the soft mud, or conceals itself beneath the banks, where it remains torpid till the spring, when it deposits its spawn in the water. At this time the throat of the male is greatly inflated, and the loud sharp croak which it then emits, is heard at a very considerable distance. The spawn is deposited in small clustered masses, about the end of April, and the tadpoles assume the form of the perfect animal about the beginning of August, at which time they begin to ascend the neighbouring trees, where they reside while the warm season continues. It has been observed that they are more noisy on the approach of rain; and the males particularly, if kept in glasses, and furnished with food, afford certain indications of the changes of the weather.

25. Rana Meriana, Merian Frog.

Specific Char.—Colour yellowish green, variegated with brown, with conically shaped auricular vesicles.

This species is three times the size of the common tree-frog, and on each side of the neck there is a remarkable protuberance like an obesely conical, inflated pouch. This species is sometimes found on trees, and sometimes in the water, according to the different periods of its growth. According to Madame Merian's description, these frogs are found in stagnant waters. They have, she observes, ears in their heads, and knobs or balls on their feet, which have been given them by nature to enable them to pass easily over the morassy places which they inhabit.

26. Rana Aurantia, Orange Frog.

Specific Char.—Orange-coloured; body and limbs very slender.

This species is entirely of a reddish orange colour, long-limbed and slender-bodied. It is smaller than the European tree frog.

It is a native of South America, inhabiting trees.

27. Rana Tinctoria, Tinging Frog.

Specific Char.—Of a reddish colour; the body fascinated with white.

It is of a bright red or ferruginous colour above, marked longitudinally with a pair of white stripes. These at an early age are often crossed with a transverse stripe; and indeed the individuals of this species have been found to vary greatly in the disposition of the colour.

It is a native of South America, and inhabits trees.

The Indians employ this species of frog to change the colour of green parrots. For this purpose they pluck the feathers from that part of the parrot on which they wish the new colour to be introduced. They rub the skin with the blood of the animal, and the renovated feathers, instead of being green as formerly, are yellow or red.


Specific Char.—Entirely of a white colour.

On the upper part of the body there are some spots or patches, which are of a brighter white than the ground. It is, however, subject to some variations.

It is a native of the woods in the warmer parts of North America.

29. Rana Bilineata, Bilineated Frog.

Specific Char.—Colour green, with a straight yellow line on each side of the body.

The only difference between this species and the common tree-frog is, in the yellow line on each side of the body of the former being somewhat straighter, and without undulations. It is a native of the warmer parts of North America, inhabiting the woods.

Sect. III. Toads.

30. Rana Bufo, Common Toad.

Specific Char.—Colour brown, with reddish brown tubercles, pale beneath.

The common toad is too well known to require any detailed description. The colour is generally of an obscure brown above, but much paler, and irregularly spotted beneath. It is, however, subject to considerable variations, being sometimes found of an olive cast; and, in the earlier part of summer, the shoulders and limbs are marked with reddish spots, while the under parts of the body have a yellowish tinge. The body is always covered with pustules or tubercles of a darkish green, or bright red colour, and they are of different sizes in different individuals. The common toad is not only a native of Europe, but of other countries of the world.

The common toad usually frequents shady places, in history of gardens or fields; is found under stones, or makes its way into cellars or other obscure recesses, anxious, as it would seem, to conceal itself, or, that it may lie protected from excessive cold, and find a supply of food. The toad, like the common frog, becomes torpid in winter; and it would appear, that they sometimes collect together in numbers, and take up their inhabitant in the same hole or cavity, with the view of preserving and retaining their heat for a greater length of time. At the return of spring, the toad leaves its lurking place, and retires to the waters, where it deposits its spawn.
Toads. The spawn. The ova are included in a transparent gluten, which is in the form of chains or strings, somewhat resembling a necklace. The length of these strings is from three to four feet; and through the whole length the ova, which have the appearance of black globules or beads, are disposed in a double series. The tadpole is hatched at the end of 14 or 15 days, according to the temperature of the season; and having burst from the surrounding gluten, they swim about in the water, feeding on different animalculae, and leaves of water plants. Early in the autumn they assume the form of the perfect animal, when they retire from the water, and are sometimes found in such numbers on the ground in its vicinity, that it has probably given rise to the common opinion of their having fallen from the clouds in showers. The age of the toad is supposed to be about 15 or 20 years, but sometimes they exceed this period. One, of which Mr Pennant has given an account in his British Zoology, lived to the great age of 40 years. This individual had been known for that time in a domesticated state. It was kept by a Mr Aecot in Devonshire, and had become so tame, that it left its hole at the approach of its master, to receive food. It grew to a very large size, and had become an object of so much curiosity, that in spite of the aversion and horror which this animal usually inspires, it was visited by all, and even by ladies, who came to the house. It was frequently brought to table, and fed with insects, and without any degree of embarrassment, or seeming desire to get away, it seized them with great celerity. Its usual place of residence was under the steps of the door of the house which led to the garden. It was unfortunately seized by a raven, and severely wounded, before it could retreat to its hole; and although it was liberated from its enemy, and lived for more than a year afterwards, it never recovered its usual health and vigour, otherwise the period of its life might have been greatly extended. It has been long supposed that the toad, when it is irritated, secretes a fluid from its skin which is of a poisonous quality. This fluid, however, has no effect whatever, except producing a little irritation, on larger animals. A dog, it has been observed, carrying a toad for a short time in his mouth is affected with a slight swelling of the lips, and an increased discharge of saliva. This fluid undoubtedly answers some purpose in the economy of the animal, and it is probably intended for its protection against the troublesome attacks of smaller animals. This seems to be in some measure proved from the experiments of Laurenti. In these experiments it appeared that small lizards which had bitten the common toad, became disordered and paralytic, and even apparently dead. They were, however, completely recovered in the space of a few hours.

Many wonderful stories have been related of the toad having been found inclosed in the solid substance of wood and stone, or marble; and what is still more wonderful, that it has been in such circumstances without any visible outlet, or the smallest passage for the access of air, alive, and not apparently injured. It is not indeed a little surprising, that a supposed fact of this kind, so contrary to the nature of animal existence, should even for a moment have gained any degree of belief; yet many such stories have been currently reported, and readily, we might almost say universally, admitted to be true; for being established on what was said to be the most un-

doubted testimony, they were received and acknowledged as fully authenticated. But on closer investigation, in all cases where inquiry could be made, it was found that some links in the chain of evidence were always wanting. In no instance whatever, it may be asserted, has the fact been ascertained from direct information, founded on any credible or respectable authority. It has always been first communicated by report, or from a distance; circumstances which always give room for mistake and error. Toads may have been found inclosed in wood, or even in stone, perhaps without having received any material external injury; but that they should have remained in such situations for any great length of time, as for years, nay, in some cases, for hundreds of years, totally deprived of food, and completely excluded from all access of air, is not only highly incredible, but impossible. But if farther evidence were necessary, this supposed fact is fully disproved by the experiments of Herissant, which he performed in presence of the French Academy. It had been asserted that a living toad was found in the year 1771, in a wall at a seat belonging to the duke of Orleans. The wall, which was then pulled down, had been built 40 years; and its hind feet were found imbedded in the mortar. In Herissant's experiments, three toads were inclosed in separate boxes, and these were immediately covered with a thick coat of mortar, and kept in the apartments of the academy. At the end of 18 months the boxes were opened, and two of the toads were found living. They were again enclosed; but being re-opened after some months had elapsed, they were found dead.

31. Rana alliacea, Alliaceous Toad.

Specific Char. — Colour pale gray, marked with brown, and having a whitish dorsal line; pupils perpendicular.

This species, excepting in a greater proportional length of the head, has a considerable resemblance to the common toad. It differs from it also in being nearly smooth. The colour above is a brownish gray, with spots of deep brown, which on the sides are disposed in a reticular form. The eye has a very peculiar structure. The form of the pupil, when the eye is contracted, is perpendicular, as in the eyes of cats. On the hind feet there is a spurious claw, or horny callus, situated beneath the heel.

This animal gives out, when irritated, a peculiar odour, which resembles that of onions or garlic, and produces a similar acrid effect on the eyes. A smell like that of the smoke of gunpowder is also sometimes combined with the garlic smell.

This species is a native of Germany. It is found in the neighborhood of Nuremberg.

It has been already mentioned, that the spawn of the common toad is deposited in the form of a double string; but in this species there is only one string, which is of considerable thickness, and the numerous ova are disposed not in a double row, as in the former, but in a confluent manner through the length of the spawn, which is sometimes found nearly two feet long.

The tadpole of the alliaceous toad, like the supposed one of the rana paradoxa, is considerably larger in size than the young frog when it has first assumed its perfect form.
E R P E T O L O G Y.

32. RANA Mephítica, Mephitic Toad.

Specif. Char.—Colour olive, spotted with brown; warts on the skin reddish; dorsal line sulphur-coloured.

Excepting in the colour, and being of a smaller size, this species greatly resembles the common toad. The body and limbs are short and thick; the fore feet are furnished beneath with a pair of bony processes, by means of which it is enabled to climb up the sides of walls. The hind feet have no webbed structure. In its motion it rushes somewhat like a mouse. It comes out only in the night, from the cavities of walls and rocks, where it conceals itself by day.

This species is a native of Germany, in some parts of which it is known by the name of vorhlich, or reed frog, because in the spring it frequents places which are overgrown with reeds. At this season, too, it is well known by the strong and peculiar note or croak which it utters.

In the month of June, when this species breeds, it resorts to the water, to deposit its ova. These are emitted, as is the case with the common toad, in double rows, in a pair of long glutinous strings; and so rapid is the progress of hatching, that the tadpoles appear in the space of five or six days, having separated themselves from the spawn. The hind legs appear about the end of August, are soon succeeded by the fore legs, and by September or October the animal has assumed its complete form.

The mephitic toad has derived its name from a most offensive smell which it diffuses when it is irritated. This odour proceeds from a white acrid fluid which exudes from the pores of the skin. The animal has the power of emitting this fluid to the distance of three or four feet, and it is said that if it fall on any part of the room where the animal is kept, it will scarcely be entirely dissipated for two months afterwards. This odour resembles the smoke of gunpowder, but is considerably stronger; or that of the fumes of arsenic.

Var. The matter-jack of Pentam is, according to some, a variety of the above species. It is not, however, said, that, like the mephitic toad, it emits any peculiarly offensive odour; but its running motions bear a near resemblance; for it does not leap, nor does it crawl with the sluggish pace of the common toad.

It is a native of England, and is found in Pulteny common, and near Revesby abbey in Lincolnshire, frequenting dry and sandy places.

33. RANA Viridis, Green Toad.

Specif. Char.—Colour pale, varied with greenish spots; tubercles reddish. Rana variabilis, Linn.

In this species the green spots or patches are bounded with a blackish margin, and the whole has somewhat of the appearance of a map. The spots on the legs and thighs are transverse, forming a kind of bars; the eyes are remarkable for a beautiful golden colour, and when the animal is irritated, seem to emit a kind of phosphoric light.

This species is a native of Germany and other parts of Europe, and is not unfrequently found about Vienna, where it inhabits the cavities of walls.

This species, like the mephitic toad, emits a very strong odour, which resembles that of garden nightshade. It is so powerful, that it diffuses itself through a large room.

During the breeding season this species frequents the waters, and in winter it retires under ground. Its croaking is said to resemble the creaking of the hinge of a door. It would appear, that the fluid which exudes from the skin of this toad, and probably also from that of others, is poisonous to small animals; for it is said that the smaller kinds of the gray lizard, on biting this toad, became immediately strongly convulsed, and died in a few minutes.

34. RANA Marina, Marine Toad.

Specif. Char.—Colour yellowish brown, with a large porous prominence over each shoulder; very large size.

This species even exceeds the bull frog in size. On each shoulder there is a protuberance of a light-brown colour, which is marked with many pores. These are the parotid glands, which are peculiarly conspicuous. The feet have no webs, and there are four toes on the fore feet, and five on the hind. The toes are furnished with claws, somewhat resembling the human hair. There are some tubercles at the extremity of the body, which are said to be owing to the folding of the skin, when the animal is placed in a particular attitude; for these disappear when the attitude is changed.

This species is said to be a native of America; and, according to some, is calculated to live both by land and sea.

35. RANA Dubia, Doubtful Toad.

Specif. Char.—Colour yellowish brown, warty, having a large porous prominence over each shoulder; hind feet subpalmed and subhexadactyle.

In size this species comes near that of the common toad; but it is different in shape, as it tapers from the shoulders to the hind legs like the tree frogs. The upper surface of the body is covered with oval tubercles, and there are protuberances on the shoulders like the rana marina. The under parts of the body are also beset with smaller tubercles. The joints of the toes of the fore feet are tuberculated beneath, and there are two remarkable protuberances under the foot.

Of the native country of this species, or of its manners and habits, nothing is yet known.

36. RANA Typhonia, Miśrod Toad.

Specif. Char.—Colour brown, dorsal line whitish; head triangular.

This species is about the size of the common toad; the
the thighs are barred with brown, and the skin of the whole body is covered with numerous small protuberances of a pearly colour. The sides of the head beyond each eye have somewhat of an angular appearance, and from this it has derived the name of misted toad.

37. Rana Braziliana, Brazilian Toad.

Specif. Char.—Colour rufous, with numerous brown spots on every part of the body.

In its general appearance this species resembles the common toad, but is much larger, and the head is proportionally shorter. The spots or stripes on the body are red brown, placed transversely, and are somewhat waved.

It is a native of South America; but, according to some, has been found in the island of Cuba.

38. Rana Ventricosa, Granulated Toad.

Specif. Char.—Colour pale brown; abdomen dilated, and marked on the sides with blackish spots.

In this species the head and eyes are large, the mouth wide, the body somewhat depressed; the abdomen is very broad; the limbs are rather short. The upper surface of the body and limbs is covered with tubercles of different sizes, very distinctly arranged.

It is supposed to be a native of Brazil.

39. Rana Cornuta, Horned Toad.

Specif. Char.—Colour cinnamon, banded with brown; eyelids conical.

In this species a broad white band runs along the back, from the head to the extremity of the body, and becoming gradually narrower. It is covered with small specks like pearls. The rest of the body, excepting the head, is rough, with sharp points. The head is large and thick, and a broad thick tongue appears when the mouth is opened. It is covered with papillae, and fastened to the anterior part of the lower jaw. The gape of the mouth extends almost half the length of the body; the eyes are rather small, and are placed nearer than in other frogs. Each of the upper eyelids rises up into a large conical calyx, or horn. From this extraordinary width of the mouth, and singular structure of the upper eyelids, this species exhibits the most deformed and hideous aspect of any of the whole tribe.

It is a native of South America.

40. Rana Pfa, Pia, or Surinam Toad.

Specif. Char.—Colour brown; toes of the fore feet quadrid at the extremities.

This species is considerably larger than the common toad. The body is flatish; the head somewhat triangular; the mouth wide, and the corners are furnished with a kind of rugged appendage. There are four long thin toes on the fore feet, and each of the toes is divided into four distinct processes; and these, when minutely examined, are found to be still farther divided. The hind feet have five toes, and are webbed to the tips. The male is larger than the female; measuring sometimes seven inches from the tip of the nose to the extremity of the body. The nose in both sexes is truncated, and the eyes very small.

This singular species is a native of Surinam.

The economy and habits of the pia greatly occupied the attention of naturalists for a long time after it was first known to Europeans, which was about the end of the 17th century. It was then supposed that the ova were produced in cells on the back of the animal, with the young being first excluded, as in the other species of this tribe, in the form of spawn. But future observers have added new facts, and greater accuracy, to the natural history of this species; and it is now found that the spawn being excluded in the usual manner, is received into a number of open cells on the back of the animal, and is there retained till the young have reached some degree of maturity. This discovery is owing to Dr Fermin, who made his observations on the spot, during a residence at Surinam. The female pia, he observes, deposits her spawn near stagnant water. The male collects the ova, and places them carefully on the back of the female, where, after being impregnated, they are pressed into the cells, which are then open to receive them. The cells close over them, and retain them for near three months, when the young animals, having arrived at their perfect state, emerge from the back of the parent. During this period of concealment, it has been discovered by other naturalists, that the ova undergo the same change as those which are hatched out of the body; first assuming the form of the tadpole, and then acquiring the complete shape before they are excluded from the cells. In this mode of hatching its young, some naturalists have observed an analogy in this process of nature between the Surinam toad and the opossum.

This animal, from the uncoyness of its shape, and its general appearance, will, by many, be considered at first view as little less hideous and deformed than the horned toad.

41. Rana Brevicervis, Short-headed Toad.

Specif. Char.—Colour brown, pale beneath; body ovate, convex, and marked with a longitudinal, ash-coloured, dentated band. Rana gibbosa, Lima.

This is a small species, and scarcely exceeds half the size of the common toad. The head is very small, obtuse, and sunk in the thorax. The toes of the fore feet are unwebbed, have no claws, and are furnished with tubercles beneath the joints. The hind feet are furnished with six toes.

It is a native of Senegal, and some other parts of Africa.

42. Rana Styxoma, Indistinct Toad.

Specif. Char.—Body somewhat globose; head indistinct, and mouth small.

In its general appearance this species greatly resembles the preceding. The body is thick and roundish, and the head is so little distinguished from the body, that the mouth is scarcely perceptible. The legs are very short, and the thighs seem enclosed in the wrinkled skin of the sides. The whole body is smooth.

It is a native of the East Indies.
43. Rana Acephala, Headless Toad.

_Specific Char._ — Colour brownish, marbled with white; head indistinct, and mouth very small, bending downwards.

Excepting in the colour, which is very different, and in the head being still less distinguished from the body, this species in appearance comes very near the two former. The mouth also is smaller, and is curved downwards at each corner. Its native country is unknown.

44. Rana Lentiginosa, Carolina Toad.

_Specific Char._ — Colour gray, freckled with brown; head somewhat pointed.

This species, in its general appearance, greatly resembles the common toad, excepting that the head is smaller, and the snout sharper. The colour is of a dusky brown, mottled with minute blackish or dark-brown spots. In its motions this species is different from the common toad, for it leaps rather than crawls.

It is a native of North America, and particularly of Carolina and Virginia. It is said to be most common in wet weather, and frequents the higher grounds, appearing not only in the evening, but even in the hottest part of the day.

This species, like others of the same tribe, feeds on insects, and seems to be extremely fond of luminous insects, as fire-flies, glow-worms, &c. It is said that it will seize a piece of live wood coal, mistaking it for a luminous insect, and swallow it, seemingly with impunity.

45. Rana Semilunata, Crescent Toad.

_Specific Char._ — Colour blackish, paler beneath; a white crescent-shaped spot at each ear.

This species is larger than the common toad, and is particularly distinguished by a large, round, white spot behind the parotids. The body is covered above with tubercles.

46. Rana Melanostica, Black-tipped Toad.

_Specific Char._ — Colour yellowish brown; warts black, speckled; upper lip and eyelids edged with black; hind feet subhexacdyous and semipalmated.

This species is nearly the size of the common toad, and resembles it in its general appearance. The space between the eyes is depressed and smooth. The edges of the projecting orbits of the eyes are black; the upper jaw is surrounded with a similar border, and the tips of the toes and the two tubercles of both hind and fore feet are also black.

It is supposed to be a native of China.

47. Rana Arunco, Arunco.

_Specific Char._ — Body warted; all the feet webbed.

This species is nearly of the same colour as the common frog, but it is larger in size. The body is warted, and all the feet are palmated.

It is a native of Chili.

Vol. VIII. Part I.

48. Rana Lutea, Yellow Toad.

_Specific Char._ — Colour yellow; feet subpalmated.

In its general habit this species resembles the common frog, but is smaller in size. The skin is covered with warts, and all the feet are subpalmated.

It is also a native of Chili, and frequents the waters.

III. DRACO, DRAGON.

1. Draco Volans, Flying Dragon.

_Specific Char._ — The fore legs are unconnected with the wings.

The flying dragon, in many respects, both in its structure and habits, resembles the tribe of lizards; but on account of the expansile cutaneous processes with which the sides are furnished, Linneus has arranged it under a distinct genus.

The body of this animal is about four inches in length; but from the tip of the nose to the extremity of the tail, it is commonly about nine or ten inches, and sometimes a foot. The form of the head is very singular; it is furnished beneath with a large triple pouch or process, one part of which hangs beneath the throat, while the other two project on each side. They are all sharp-pointed, and are more conspicuous, in proportion to the size of this animal, than the same processes in lizards. The mouth is wide; the tongue large and thick at the base; the teeth are small and numerous; the neck is also small; the body and limbs are slender, and entirely covered with small pointed scales. On the upper part of the body the colour is pale blue, or bluish grey; but the back and tail are marked with transverse dusky bars. The wings are elegantly spotted with patches of black, deep brown, and white, of different forms. The under surface is of a whitish-brown colour.

The flying dragon is a native of Asia and Africa, where it is found frequenting trees; and for this it is peculiarly adapted, from the cutaneous processes with which it is furnished on each side. For by means of these lateral membranes, it is enabled to spring with more facility from branch to branch, and even to support itself for some time in the air, like the bat or flying squirrel. Like the lizard, it feeds on insects.

2. Draco Praetos, American Flying Dragon.

_Specific Char._ — Wings united with the arms.

This species is considered by some naturalists only as a variety of the former. The circumstances in which it differs are, that the body and neck are more slender, and the pouch at the throat is single.

It is said to be a native of America.

The real dragon of modern naturalists, it may be observed, is not that terrible and destructive monster, the mere creature of imagination, which existed only in the descriptions of romance, and the older poetry; nor is it the
The character of the animals included under this section is, that they are furnished with very strong scales.

1. Lacerta Crocodilus, Common Crocodile, or Crocodile of the Nile.

**Specif. Char.**—Head mailed; neck carinated; tail furnished on the upper part with two lateral crested processes.

The crocodile sometimes arrives at a very great size. Individuals of 20 feet long have frequently been seen, and instances are mentioned of some which have exceeded the length of 30, and even 40 feet. When it is full grown, the colour of the upper part of the body is blackish brown; beneath it is yellowish white. The upper parts of the legs and sides are variegated with deep yellow, and in some parts tinged with green. The colour of the younger animal is different; for that of the upper part is a mixture of brown and pale yellow, while the under parts are nearly white. The opening of the mouth is of great width, and exhibits somewhat of a flexuous outline. Both jaws are furnished with numerous sharp-pointed teeth; those in the middle part of the jaw being largest, and resembling the canine teeth of viviparous quadrupeds. Each jaw contains 30 teeth or more, for the number is found to vary in different individuals, perhaps from the difference of age. The disposition of the teeth is such, that when the mouth is shut, they alternate with each other. When the teeth have been taken out, and the alveoli examined, it has appeared that small teeth were forming beneath, to supply the loss of the others when shed. The external openings of the ears are placed on the top of the head, above the eyes; they are of moderate size, of an oval form, and covered with a membrane, in which there is a longitudinal slit, giving them the appearance of closed eyes. The eyes are furnished with a nictitating membrane, or transparent moveable pellicle, similar to that of birds. The legs of the crocodile are short, strong, and muscular. There are five toes on the fore feet, and they are unwebbed. On the hind feet there are only four toes, which, towards the base, are united by means of a strong membrane. The two anterior toes on each of the fore feet, and the interior one of the hind feet, have no claws; but the other toes are furnished with claws, which are strong, sharp, and curved. The tail is long, compressed on the sides, and furnished above with an upright process, formed by the gradual approach of two elevated crests which proceed from the lower part of the back. The upper part of the body of the crocodile is covered with strong armour; which, in its structure, exhibits the appearance of a regular and curious carved work, and is indeed a most elaborate piece of mechanism. It is so strong
strong and thick, when the animal has reached its full
growth, that it easily resists the force of a musket-ball.
On the lower parts of the body, it is more pliable, and
much thinner, so that it is in these parts only that
wounds can be inflicted.
The crocodile deposits its eggs in the sand or mud,
in the banks of the rivers which it inhabits; and as soon
as the young are hatched, they proceed to the water.
When the young are first excluded, the head is pro-
portionally much larger than that of the full grown ani-
mal. The egg of the common crocodile is about
the size of that of a goose, and resembles greatly that of
a bird. It is covered with a calcareous shell, which is
lined with a membranous substance. Various birds,
the ichneumon and other animals, make great havoc
among the eggs of the crocodile during the period of
hatching, thus diminishing the numbers which would
otherwise be produced. The eggs of the crocodile,
and indeed the flesh itself, are regarded as delicacies
among some African nations, and compose a part of their
favorite repasts.
The crocodile is a native of Asia and Africa, but it
seems to be more common in the latter than in the for-
mer country. It inhabits the large rivers, as the Nile,
the Niger, &c. frequenting the low sand islands of
these rivers, and preys chiefly on fish, although, being
extremely voracious, it seizes any other animal that
comes within its reach.
The crocodile has been long regarded as one of the
most formidable animals of the countries which it in-
habits; but from the accounts of later naturalists, it
appears, that it is by no means so ferocious as has
been pretended. Dumas, who visited Egypt along
with the French army, observes, that many stories are
related of crocodiles, but that he had not any oppor-
tunity of verifying a single one. " Daring, (says he)
even to imprudence, our soldiers set them at defiance.
Even I myself bathed daily in the Nile; for the tran-
quill nights that I thus obtained, rendered me regard-
less of dangers, which we had not as yet verified by a
single fact. If the crocodiles had devoured a few of
the carcasses which the war left at their disposal, such a
food, it might be imagined, would only excite their
appetite, and engage them to pursue, when alive, so
favourite a prey. And yet we were never once attack-
edy by them, nor did we ever meet with a single cro-
doile at a distance from the water. Hence it appears
probable, that they find in the Nile itself a sufficient
quantity of easily procurable food, which they digest
slowly, being like the lizard and serpent, cold-blooded,
and of an inactive stomach. Besides, having in the
Egyptian part of the Nile no enemies but each other
and man, they would be truly formidable; if, covered
as they are with almost imperceptible defensive arm-
our, they were alert and skilful in making use of those
which nature has given them for attack."

The same author observes, that no crocodiles were
seen at Syene on the river Nile, but that they are to
be met with above the cataracts. " They seem (he
says) to prefer certain reaches of the river, and par-
cularly from Tentyra to Ombos; they abound most of
all near Hermontes. We here saw three of them; one
much larger than the rest, was nearly 25 feet long;
they were all asleep, so that we could approach them
within 20 paces, and we had time to distinguish all the
peculiarities which gave them such a hideous aspect.
They resembled dismounted camon. I fired on one
with a heavy musket; the ball struck him, and re-
bounded from his scales. He made a leap of 10 feet,
and dived into the river."

In the large rivers of Africa, vast schools of croco-
diles are seen swimming together, when they exhibit
the appearance of the trunks of large trees floating on
the water. It is said, that the negroes venture to at-
tack, and often succeed in killing a single crocodile,
by stabbing it with a sharp instrument under the belly,
where the skin is soft and vulnerable. In some coun-
tries, we are told, the hunting of the crocodile with
strong dogs is practised for amusement. For this pur-
pose the dogs are properly trained and instructed; and
to protect them against the attack of the crocodile, they
are armed with collars furnished with spikes.

It is even said, that crocodiles are occasionally tamed
in some parts of Africa, and that they constitute an ar-
ticle of royal magnificence with some of the African
monarchs, in which case they are kept in large ponds
or lakes. It is well known that crocodiles were ex-
hibited by the ancient Romans during their public spec-
tacles. In the edileship of Scipion, he presented the
people with a sight of five crocodiles in a temporary
lake; and one was introduced by Augustus in his tri-
umph over Cleopatra, for their entertainment.

Var.—A variety of the common crocodile, it is said,
have been found in the river Senegal; according to M.
Adanson, it has a longer snout, and is almost entirely
blac. It is said that it is very rapacious, and has only
been observed in the above river, where the common
crocodiles are very numerous.

2. Lacerta Alligator, The Alligator or American
Crocodile.

Specif. Char.—Head flat, imbricated; neck naked, or
uncarinated; tail furnished above with two lateral
lines.

The alligator is considered by some naturalists only
as a variety of the crocodile; any differences which
are observable, they suppose, may be ascribed to the
effect of climate. They have the same number of teeth,
and their manners and habits are nearly similar in the
old and new world; but the difference, although not at
first sight obvious, seems to be fully established from
the more accurate observations of others. The head of
the alligator is smooth, and is not furnished with the
rugosities and hard carinated scales which appear on
the head of the crocodile; and besides, the snout of the
alligator is flatter, wider, and more rounded at the ex-
tremity. The size of the alligator is little inferior to
that of the crocodile. Individuals have been often seen
from 18 to 20 feet long.

Catesby, in his history of Carolinas, has given a ful-
er account of the economy and habits of the alligator,
than any other author. " Though the largest, says he,
and greatest numbers of alligators, inhabit the torrid
zone, the continent abounds with them 15° more
north, particularly as far as the river Neus in North
Carolinas. In the latitude of about 35°, beyond which
I have never heard of any, which latitude nearly an-
swers to the northernmost parts of Africa, where they are
likewise found, they frequent not only salt rivers near
ERPETOLOGY.

Lizards. In the sea, but streams of fresh water in the upper parts of the country, and in lakes of salt and fresh water; on the banks of which they lie lurking among reeds, to surprise cattle and other animals. In Jamaica, and many parts of the continent, they are found about 20 feet in length. They cannot be more terrible in their aspect than they are formidable and mischievous in their nature. Sparing neither man nor beast they can surprise, pulling them down under water; that being dead, they may with greater facility, and without struggle or resistance, devour them. As quadrupeds do not so often come in their way, they almost subsist on fish; but as Providence, for the preservation, or to prevent the extinction of defenceless creatures, hath in many instances restrained the devouring appetites of voracious animals by some impediment or other; so this destructive monster, by the close connection of his vertebrae, can neither swim nor run any way, but straight forward, and is consequently disabled from turning with that agility requisite to catch his prey by pursuit; therefore, they do it by surprise in the water, as well as by land; for effecting which nature seems in some measure to have compensated their want of agility, by giving them a power of deceiving and catching their prey by a sagacity peculiar to them, as well as by the outer form and colour of their body, which on land resembles an old dirty log or tree, and in the water frequently lies floating on the surface, and there has the like appearance; by which, and his silent artifice, fish, fowl, turtle, and all other animals are deceived, suddenly caught, and devoured.

Carnivorous animals get their food with more difficulty and less certainty than others; and are often necessitated to fast a long time, which a slow concoction enables them to endure; reptiles particularly, by swallowing what they eat whole, digest slowly, eat seldom, and live long without food. Wolves are said to gorge themselves with mud, to supply the want of better food. For the like cause, many alligators swallow stones and other substances to distend and prevent the contraction of their intestines when empty, and not to help digestion, which they seem in need of. For in the greater number of many which I have opened, nothing has appeared but lumps of light wood and pieces of pine-tree coal, some of which weighed eight pounds, and were reduced and worn so smooth from their first angular roughness, that they seemed to have remained in them many months. They lay a great number of eggs at one time on the sandy banks of rivers and lakes, which are hatched by the heat of the sun without further care of the parents. The young, as soon as they are disengaged from their shells, betake themselves to the water, and shift for themselves; but while young, they serve as a prey, not only to ravenous fish, but to their own species. It is to be admired, that so vast an animal should at first be contained in an egg no bigger than that of a turkey.

In South Carolina they are very numerous; but the northern situation of that country occasions their being of a smaller size than those nearer the line; and they rarely attack men or cattle, yet are great devourers of hogs. In Carolina they lie torpid from about October to March in caverns and hollows in the banks of rivers, and at their coming out in the spring, make a hideous bellowing noise. The hind part of their belly and tail are eaten by the Indians. The flesh is delicately white, but has so perfumed a taste and smell, that I never could relish it with pleasure.

The alligators of South America, like the turtles, deposit their eggs at two or three different periods, at the distance of several days, and from 20 to 24 eggs each time. They have been observed to raise a small hillock near the banks of the river; and, after hollowing it out in the middle, to collect a quantity of leaves and other vegetable matters, in which they deposit their eggs. These are covered with the leaves, and are hatched by means of the heat extricated during their putrefaction, along with that of the atmosphere. The alligators about Cayenne deposit their eggs in the month of April.

To the account of the alligator which we have now given, we add the following particulars concerning its natural history by Don Ulloa, in his voyage to South America. The observations were made on the river Guayacuq; and we shall detail them in his own words.

The increase of fish, says he, in this river is greatly hindered by the prodigious numbers of alligators, an amphibious creature, living both in the rivers and the adjacent plains, though it is not often known to go far from the banks of the river. When tired with fishing, they leave the water to bask themselves in the sun, and then appear more like logs of half-rotten wood thrown ashore by the current, than living creatures; but upon perceiving any vessel near them, they immediately throw themselves into the water. Some are of so monstrous a size as to exceed five yards in length. During the time they lie basking on the shore, they keep their huge mouths quite open, till filled with mosquitoes, flies, and other insects, when they suddenly shut their jaws and swallow their prey. Whatever may have been written with regard to the fierceness and rapacity of this animal, I, and all our company knew from experience, they avoid a man, and on the approach of any one, immediately plunge into the water. Its whole body is covered with scales impenetrable to a musket ball, unless it happens to hit them in the belly near the fore legs, the only part vulnerable.

The alligator is an oviparous creature. The female makes a large hole in the sand near the brink of a river, and there deposits her eggs, which are nearly equal to those of an ostrich, and as white as those of a hen, but much more solid. She generally lays about a hundred, continuing in the same place till they are all deposited, which is about a day or two. She then covers them with the sand; and the better to conceal them, rolls herself not only over her precious depositum, but to a considerable distance. After this precaution she returns to the water, till natural instinct informs her, that it is time to deliver her young from their confinement, when she comes to the spot, followed by the male, and tearing up the sand, begins breaking the eggs, but so carefully, that scarce a single one is injured, and a whole swarm of little alligators are soon crawling about. The female then takes them on her neck and back in order to remove them into the water; but the watchful gallinazo make use of this opportunity to deprive her of some; and even the male alligator, which indeed comes for no other end, devours what he can, till the female has reached the water with the few remaining; for all those which either fall from her...
her back, or do not swim, she herself eats; so that of such a formidable brood, happily not more than four or five escapes.

"The gallinazoos mentioned in our account of Carthagena, are the most inveterate enemies of the alligators, or rather extremely fond of their eggs, in finding which they make use of uncommon address. These birds often make it their whole business to watch the females during the summer, the season when they lay their eggs, the sands on the sides of the river not being then covered with water. The gallinazoos perches in some tree, where it conceals itself among the branches, and there silently watches the female alligator till she has laid her eggs and retires, pleased that she has concealed them beyond discovery. But she is no sooner under the water, than the gallinazo dart down to the repository, and with its beak, claws and wings, tears up the sand, and devours the eggs, leaving only the shells. This banquet would indeed richly reward its long patience, did not a multitude of gallinazoos, from all parts, join the fortunate discoverer and share in the spoil. I have often been entertained with this stratagem of the gallinazoos, in passing from Guayaquil to the custom-house of Babahoyo; and my curiosity once led me to take some of the eggs, which those who frequent this river, particularly the moluttons, make no difficulty of eating when fresh. Here we must remark the methods used by providence in diminishing the number of these destructive creatures, not only by the gallinazoos, but even by the males themselves. Indeed neither the river nor the neighboring fields would otherwise be sufficient to contain them; for, notwithstanding the ravages of these two insatiable enemies, their numbers can hardly be imagined.

"These alligators are the great destroyers of the fish in this river; they being their most safe and general food: now are they wanting in address to satisfy their desires, eight or ten, as it were by compact, draw up at the mouth of a river or creek, whilst others of the same corps go a considerable distance up the river, and chase the fish downwards, by which none of any size escape them. The alligators being unable to eat under water, on seizing a fish raise their heads above the surface, and by degrees draw the fish from their jaws, and chew it for deglutition. After satisfying their appetite, they retire to rest on the banks of the river.

"When they cannot find fish to appease their hunger, they betake themselves to the meadows bordering on the banks of the river, and devour calves and colts; and in order to be more secure in seizing their prey, take the opportunity of the night, that they may surprise them in their sleep; and it is observed that those alligators which have once tasted flesh, become so fond of it, as never to take up with fish but in cases of necessity. There are even too many melancholy instances of their devouring the human species, especially children, who, from the inattention natural to their age, have been without doors after it is dark; and though at so great a distance, these voracious animals have dared to attack them, and having once seized them with their mouths, to make sure of their prey, against that assistance which the cries of the victim never fail to being, hasten into the water, where they immediately draw it, and then return to the surface and devour it at leisure.

"Their voracity has also been felt by the boatmen, who, by inconsiderately sleeping with one of their arms or legs hanging over the side of the boat, these animals have seized and drawn the whole body into the water. Alligators who have once feasted on human flesh are known to be the most dangerous, and become, as it were, inflamed with an insatiable desire of repeating the same delicious repast. The inhabitants of those places where they abound are very industrious in catching and destroying them. Their usual method is by a exs ensure, or piece of hard wood sharpened at both ends, and baited with the lungs of some animal. This exs ensure they fasten to a hook, the end of which is secured on the shore. The alligator, on seeing the lung floating on the water, snatches at the bait, and thus both points of wood enter his jaws in such a manner, that he can neither shut nor open his mouth. He is then dragged ashore, where he violently endeavours to rescue himself, while the Indians bait him like a bull, knowing that the greatest damage he can do is to throw down such, as for want of care or agility, do not keep out of his reach.

"The form of this animal so nearly resembles that of the lagarto or lizard, that here they are commonly known by that name; but there is some difference in the shape of the head, which in this creature is long, and towards the extremity slender, gradually forming a snout, like that of a hog, and, when in the river, is generally above the surface of the water; a sufficient demonstration that the respiration of a porous air is necessary to it. The mandibles of this creature have such a row of very strong and pointed teeth, to which some writers have attributed particular virtues; but all I can say to this is, that they are such as I and my companions, notwithstanding all our enquiries to attain a complete knowledge of every particular, could never hear any satisfactory account of it."

3. LACERTA GANGE ETICA, Gangetic or Indian Crocodile.

Specific: Char.—Jaw somewhat cylindrical, elongated; tail furnished above with two crests uniting in one towards the extremity.

In this species, the jaws are long, narrow and straight; and the upper mandible is terminated above by an elevated taberelle. This structure of the snout is more remarkable in the young animal. The teeth of this species are more numerous than in the common crocodile, being nearly double the number, and they are of equal size through the whole length of the jaws. Excepting that the third and fourth toes, both on the fore and hind feet are connected together by a web; the structure of the feet is the same as that of the common ones. The eyes are extremely prominent; and it has been observed, are so constructed, that they may be raised above the water, when the rest of the body is under the surface; by which the animal is enabled to see its prey either on the surface of the water, or on the banks of rivers. In the general form and colour of the body and limbs, this species resembles the common crocodile, only the number of transverse bands formed by the rows of scales on the back, is greater.
Sect. II. GUANAS.

4. LACERTA IGUANA, Common or Great American Guana.

Specif. Char.—Tail long and round; back serrated; gular crest denticulated.

The guana, which of all the lizard tribe is of the most peculiar form, grows to a considerable size. It is often seen, three, four, and sometimes five feet long. The general color is green, shaded with brown. The back is strongly serrated; which, as well as the denticulations of the pouch at the throat, gives it a formidable appearance.

The guana is a native of many parts of America, and the West Indies. It is said also that it has been found in some parts of the East Indies. It frequents rocky and woody places, and feeds chiefly on insects and vegetables.

The guana itself is reckoned very nourishing and delicate food. The usual method of taking it is by casting a noose over its head, and then drawing it from its place; for without making any attempt to escape, it stands with its eyes fixed steadfastly at its discovery, while at the same time it inflates its throat to a very large size.

Catesby has given a good account of the guana, which we shall detail in his own words. "They are," he says, "of various sizes, from two to five feet in length; their mouths are furnished with exceeding small teeth, but their jaw is armed with a long beak, with which they bite with great strength. They inhabit warm countries only, and are rarely to be met with anywhere north or south of the tropics. Many of the Bahama islands abound with them, where they nestle in hollow rocks and trees. Their eggs have not a hard shell like those of alligators, but a skin only like those of a turtle, and are esteemed a good food. They lay a great number of eggs at a time in the earth, which are there hatched by the sun's heat. These guanas are a great part of the subsistence of the inhabitants of the Bahama islands, for which purpose they visit many of the remote keys and islands in their sloops to catch them, which they do by dogs trained up for that purpose, which are so dexterous as not often to kill them; which, if they do, they serve only for present spending: if otherwise, they sew up their mouths to prevent their biting, and put them into the hold of their sloop till they have caught a sufficient number; which they either carry alive for sale to Carolina, or salt and barrel up for the use of their families at home. These guanas feed wholly on vegetables and fruit, particularly on a kind of fungus growing at the roots of trees, and on the fruits of the different kinds of ananas. Their flesh is easy of digestion, delicate, and well tasted. They are sometimes roasted, but the more common way is to boil them, taking out the leaves of fat, which are melted and clarified, and put into a calabash or dish, into which they dip the flesh of the guana as they eat it. It is remarkable that this fat, which adheres to the inside of the abdomen, imbibes the colour of the fruit the animal eats last, which I have frequently seen tinged of a pale red, yellow, or sometimes of a purple colour; which last was from eating the prunus maritima, which fruit at the same time I took out of them. Though they are not amphibious, they are said to keep under water above an hour. When they swim, they use not their feet, but clap them close to their body, and guide themselves with their tails. They swallow all they eat whole; they cannot run fast, their holes being a greater security to them than their heels. They are so impatient of cold, that they rarely appear out of their holes but when the sun shines."

Dr. Browne, in his Natural History of Jamaica, gives the following particulars of the guana. "Like most of the tribe, he observes, it lives a very considerable time without food, and changes its colour with the weather, or the native moisture of its place of residence. I have kept a grown guana about the house for more than two months: it was very fierce and ill-natured at the beginning; but after some days it grew more tame, and would, at length, pass the greatest part of the day upon the bed or couch, but it went out always at night. I have never observed it to eat any thing, except what imperceptible particles it had lapped up in the air; for it frequently threw out its forked tongue, like the chameleon, as it walked along. The flesh of this creature is liked by many people, and frequently served up in fricasses at their tables; in which state they are often preferred to the best fowls. The guana may be easily trained while young, and is both an innocent and beautiful creature in that state."

Var. Horned guana. This is considered as a variety of the former. It is nearly the same in size and general proportion; the back is also serrated, and the form of the scales is the same. It wants, however, the gular pouch, and there are in front of the head, between the eyes and nostrils, four pretty large oval tubercles, behind which there is a bony conical process, which is covered with a single scale.

It is a native of St. Domingo, where it is said to be very common.

5. LACERTA AMBOINENSIS, Amboina Guana.

Specif. Char.—Variegated, tail long, tail fin radiated, dorsal suture dentated.

This species, which grows to the length of three feet, and sometimes more, is at once distinguished by the singularity of its appearance, and the beauty of its colour. The head and neck are green, and variegated with white transverse undulations. The back and tail are brown, with a shade of purple. The sides and belly are grayish, or pale brown; the head is tuberculated above, and covered with small roundish scales; the mouth is wide, and the teeth are sharp and numerous.

This species is a native of the East Indies, but is most frequent in the island of Amboina, frequented the neighbourhood of rivers and other fresh waters. It is often seen on the banks of rising grounds, and on low shrubs which grow near the water. It does not ascend tall trees. Whenever it is disturbed by the approach
ERPETOLOGY.


Specif. Char.—Tail long; dorsal and caudal fins radiated; occipital crest pointed.

The basilisk is about one foot and a half in length, of a pale ash-brown colour, with some darker variegations about the upper part of the body. In the young animal, the dorsal or caudal process, and the pointed occipital crest mentioned in the specific description, are less distinct.

The basilisk is chiefly a native of South America. It resides principally among trees, and feeds on insects.

It is said to be a very active animal, and by means of its dorsal crest or fin, it is enabled to spring from tree to tree. It can also swim with great ease.

This animal has a very formidable appearance, but is quite harmless; but in the poetical descriptions of the ancients, we find that it was considered to be the most malignant of all poisonous animals; even its look was regarded as fatal. The terrific glance of the basilisk in the African deserts, according to the poetical representation of Lucan, obliged the rest of the poisonous tribe to keep at a distance.

7. Lacerta Calotes, Galeot Lizard.

Specif. Char.—Tail long and round; back dentated on the fore part, and the head on the hind part.

This species seldom exceeds a foot and a half in length, from the tip of the nose to the extremity of the tail; but otherwise in its general habit and appearance, it resembles the common gama. It wants, however, the gular pouch; in its place there is only a slight enlargement of the throat. The colour, which occasionally varies, is most commonly of an elegant bright blue, variegated with broad, irregular, white, transverse bands on each side of the body and tail. The limbs are slender, and this is particularly the case with the toes.

This species is a native of the warmer regions of Africa, Asia, and many of the Indian islands. It is very common in Ceylon. It is said also to be a native of Spain, where it wanders about the tops of houses, in search of spiders. According to some, it preys on rats, and, like some other lizards, attacks small serpents.

8. Lacerta Agama, American Gablet.

Specif. Char.—Tail long, round; neck above, and head behind, aculeated; scales of the hind head reverses.

This species in some respects resembles the calotes; but it wishes the strong serratures on the back, in place of which it has only a small denticulated carina. The head is proportionally larger, and on the back part is furnished with sharp-pointed scales, some of which are reversed at their extremities. The colour is brownish, and variously clouded. In the male, the crest on the back is composed of longer spines, and extends to the lower part.

It is a native of South America, and some of the islands of the West Indies.

Var. Lacerta Muricata, Muricated Lizard. Tail long, round; body grayish; scales carinated and sharp-pointed.

This lizard, which is considered as a variety of the preceding, measures more than a foot in length, and has even been sometimes found to exceed that size. The want of the reverse scales on the back part of the head, constitutes the principal difference between this and the former species.

It is a native of New South Wales.


Specif. Char.—Tail of moderate length; four rows of strong carinated scales on the back.

In its general habit, this species bears some resemblance to a small crocodile, on account of the hard tuberculated and carinated scales on the upper parts of the body, two rows of which are more prominent than the rest, and extend from the upper part of the back to the tail, where they coalesce and form a serrated crest to the extremity.

The head is small, the mouth wide, and the snout somewhat sharp. The colour is reddish-brown, tinged in some parts with various shades of green.

It is a native of South America, where it is sometimes used as food. The eggs, it is said, are also greatly esteemed for the same purpose. Woody and marshy regions are the usual places of its resort. One of this species, which was kept alive for some time by M. de la Bordes, was observed to remain for hours together in the water, and when it was disturbed or alarmed, it concealed itself, but delighted to come out occasionally and bask in the sun.

Var. A lizard known by the name of ignarina, and said to be a native of Brazil, is considered as a variety of the preceding, differing only in the colour, which is darker, and the claws which are shorter; but, like it, it has some resemblance to the crocodile, and readily climbs trees.

10. Lacerta Monitor, Monitory Lizard.

Specif. Char.—Colour black; tail very long, compressed, carinated; body marked with transverse rows of white, oscillated.

This is one of the largest of the whole tribe of lizards. From the tip of the nose to the extremity of the tail, it sometimes measures no less than four or five feet. It is also one of the most beautiful. The head is small, the snout gradually tapers, the limbs are slender, and the tail, which is laterally compressed, gradually decreases towards the extremity. Indeed the shape altogether is slender and elegant; and although the colours are simple, they
Lizards. they are so disposed as to produce an agreeable and pleasing effect. This species is a native of South America, inhabiting woody and marshy places.

It is said that the monitory lizard, from the gentleness of its disposition, is remarkable for its attachment to mankind, warning them of their danger from the alligator by emitting a peculiar and shrill sound.

Var. Lacerta Varia. Variegated Lizard.—Although this lizard is somewhat different in colour, and in the disposition of its variegations, which are rather of a pale yellow than white, yet it is considered only as a variety of the preceding. It is a native of New Holland.

11. Lacerta Acanthura, Spine-tailed Lizard.

Specif. Char.—Throat plaited beneath; body covered with minute scales; tail long, and verticillated with carinated triple-spined scales.

The length of this species is about a foot and a half. The head is covered with scales, which are small and nearly six-sided; it is quite distinct from the body. The whole skin about the neck, throat, and beginning of the sides, is quite loose, which in the specimen described, may have had a pouched appearance. All the other parts of the body are covered with very small scales. The tail is very long, and strongly marked into numerous rings, which are composed of long and strongly carinated scales, each of which terminates in a lengthened point, and produces the spiny appearance. There are five long toes on each foot; the claws are strong and sharp. The colour on the upper parts of the body is glaucous, variegated with small whitish clouds and marblings.

It is described by Dr. Shaw from a specimen in the British Museum.

12. Lacerta Lophura, Sharp-tailed Lizard.

Specif. Char.—Body covered with dissimilar scales; back serrated; tail long, and somewhat compressed.

This is a very large species; there are large, rounded, and oval scales scattered here and there among the smaller ones. The tail is long and sharp-pointed; the back and tail are serrated throughout their whole length.

This species is also described by Dr. Shaw from a specimen in the British Museum.

13. Lacerta Dracena, Dracena Lizard.

Specif. Char.—Large tail; long and denticulated along the upper part.

This is one of the largest species belonging to the tribe. Not only in the size of the body, but in the proportion of the limbs and tail, it exceeds that of the guana. The colour is brown, with a slight shade of chestnut. On the outside of the limbs there are numerous small pale yellowish spots. The head is small, and the snout tapering.

It is a native of South America, and some of the Indian islands; and it is said that in some countries it is preferred as an article of food to the guana.


Specif. Char.—Tail carinated; back and eyebrows ciliated, with upright lanceolated scales.

The general appearance of this species bears some resemblance to the guana, and still more to the hared guana, in having the appearance of a pair of short pointed horn-like processes above and beyond each eye; between these are placed some aculeated scales. The size of one of which has been described, measures from 12 to 16 inches, from the tip of the nose to the extremity of the tail.

It is a native of Asia, and some of the Indian islands.

15. Lacerta Scutata, Scutated Lizard.

Specif. Char.—Tail of moderate length, compressed; dorsal nature dentated; two pointed processes on the back of the head.

This species is distinguished from the former by having a proportionally larger head, and a row of scales more elevated than the rest, passing over each eye; and from these a ridge is continued towards the back of the head, where they unite and extend down the middle of the back, in form of a short denticulated crest, to the beginning of the tail. The body is covered with aculeated scales which are but small; the limbs and tail with larger ones.

16. Lacerta Principalis, Smooth-crested Lizard.

Specif. Char.—Tail subcarinated; gular crest flat edge; back smooth.

This species is in general of a slender form, and small, rarely exceeding eight or nine inches in length, including both the body and tail. The colour is blue, the head small, and the snout taper.

It is a native of South America.

Var. Lacerta Bimaculata, Linn. This is considered as a variety of the former; the colour is blue, spotted here and there with black, with two larger black spots over the shoulders.

It is a native of St. Eustatius, and is found also in Pennsylvania.

Var. Le Roquet, of Cepede, is considered by Dr. Shaw also as a variety of the smooth-crested lizard; it resembles it both in size and habit; it is however destitute of the gular crest.

It frequents gardens, moving nimbly among trees, and devours great multitudes of smaller insects.

17. Lacerta Strumosa, Strumous Lizard.

Specif. Char.—Tail long, round; breast gibbose, projecting.

This is of a small size, has no dorsal serrations, but is furnished with a large flat gular crest of a pale red colour; the rest of the animal is of a pale bluish gray, with some slight shades of a more dusky hue. The limbs are slender.

It is a native of South America.

18. Lacerta Marmorata, Marmorated Lizard.

Specif. Char.—Tail long, round; throat subcrested; back smooth.

This species is of a slender and elegant form, and measures, including the tail, about a foot in length.
Sect. III. Cordylus.

Having denticulated or spiny scales, on the body or tail, or both.


Specific Char.—Tail long, and verticillated with rhomboidal scales.

This lizard is about two feet in its total length, and is distinguished on the upper parts of its body by a beautiful variety of green, yellow, blue, and black colours. The under parts of the body are of a glossy yellowish green.

It is a native of Chili.


Specific Char.—Tail short, verticillated with mureturate scales.

This is of a fine blue colour, transversely banded with black or blue. It is sometimes only a few inches long, but others are found of a larger size.

The larger variety is a native of South America, the smaller of some parts of Africa.

22. Lacerta Cordylus, Cordyle Lizard.

Specific Char.—Body smooth; tail short and verticillated with denticulate scales.

This species, at first sight, bears a considerable resemblance to the former; but the scales which cover the body, are of an oblong square form, and larger, and the tail is verticillated with rows of large scales of the same form. The colour is sometimes blue, sometimes a livid brown, and the total length is about ten inches.

23. Lacerta Stellio, Rough Lizard.

Specific Char.—Tail verticillated, with denticulated scales; body and head muretturate.

The whole upper surface of the body is remarkably rough, from being covered with projecting pointed scales. It is of a pale bluish brown colour, with some deeper and lighter transverse variegations. It is about eight inches long.

This species is a native of many parts of Africa.

Species Char.—Colour blackish green, undulations transverse and black; abdomen longitudinally banded with black, white, and blue; breast black; top of the head red.

This species is of a moderate size; the scales on the head are largest, and there is a row of tubercles beneath the thighs.

It is a native of the island of St Christopher.

29. Lacerta Cerulea, Ameiva Lizard.

Species Char.—Colour blue, with black and white variegations; tail long, verticillated; abdominal scales 30.

The ameiva greatly resembles the green lizard, but it wants the scaly collar. The scales on the upper part of the body are not distinctly visible; those of the abdomen are composed of square plates, and there is a row of tubercles beneath each thigh.

It is a native of South America, and it is said that it is sometimes found in Africa and Asia.

30. Lacerta Lemnisca, Striped Lizard.

Species Char.—Colour dusky blue; eight white lines down the back; limbs spotted with white; tail long, round.

This is of a smaller size than the last species, but in its general appearance bears a considerable resemblance. The white stripes on the back vary in breadth, and sometimes in number.

It is a native of Guinea, but is also found in some parts of India and South America.

31. Lacerta Quadrilineata, Four-striped Lizard.

Species Char.—Colour blackish blue; four white or yellowish lines down the back; tail long, round; fore feet tetractious.

This is a smaller species than the last, but resembles it greatly. The claws are very small.

It is supposed to be a native of North America.

32. Lacerta Teniolata, Ribband Lizard.

Species Char.—Body marked above with black and white stripes; beneath white; tail long and round.

This is a small species; the colour above is chestnut brown, and the scales on every part of the body are smooth, round, and imbricated. From the head to the middle of the tail there are six white linear stripes. The limbs are striped longitudinally with black.

It is a native of New Holland.

33. Lacerta Sexlineata, Six-lined Lizard.

Species Char.—Colours gray brown; six white lines down the back; tail long, verticillated.

This is a small species. Beneath the throat there is a double plate, and a row of tubercles beneath the thighs. The legs are long and the feet slender; the tail is carried curved over the back, from which it has been called the lion lizard.

It is a native of the West Indies, where it frequents the rocks on the sea coast.

34. Lacerta Fasciata, Fasciated Lizard.

Species Char.—Colour of the body brown; tail blue and rather long. There are five yellowish lines down the back.

This is a small species, rarely exceeding eight inches in its whole length. The head is short.

It is a native of Carolina, inhabiting hollow trees.

35. Lacerta Quinquelineata, Five-lined Lizard.

Species Char.—Colour dusky; five whitish lines down the back; tail round, and of a moderate length.

This is a small species. The tail is twice the length of the body. There are six stripes on the head. The abdomen is imbricated with stripes.

It is a native of Carolina.

36. Lacerta Interpunctata, Punctated Lizard.

Species Char.—Tail long, round; dorsal lines two, and yellow, having black specks interspersed.

This is a small species; the body is smooth and glossy, and the head is covered with large scales.

It is a native of Asia.


Species Char.—Colour green; gular pouch red; tail long, round.

This species is about six inches long, of a shining grass-green colour. When it is approached, the throat swells into a globular form, and the protruded skin becomes of a bright red colour. This is supposed to be a threatening aspect, but probably without foundation.

This species is a native of Jamaica, where it is common about hedges and trees.

Var. Green Carolina lizard.—This resembles the former in every respect, except in the appearance of the gular pouch. In dry hot weather it appears of a bright green colour; but in cold weather this changes to a brown.

It is a native of Carolina, where it is very common about houses.

38. Lacerta Cruenta, Red-tailed Lizard.

Species Char.—Colour brown; on the neck there are seven white stripes, and four on the back. Under the throat there is a plate; the tail is verticillated and red beneath.

There is a very small species, resembling the lacerta velox, but differs from it in having a sharper snout. The limbs are marked with white round spots; the tail is red beneath and white at the tip. There is a row of tubercles on the thighs.

It is a native of the southern parts of Siberia, and is found about the salt lakes.


ERPETOLOGY.

39. <i>Lacerta lobata</i>, Lobo-cheeked Lizard. <i>Lacerta aurata</i>, Lin.

Specif. Char.—Colour brownish, with a roundish denticulated lobe on each side of the neck.

This species is of moderate size, and in appearance is somewhat thick or ventricose. Body rather depressed; the head rounded on each side. From the corner of the mouth extending to the shoulders, there is a flat semicircular lobe of a red colour, with serrated edges. The whole of the body is rough, with small pointed granules.

It is a native of the southern deserts of Siberia, and is found among the sand hills.

40. <i>Lacerta helioscopa</i>, Sun-gazing Lizard.

Specif. Char.—Colour brownish; head rough, with cells; a transverse plate beneath the throat; tail imbricated, thick at the base, and sharp at the tip.

This is a small species, scarcely exceeding a finger's length. The colour of the upper parts of the body is grey, with brown and bluish spots and linear streaks. The neck is often marked above with a red spot. The tip of the tail is red beneath.

It is a native of the southern parts of Siberia, where it bask in sunny situations, with its head turned up towards the sun.

41. <i>Lacerta turcica</i>, Turkish Lizard.

Specif. Char.—Colour brown; body roughish; tail of moderate length, and somewhat verticillated.

This is a small species; the head is rather large, and the body thickish; the tail short, thick at the base, and pointed at the tip.

It is a native of eastern countries.

42. <i>Lacerta platura</i>, Broad-tailed Lizard.

Specif. Char.—Colours gray brown, paler beneath; body rough; tail depressed, lanceolated, and spiny on the margin.

This species is from four to six inches long, and is remarkably distinguished by the singular form of its tail. The feet are pentadactylyous; the toes slender, and the claws curved.

It is a native of New Holland.

43. <i>Lacerta plica</i>, Plica Lizard.

Specif. Char.—Hind head callous; eyebrows excoriated above; neck plated beneath, and warted at the sides; tail long and round.

This is a small species, not exceeding a finger's length. It is entirely covered with conical scales; there is a double plate beneath the throat.

It is a native of South America and India.

44. <i>Lacerta japonica</i>, Japanese Lizard.

Specif. Char.—Tail long, round; feet unguiculated; fore feet tetradactylyous; a single stripe on the back.

This is a small species; the colour above is livid brown, and the yellow stripe from the hind head to the beginning of the tail is brown and dentated. The claws are black.

45. <i>Lacerta nilotica</i>, Nilotic Lizard.

Specif. Char.—Tail long and triquetrous; body smooth, with four lines of scales down the back.

This likewise is a small species.

It is a native of Egypt.

46. <i>Lacerta tiliguerta</i>, Tiliguerta Lizard.

Specif. Char.—Tail verticillated, twice the length of the body, and having eighty abdominal scuta.

This, like the former, is a small species, measuring not more than seven or eight inches long. The female is of a brown, and the male of a green colour, with black spots. It seems to bear some relation to the green lizard.

It is a native of Sardinia, where it is to be met with in fields, about walls, &c.

47. <i>Lacerta deserti</i>, Desert Lizard.

Specif. Char.—Tail round, longish; feet pentadactylyous; body black above, and marked with six longitudinal white lines.

This is a very small species; the body is white beneath, and the stripes on the back are composed of oblong spots.

It is a native of the Uralian desert.

48. <i>Lacerta arguta</i>, Argute Lizard.

Specif. Char.—Tail short, verticillated; thick at the base and filiform at the tip; collar marked with obsolete scales. There is a remarkable double plate under the neck.

This species is somewhat similar to the green lizard, but is shorter and more ventricose, and has a sharper snout.

It is a native of the south of Siberia.

49. <i>Lacerta algira</i>, Algerine Lizard.

Specif. Char.—Tail long, verticillated; two yellow lines on each side of the body.

This species is about a finger's length, brown above, and yellowish beneath.

It is a native of Algiers.

50. <i>Lacerta velox</i>, Swift Lizard.

Specif. Char.—Tail longish, verticillated; scaly collar beneath the neck; body cinereous, with five longitudinal paler bands, variegated with black specks; the sides spotted with black, and speckled with blue.

This species is much smaller and more slender, but in other respects comes very near to the <i>Lacerta agilis</i>. The hind feet are marked with orbicular spots.

It is a native of Siberia.

51. <i>Lacerta uralensis</i>, Ural Lizard.

Specif. Char.—The tail is long and round; the neck P p 2 plated
ERPETOLOGY.

Chap. I.

Lizards.

52. LACERTA SERT, Seps Lizard.

Specific Char.—Colour bluish brown; tail longish, verticulated; lateral suture reflexed; scales square.

This is a small species, and is easily known from the thin lengthened form of its body, and long slender tail, as well as from the square scales with which it is entirely covered. The tail is marked with about 50 divisions.

It is a native of the southern parts of Europe.

Sect. V. CHAMELEONS.

These are distinguished by having a granulated skin, a large head, a long missile tongue and cylindrical tail.

53. LACERTA CHAMELEON, Common Chameleon.

Specific Char.—Crown flat; tail cylindrical and incurvated; toes united by two and three.

The length of the chameleon, from the tip of the nose to the beginning of the tail, is about ten inches. The tail is nearly of the same length. The skin on every part of the animal is granulated. A series of obscure denticulations runs down the back, and forms a ridge on that part. There are five toes on each foot, two and three of which are united by a common skin, as far as the claws; the two outward and the three inward toes of the fore feet are united, and the two inward and three outward of the hind feet. The structure of the tongue of the chameleon is very peculiar; it is very long, and furnished with a dilated somewhat tubular tip, by which means it is enabled easily to seize insects, which are its prey, by darting out and securing them on the tip.

The chameleon, like others of the amphibia, has the power of inflating its lungs, and retaining the air for a long time. It is in this way that it sometimes appears plump and fleshy, while at other times, when the air is ejected, and the lungs in a collapsed state, it exhibits nothing but skin and bone. The natural colour of the skin of the chameleon is of a bluish ash, and the usual changes are from this to a green or yellowish colour, spotted unequally with red. When the animal is exposed to full sunshine, the darkened side appears in a few minutes of a pale yellow, with large roundish spots of red brown; but when the animal is turned round, the reverse takes place. The side formerly in the shade appears of a brown or ash colour, and the other side yellow and red. These changes, however, vary greatly, both with regard to the disposition of the spots and the intensity of the colours.

The chameleon is a native of Europe, Africa, and Asia. It is indeed chiefly found in tropical regions; but is also sometimes met with in the warmer parts of Spain and Portugal.

No animal has been more celebrated than the chameleon, and particularly on account of the power which it was supposed to possess of changing its colour. This account was greatly exaggerated, when it was asserted, that it could produce this change at pleasure, and assimilate it to that of any particular object. But the more accurate observations of modern naturalists have shown, that this change of colour varies greatly, and seems to depend on the state of the animal's health, the temperature of the weather, and probably some other unknown causes. Another erroneous assertion with regard to the chameleon was, that it could live entirely on air. This no doubt arose from the long abstinence which this animal, as well as many others belonging to the class amphibia, can endure.

54. LACERTA AFRICANA, African Chameleon.

Specific Char.—Colour blackish; crown carinated.

This is one of the largest yet discovered. Along the back to the end of the tail there runs a pure white stripe, bounded by a broad blackish band. The other parts of the animal are variegated with pale ash-coloured undulations.

It is supposed to be a native of Barbary.

55. LACERTA PUMILA, Little Chameleon.

Specific Char.—Body bluish on each side, and marked with two yellowish lines.

The head of this species is somewhat flatter than the former, but still elevated in the middle, and edged on each side with a denticulated margin.

By some the two latter seem to be considered only as varieties.

Sect. VI. GECKOS.

In the animals of this division the skin is granulated or tuberculated; the feet are lobated, and the toes lamellated beneath.

56. LACERTA GECO, Common Gecko.

Specific Char.—Livid, with brown variegation; upper part of the body warty, and the lamelle of the feet not divided.

This animal is said to have received the name of gecko from the peculiar sound of its voice, which bears some resemblance to that word when uttered in a shrill tone. Its length, in general, is about a foot or more, and therefore it ranks among the middle-sized animals of the lizard tribe. Its form is thicker and stronger than the greater part of lizards. Its head is flatish, somewhat triangular and large, with a covering of minute scales; its mouth is wide, eyes large, teeth small, and its tongue is broad and flat. The limbs of this animal are moderately long, with broader feet than the rest of the tribe; the toes are dilated on the margins, and beneath are divided into a number of transverse lamellae parallel to each other, without any longitudinal furrow. The general colour of the gecko is a pale brown,
ERPETOLOGY.

59. Lacerta Mauritanica, Mauritanic Gecko.

Specif. Char.—Colour brown, covered above with sharp warts; tail flat, and furnished with scuta beneath; lamellae of the feet lunate and divided.

This species resembles the common one, but is different from being covered with spiny or sharp-pointed warts on the upper surface. The toes are lamellated beneath, but are not divided by a middle sulcus.

60. Lacerta Sinenesis, Chinese Gecko.

Specif. Char.—Tail flat, all the toes ungualiculate; face perforated with several pores.

The head is broad and flat; the teeth small; the tongue flat, and margined at the tip. About the sides of the nose and eyes there are several scattered pores. It is a native of China, and is frequently seen in houses, running about the walls, and climbing readily on the smoothest surfaces. It preys chiefly on the smaller kind of cock-reach. It is considered as an innocent animal.

61. Lacerta Vittata, White-striped Gecko.

Specif. Char.—Colour yellowish brown, with a white dorsal band, which is forked over the head.

This is a small species, not exceeding seven or eight inches in length; the head is large in proportion to the body; the toes are lamellated beneath, divided by a sulcus, and terminated by curved claws. The upper surface is covered with extremely small tubercles: they are so minute as to be scarcely perceptible.

This species is said to be a native of India.

62. Lacerta Fimbriata, Fimbriated Gecko.

Specif. Char.—A membraneous fimbriated border on each side of the body; tail flat; lamellae of the feet divided by a furrow.

This is a very remarkable species, which, as the count de Cepede, who describes it, observes, seems in some degree to connect the chameleon, the gecko, and the water-newts. The largest individual which he examined measured about eight inches in length. The head is large and flattened, and its outline seen from above is nearly triangular, as in the chameleon; but the triangle is of a longer form, and there is no rising crest. The most remarkable part of its structure is the fringed process which commences on each side of the head, and is continued along the sides of the body. The colour of this animal varies as in the chameleon, exhibiting different shades of red, yellow, green and blue.

It is a native of Madagascar, where it is pretty common. It is a harmless animal, and yet is regarded with great abhorrence by the natives, who consider it as of a poisonous nature, and run from it with great precipitation. This popular prejudice is supposed to have arisen from a peculiar habit of the animal, of running with open mouth towards the spectator, instead of making its escape when it is discovered. It appears chiefly in rainy weather, moving about with great agility, and springing
63. Lacerta Tetradactyla, Four-toed Gecko.

**Specif. Char.**—Colour yellow, varied with green; tail flat; feet tetradactylous.

This species is about 12 inches long, and is nearly allied to the preceding species, except that it wants the fringed margin, and the number of the toes on the fore feet being only four.

It is also a native of Madagascar, and is not held in less abhorrence by the inhabitants than the former. It lives in the woods, appearing in the rainy season during the night.

64. Lacerta Caudiverbera, Scollop-tailed Gecko.

**Specif. Char.**—Tail flat, pinnatifid; feet palmated.

This species, which is a very singular one, is about 16 inches long, and of this the tail measures about one-half. The head is large and flat, the body thick, and the limbs short. The fore feet are like the rest of the species, but the hind feet are strongly palmated. The tail is three feet gradually to the tip, but through its whole length is edged with a broad deep scalloped fin; this gradually widens towards the tip, and is considerably broader than on the sides. The back is marked with numerous distant red tubercles, each of which is surrounded by a circle of small white scales. The webs of the hind feet, and the finny part of the tail, are of a bright red.

This species is said to be a native of Arabia; but being a very rare animal, its natural history is not well known.

65. Lacerta Schneideriana, Schneiderian Gecko.

**Specif. Char.**—Colour gray; tail convex above and flat below; a black band on each side of the head; lamellae of the feet lunulate and divided.

The colour of this species is cinerous, with a brown band on each side of the head; on each side of the body there is a suture or wrinkling of the skin; and the tail is edged with a row of sharper and longer scales than on the other parts.

66. Lacerta Sparmanniana, Sparmannian Gecko.

**Specif. Char.**—Body papillated above; tail lanceolate; fore feet tetradactylous.

This is a small species, measuring not more than three inches in total length. The colour on the upper part of the body is varied with darker and lighter shades; on the under part it is whitish.

It is a native of the Cape of Good Hope, where it is regarded as a poisonous animal. It is said that the fluid secreted from its pores, as well as the saliva, produces inflammatory tumours, and sometimes even gangrene.

67. Lacerta Spittator, Spitting Gecko.

**Specif. Char.**—Colour gray, marked above with brown transverse bands; tail round, furnished with scuta beneath.
Chap. I.  

**ERPTETOLOGY.**

Lizards.

turns its neck with great difficulty. Its ears are large, open, and nearly round. Its body is a light yellow, bordering on straw colour, crossed with eight bands of black, almost equally distant, except the two next the tail. All these decrease both in breadth and length, from the middle towards each extremity of the animal. The scales are largest along the back. They are very close, though the divisions are sufficiently apparent. Their surface is very polished, and seems as if varnished over. Its legs, from the shoulder to the middle toe, are nearly an inch and three quarters long. Its feet are composed of five toes, the extremity of which is armed with a brown claw of no great strength, whose end is tipped with black.

The same author, speaking of the immense multitudes of lizards which are found in eastern countries, adds, "I am positive that I can say, without exaggeration, that the number I saw one day in the great court of the temple of the sun at Balbec, amounted to many thousands. The ground, the walls, and the stones, were covered with them; and the various colours of which they consisted, made a very extraordinary appearance, glittering under the sun, in which they lay sleeping and basking.

69. **LACERTA RUFFESCENS**, Greater Scink.

**Specif. Char.**—Colour yellowish rufous; feet short; tail of moderate length.

This species sometimes exceeds 15 inches in total length. The head is covered in front with large angular scales; the legs are short and thick; the feet pentadactyly, and furnished with small claws.

It is a native of Arabia and Egypt, living both on land and in water. It is frequent on the shores of the Nile. It is also met with in some European islands, and particularly in the island of Cyprus.

70. **LACERTA LONGICAUDA**, Long-tailed Scink.

**Specif. Char.**—Colour olivaceous yellow; tail very long.

The great length of the tail in this animal forms the specific distinction; the colour, which is greenish yellow, varies in the shade in different individuals.

It is said to be a native of America, and frequents the sea coasts, where it feeds on small crabs and spiders.

71. **LACERTA MABOYA**, Maboya Scink.

**Specif. Char.**—Colour golden yellow; sides brownish; jaws equal; tail of middling length.

The length of this species is about eight inches; it greatly resembles the common scink, but differs from it in the length of the legs, and the jaws being equal.

It is a native of America, of Jamaica, and some other West India islands. It is also found in the island of Sardinia.

72. **LACERTA OCCIDUA**, Galliwasp.

**Specif. Char.**—Colour brownish; transverse bands somewhat waved; legs short; tail of middling length.

Except being larger, somewhat thicker, and having a tail proportionally shorter, this species comes very near the greater scink. It is about two feet in total length. The teeth are small in front; but as they approach the back part of the jaws, they gradually increase in size, like the molars teeth of the mammalis.

The galliwasp is a native of the American islands. It is very common in woody and marshy places in Jamaica, and has been reckoned, but without foundation, a poisonous reptile.

Var. **LACERTA SCINCOIDES**, australasian galliwasp.—

This, although it is of a darker colour, has a longer tail, and larger scales, is considered only as a variety of the former. On each side of the neck there is commonly a longitudinal brown spot.

It is a native of New Holland.

73. **LACERTA GUTTATA**, Spotted Scink.

**Specif. Char.**—Colour gray, spotted with white; tail long, marked with four transverse black bands, and black tip.

This species does not exceed three inches in length.

It is a native of the Ural desert.

74. **LACERTA OCELLATA**, Ocellated Scink.

**Specif. Char.**—Colour greenish-gray, white beneath, marked above with roundish ocellated brown spots, which have white rectangular disks.

This species is about a span long. The body is depressed; the feet are short and pentadactyly. It has no femoral warts.

It is a native of Egypt, and frequents houses.

**Sect. VIII. SALAMANDERS, Newts or Efts.**

The species included under this section have soft skins, and some of them are water lizards.

75. **LACERTA SALAMANDRA**, Salamander.

**Specif. Char.**—Colour black, spotted with golden yellow; tail round, and of moderate length.

The colours of the salamander afford sufficient marks of distinction. It is of a deep shining black, variegated with large oblong and irregular spots of bright orange yellow. The sides are marked with many large transverse wrinkles. The parotid glands form protuberances on each side of the head. On the back and sides of the body there are several large open pores, from which is exuded a peculiar fluid, which serves to lubricate the skin. This fluid is of an acid nature; and when the animal is irritated, is copiously secreted, and even it is supposed, ejected to some distance for its defence. It is in general from seven to eight inches in length. Sometimes it is seen entirely black.

The salamander is a native of many parts of Germany, Italy, France, and other parts of Europe, delighting in moist shady places, woods, &c. During the winter it conceals itself in recesses under ground, in the cavities of old walls, or about the roots of old trees.

This species lives chiefly on insects, small snails, &c. It is capable of living in waters as well as on land, and sometimes resorts to stagnant pools. It is slow in its motions, and torpid in its manners.

The
ERPETOLOGY:

Lizards. The salamander is viviparous. The young are produced perfectly formed in the same way as the viper. It is said that it retires to the water to deposit its young, the number of which at one birth amounts to 30 or 40, and when they are first excluded, they are furnished with branchial fins on each side of the neck, which are temporary organs, and are afterwards obliterated like those of the tadpole.

Many popular errors concerning the salamander have long prevailed. One of these was, that it was a venomous animal, and that its poison is of so malignant a nature, as scarcely to admit of any remedy. It is now, however, found from the observations of later naturalists to be perfectly innocent, and although the fluid secreted from the skin may be noxious to smaller animals, it is incapable of inflicting either wound or poison on any large animal. In an experiment made on purpose, a gray lizard, which had bitten a salamander, and swallowed some of the fluid secreted from the skin, was almost immediately seized with convulsions, and soon after died. It was not other popular error that the salamander could exist uninjured in the fire, and that it could even extinguish it by means of the fluid secreted from its skin. This fluid, it is probable, is secreted in greater abundance when the animal is exposed to heat, and thus it is protected for a short time against the action of the fire, which can produce no effect till the moisture on the skin is evaporated; and from this circumstance, and hasty observation, has arisen the improbable story of its being able to resist the action of any water.

76. LACERTA VULGARIS, Common Newt.

Specific Char.—Colour yellowish brown; dorsal line double; abdomen orange-coloured, spotted with brown.

This species is the smallest of the British lizards, the general length not exceeding three inches and a half.

It is a native of Europe, and is found in gardens in the neighbourhood of dunghills, &c. Like the slug and toad, it makes its way into cellars. It is altogether a land species, and it seems to be viviparous; for some of a very small size, yet perfectly formed, have been discovered at a very great distance from any water.

77. LACERTA PALUSTRIS, Great Water Newt.

Specific Char.—Colour blackish; sides speckled with white; abdomen orange, with irregular black spots.

This species is small in size, and marked with a different distribution of colours, but in its general appearance it bears a considerable resemblance to the salamander. It is from five to six inches in length. The tail is flat, with thin sharp edges, and terminating in a point; on each side of it in the male there is a silvery white broad band, accompanied with a bluish tinge. This stripe and the dorsal crest are sometimes wanting in the female.

It is a native of Europe, but is rare in Britain. It frequents stagnant waters in cool shady places, and lives entirely on insects. It is to larger animals quite innoxious; but the fluid exuded from its skin seems not as a poison on small animals.
and of this the tail measures 6½ inches. The head is flattened, the mouth moderately wide, and the upper jaw is furnished in front with two concentric rows of numerous, small, bristly teeth. The under jaw has only a single row. The eyes are small, round, and situated on each side of the front of the head, so that they are very remote from each other. The colour is pale brown, marked in a confluent manner with darker variagations. The legs are about one inch in length, and they are all furnished, along their whole length behind, with a dilated skin or crest. The tail is like that of the common water newt, but is shorter, and less deeply finned.

Its native country, and farther particulars of its natural history, are unknown.

80. LACERTA MACULATA, Spotted Water Newt.

Specific Char.—Colour blackish; a double row of white spots down the back.

The length of this species is about five inches. The head is large; there are four toes on the fore feet, and five on the hind. The colour is deep brown, and the double row of white spots, which begins at the top of the head and continues to the tail, becomes a single row to the end.

It is a native of Carolina, and inhabits ponds, ditches, and stagnant waters.

Sect. IX. SNAKE LIZARDS.

The species belonging to this section have very long bodies, and short legs.

81. LACERTA CHALCIDES, Chalcides Lizard.

Specific Char.—Colour ferruginous; feet tetradactylous; body long, and marked with six brown dorsal lines.

The usual length of this animal is about eight or nine inches; but it is sometimes found only a few inches long, and sometimes exceeds a foot. The head is anteriorly covered with large scales; the snout is tapering; the eyes are small, and the openings of the ears are very distinct. The colour is ferruginous or chestnut brown above, and yellowish brown beneath.

This animal is a native of Africa and the warmer parts of Europe, frequenting moist shady places. It is quite inoffensive, and feeds on insects, small worms, &c. The motions of the chalcides are rather slow. It is viviparous, and is said to produce a great number of young.

82. ANNULATED CHALCIDES. Chalcides Cepeda.

This is nearly allied to the former, but differs from it in having square scales, and in being marked through its whole length with a continued series of annuli or rings, to the number of 48. The length of the body is about 2½ inches, and is somewhat shorter than the tail. The feet are shorter than in the former species, and are all tetradactylous.

The native country of this species is unknown.

83. LACERTA SERPENS, Serpent Lizard.

Specific Char.—Head, body, and tail cylindrical; feet small, remote, pentadactylous.

The length of this species is about 3½ inches. The colour is cinereous or pale ferruginous above, marked with from 15 to 20 dusky lines; beneath it is ash-coloured, with a silvery gloss. It is entirely covered with imbricated scales.

This animal is a native of Java.

84. LACERTA ANGUINA, Snake Lizard.

Specific Char.—Body long; tail very long; feet oval-shaped, and without toes.

The body of this species measures four, the whole length 1½ inches. The colour is brown above, ash-coloured on the sides, yellowish beneath, and the upper surface is marked throughout its whole length with several dark stripes. The head is small; the legs very short, and placed near the head and vent, and seemingly terminated in one undivided process. The whole body is covered with ovate scales.

It is a native of the Cape of Good Hope, and is frequently found in the water, and about the rocks in Table bay.

85. LACERTA APU, Apidal Lizard.

Specific Char.—This snake-formed lizard is ferruginous, has no fore feet, and its hind feet are very short and monodactylous.

The chalcides itself does not approach so near to the snake tribe as this large and singular species of the lizard. It measures almost three feet in length, and its general appearance bears such a striking resemblance to a large snake, that it requires a very attentive examination to ascertain the difference; as it has only a pair of extremely short-pointed processes by way of feet, at a great distance from the anterior parts of the body, almost on either side of the vent, and without toes. The head is rather large, and covered with large scales; the snout is tapering; the upper jaw projects a little over the lower; the mouth is of a moderate wideness, and the ears are very visible. There is no appearance of a neck, as the body gradually tapers from the head to the extremity of the tail, which is longer than the body, and terminates in a point. The whole animal is covered with rows of scales of a moderately large size, in a longitudinal direction, and emarginated at the tips. From the head to nearly half the length of the tail, a deep continued channel runs along each side of the body. Its colour is a pale chestnut, and beneath a pale yellow-brown.

Two specimens of this lizard were brought from Greece by Dr John Sibthorp, professor of botany in the university of Oxford. It is rather a singular circumstance that an animal of such magnitude should have remained so long unknown to the inquisitive naturalist.

It is a native of Greece, of the southern parts of Siberia, and unquestionably of many other parts both of Europe and Asia, although the knowledge of it has been but lately acquired, the first describer of it being Dr Pallas, by whom it was found in the south of Siberia. It frequents moist and shady places, and, as far as is yet known, is an innocent animal.

86. LACERTA BIPES, Biped Lizard.

Specific Char.—Long bodied, cylindrical, pale yellow, speckled.
ERPETOLOGY.

This species, which is not larger in diameter than that of a goose quill, measures about six inches in length; its colour is a pale yellow, spotted with brown; the head is small, body cylindrical, tail short and taper; on each side of the vent there is a small subulated foot, which is furnished with two small unequal toes.

It is a native of India and South America.

87. LACERTA LUMBRICOIDES, LUMBRICIFORM LIZARD.

Specif. Char.—Body cylindrical, two-footed, and annulated with square scales, having a lateral furrow, and no hind feet.

This is about eight inches long, and half an inch in diameter. The whole body, including head and tail,

is of the same diameter, and is covered with rings of square scales. Along each side there is a continued furrow, which separates the upper and lower surfaces. The legs are two, very short, and placed near the head. They are divided into five minute toes, which are furnished with claws. The colour of the living animal is supposed to have been green, and paler beneath.

It is a native of Mexico.

Number of species in each genus, included under the order Reptilia.

<table>
<thead>
<tr>
<th>Genus</th>
<th>No.</th>
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</thead>
<tbody>
<tr>
<td>TESTUDO</td>
<td>39</td>
</tr>
<tr>
<td>RANA</td>
<td>48</td>
</tr>
<tr>
<td>DRAGO</td>
<td>2</td>
</tr>
<tr>
<td>LACERTA</td>
<td>87</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>176</strong></td>
</tr>
</tbody>
</table>

CHAP. II. OF THE ANATOMY AND PHYSIOLOGY OF REPTILES.

HAVING in the former chapter taken a brief and comprehensive view of the classification, and such particulars of the natural history of reptiles, as were connected with the different species, we now proceed to give a slight sketch of the anatomy and physiology of this order of animals. These shall be the subjects of the two following sections. In the first we shall treat of the anatomy, in the second of the physiology of reptiles.

SECT. I. Of the Anatomy of Reptiles.

BETWEEN this order of animals, and the quadrupeds belonging to the class mammals, there are many points of resemblance, making allowances for the difference of size; and hence they have been denominated omnivorous quadrupeds. This resemblance, however, only extends to external appearance.

The body of reptiles is supported by four feet, and these form the principal external character. They are disposed like those of the mammals, two before and two behind. With the exception of some animals which have been arranged under this order, and which have only two feet, all reptiles are furnished with four feet.

The body is furnished with a tail, which is different from that of quadrupeds, in having no hair. This is common to the tortoises and the whole of the lizard tribe. The genus RANA is an exception to this. All the species included under it are supplied with a tail.

The body is either lengthened, that is, when it is considerably longer than broad, as is the case with lizards; or rounded, that is, when the body, seen from above, exhibits an orbicular form, as in the tortoise and some toads.

With regard to the surface of the body, it is never covered with hairs, but sometimes with scales; such are reptiles without a tail, the salamanders and some lizards. It is sometimes covered with inequalities or asperities, the whole surface being rough with elevated points, which resemble warts or pustules. This is the case with some lizards, and several frogs and toads. The body is covered sometimes with a shell both above and below; this bony covering protects the animal from external injury. With such a covering the genus turtise is furnished.

In the sketch which we propose to give of the anatomy of reptiles, the parts of the body may be divided into external and internal; the external parts comprehend the head, the trunk, the tail, and the feet. Under the internal parts are included the skeleton, the muscles, and the viscer.

External Parts of the Body.

i. The Head.—The head is that part of the body which is articulated with the first vertebra of the neck. It is rounded, that is, when its external surface is round in every direction, as is the case with tortoises; or flattened or depressed, when it is compressed above and below, which is the case with almost the whole order; or triangular, when the head, seen from above, represents a triangle, as in some toads and frogs.

The mouth is semicircular, when the outline forms a semicircle, as in the genus RANA, and in almost all the lizard tribe; or inferior, when the upper jaw comes over the lower, so that the mouth necessarily occupies the lower part of the head. This is the case with the tadpole.

The beak or snout either forms an inclined plane from the top of the head to the end of the jaws, as in the chameleon, and many lizards; or conical, when the two jaws gradually diminish, as in the crocodile; or reflected upwards, when both jaws are flattened and turned upwards towards the extremity of the beak; or rounded, when they are thick and ventricose towards the extremity, as in several tortoises; or pointed, when the upper jaw terminates like the beak of a bird.

The jaws are either equal, as in most part of the genus RANA, in many of the lizards, and salamanders; or unequal, as is the case with many of the tortoises and lizards, in which case, the upper jaw is always the longest. Among the whole order of reptiles, there is
no instance of the contrary; that is, of the lower jaw being longest, and perhaps this structure would be inconvenient, or incompatible with the nature of the animal, or its habits and mode of life.

A common error long prevailed with regard to the motion of the jaws of the crocodile. It was asserted, that this animal only moved its upper jaw; but the more accurate observations of later anatomists have proved the contrary, and that the articulations of the head and jaws of this animal are precisely the same as in other quadrupeds. The head is articulated with the last vertebra of the neck, and the lower jaw is articulated with the upper, so that the former, namely the lower jaw, only has the power of motion.

All the animals belonging to the order of reptiles, are not furnished with teeth. The tortoises and some lizards, have none. All the species belonging to the genus *Rana* may be considered as having none, the jaws being only crenulated or notched. In other tribes belonging to this order, the teeth are conical, as those of the crocodile, which are hollow, and filled with a soft substance; or recurved, when the extremity of the tooth turns backward towards the throat, as in the Indian crocodile; or straight, as in most of the lizard tribe; compressed at the sides, and in the guana; or notched, when the summit of the tooth is truncated and crenulated, as in the horned lizard.

Tongue.—In almost all the tribes of animals belonging to this order, the tongue is peculiarly fitted for seizing their prey. The form of it varies in all the families. Another error has prevailed with regard to the tongue of the crocodile. It was said that it had no tongue, but in place of it is furnished with a strong membrane, which adheres to the two edges of the lower jaw. Even the observations of later naturalists tend to confirm this error. Denon, who had numerous opportunities of seeing the crocodile both dead and alive, in its native haunts on the borders of the Nile, believes in this opinion, that the crocodile has no tongue; but it does not appear that any accurate anatomical inspection was made to ascertain this point, or indeed that he was accompanied by any anatomist at all, by whom alone the truth or falsehood of the opinion could be investigated. This organ of the crocodile, however, is very large, and even proportionally larger than that of the ox, but it is strongly connected with the sides of the lower jaw, and being thus fixed or tied down, cannot be stretched forwards, as is the case with other animals.

In some of the animals belonging to this order, the tongue is nearly of equal length and breadth. This is the case with the tongue of frogs, toadstoes, the salamander, and the guana.

In some it is very narrow at the base, and divided in two at the extremity, as in most of the lizard tribe, which are thus furnished with a bifid tongue.

But the structure of the tongue of the chameleon, is perhaps the most singular of any belonging to the order. It is composed of a white solid flesh, 10 inches long, and about three broad. It is round, and flattish towards the end; hollow and open, somewhat resembling the termination of the trunk of the elephant. The tongue is attached to the os hyoideum by a kind of trunk, of the shape of an intestine, about six inches long, and a line in breadth. This trunk is furnished externally with a membrane, and internally with a soft, but solid and compact, nervous substance, which is with difficulty divided into fibres. It is by means of this trunk that the tongue, which is attached to it, is projected from the mouth. This is done by the extension of the trunk, and it is again drawn back by its contractile power. These motions are performed by a kind of cartilaginous stilius, to which the investing membrane is attached, and over which it is plaited like a silk stocking on the leg. This stilius is an inch long, and originates from the middle of the base of the os hyoideum.

In consequence of this extensible and retractile power which the tongue of the chameleon possesses, it has obtained the epithet of *termitiform*, because in those motions it resembles those of an earth-worm.

There is no great peculiarity about the nostrils of *Nostria* any of this order of animals. In general they are almost always of a round form. In some, however, they are lunate, or shaped somewhat like a crescent, the horns of which are turned backwards. This is the case with the nostrils of the crocodile.

The eyes, as in most other animals, are placed on the sides of the head; but in some they are vertical, or placed on the top of the head, as in several of the toads and the crocodiles; approximating, when the distance between the eyes is very small; or protuberant, when the globe of the eye on each side forms a considerable projection, as in those belonging to the genus *Rana*, the *crocodiles*, and the *salamanders*.

The nictitating membrane, which is peculiar to some birds, belongs also to some of the animals of this order. By means of extending this membrane over the eye, the excessive brightness of sunshine, to which many of them, being natives of warm climates, are exposed, is greatly moderated, and perhaps this membrane may be useful to those animals of this order which frequent the water.

The iris of the eye is differently coloured in the animals of this order. In many it is red; in the chameleon it is of a golden yellow colour.

Externally, the ears of reptiles do not exhibit any remarkable peculiarity. The opening is more or less round, and it is usually covered with a membrane. There is no external ear, by which the vibrations of the air might be collected, and conveyed to the sense of hearing; from which it has been concluded, that this sense is more obtuse than in quadrupeds.

2. The Trunk.—The trunk of the body includes the neck, the breast, the back, the ribs, the abdomen, and the anus; and some of these parts, in different reptiles, present considerable varieties.

The neck, which unites the head with the trunk, is very different in the different tribes belonging to this order. In all those included under the genus *Rana*, the head is so closely attached to the trunk, that the neck is scarcely to be distinguished. In others, however, it is considerably elongated, and quite distinct, as in the crocodile and the salamander. The neck is also pretty long in some of the tortoises. Sometimes it is covered with wrinkles or folds, when the skin forms several transverse wrinkles, as in the neck of some of the tortoises.

The breast or thorax is situated on the anterior part of the body.
of the trunk; it forms a close cavity which is covered beneath by the sternum, on the sides by the ribs, and above by the vertebra at the back bone.

The back is the upper part of the trunk, extending from the last vertebra of the neck to the first of the tail. In some reptiles it is sometimes convex, sometimes more or less flattened. It is either furnished with scales, when there extends along the superior surface a row of scales from the neck to the extremity of the tail, as in the guana and horned lizard; or it is furnished with a toothed suture, when the upper extremity of the trunk terminates in a notched ridge, as in the chameleon of the Cape; or is supplied with a kind of radiated fin, somewhat resembling the fin of a fish, as in the basilisk; or it is protected with a strong bony covering, known by the name of calypash. This is the name by which the bony covering of the turtle is distinguished. This covering is composed of different pieces closely united to each other, and they are sometimes smooth and convex, sometimes striated and flat, disposed in three rows; and there are about 24 pieces situated on the edges of this covering.

The ribs include the lateral parts of the trunk, from the neck to the anus. In the tortoises, the ribs are defended by the edges of the calypash, which is here united with the inferior shell, or bony covering.

Abdomen.

The abdomen or belly constitutes the inferior part of the body, and extends from the extremity of the breast or thorax to the anus. In the tortoises, this part is composed of a bony covering; and in some species belonging to this tribe, there are openings in those places which correspond to the head, the four feet, and the tail; but in some other species, as in the testudo clausa, there is no opening whatever, but the bony covering is transversely divided into two parts, which play on a kind of hinge, so that when the animal wishes to move, it opens the anterior division to put out the head and the four feet; and in the same way for the opening behind. This inferior bony covering is united with the upper one by means of a cartilage placed near the middle of the body. This is usually known by the name of calipee. Sometimes the abdomen is covered with plates or scuta, which is the case with most of the lizards, which have on the inferior surface of the body, very large plates regularly arranged.

The anus is not only the passage for the evacuation of the excrement, but is besides the canal in which are contained the parts of generation of the male lizards and tortoises. The males of the animals belonging to the genus Rana, which are destitute of these parts, eject by this opening the fluid which impregnates the ova of the female.

3. The Tail.—This part terminates the trunk. Many reptiles, as those belonging to the genus Rana, have no tail whatever; but the animals belonging to the other genera of this order are furnished with a tail of different lengths. The tail is covered with scales, as in almost all the lizards; and these scales are sometimes disposed in rings or circular bands, as in several lizards; or they are somewhat elevated, forming a kind of notched appearance on the upper surface of the tail, as in the guana.

4. The Feet.—The feet of the animals belonging to this order greatly resemble those of quadrupeds; their position and articulations are nearly the same, but they are much shorter, and placed at a greater distance from each other. The feet terminate in a certain number of toes, and thence, according to the number of the toes, assume different names; as tridentate, tetradactylous, &c. The structure of the toes is similar to that of other animals. They are separated from each other, as in lizards; palmed, when united by means of an intermediate membrane, as in the kind feet of the frog; furnished with nails or claws at the extremity, which are sometimes flat, as in the frogs; or hooked, as in the lizards; or destitute of nails or claws, as in the salamander.

Internal Parts.

Under the internal parts are included the skeleton, the muscles, and the viscera.

1. The Skeleton.—With regard to the skeleton of reptiles, it may be observed, that the structure of the bones is less complicated than that of quadrupeds, and the texture is less compact. They possess at the same time somewhat of the transparency of cartilages. The bones may be divided into those of the head, the neck, the thorax, the spine, the tail, and the feet.

The bones of the head are composed of those of the bones of cranium, and those of the lower jaw. In the greatest number of reptiles, the cranium consists of a single bone. The bone of the upper jaw, and that of the forehead, are completely united in the crocodile, the chameleon, and some others. They do not seem to be separated by any distinct suture. The lower jaw of the chameleon terminates on each side in a separate bone, which unites on one band with the region of the temples, and forms on the other an angular articulation with the jaw.

The bones of the neck are composed of a series of the vertebra, the number of which varies in the different tribes of this order. The species belonging to the genus Rana have no cervical vertebra; but in the other tribes the number varies, as has been mentioned, as will appear from the following table.

<table>
<thead>
<tr>
<th>Number of Vertebrae</th>
<th>Chameleon</th>
<th>Most of the Lizards</th>
<th>Crocodile</th>
<th>Tortoise</th>
</tr>
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<tbody>
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<tr>
<td>8</td>
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</tbody>
</table>

The number of processes with which the vertebrae are furnished, also varies. In those of the chameleon there are seven; but in those of the crocodile, there are nine, viz. five above, and four below.

The bones of the thorax comprehend those of the vertebrae, corresponding to this cavity, the ribs, and the sternum. The vertebrae, which correspond to the cavity of the thorax, are not the same in all the individuals belonging to this order. In the crocodile there are only 12, but in the chameleon, the number amounts to 18. Each of these vertebrae is in general furnished with seven processes, which are sometimes simple and sometimes spiny.

The ribs are wanting in the reptiles belonging to the genus Rana; the salamander also is destitute of ribs. In the other tribes they are always found, but unequal in number. In the tortoise there are eight on each side; in the crocodile 12; in the chameleon 18. The ribs
E R P E T O L O G Y.

Anatomie. - The ribs are articulated with one vertebra only; but in the structure and articulations of these bones there is a peculiarity in the crocodile and chameleon. The two first and the two last ribs of the crocodile do not terminate in the sternum. The cartilages which attach the other eight are broken, so that each rib from the vertebra to the sternum is composed of three parts, one of which is bony, the other two cartilaginous. In the chameleon the two first anterior ribs are not supported by the sternum; the four following are attached to it by means of appendages, which form at the point of junction an angle with the ribs, and which are not composed of a substance purely cartilaginous, but as hard as that of the ribs. The other following ribs do not reach the sternum. Each is joined to that which is opposed to it by a bony appendage, forming an arch on the middle of the thorax and abdomen. The three last are loose, separated, and as it were truncated in the middle.

Sternum. - The sternum or breast-bone is a flat bone, placed on the anterior part of the thorax, the figure and dimensions of which vary considerably. In the crocodile this bone reaches to the third rib; it is composed of a single piece, having at its upper part a kind of cartilage which forms a point towards the throat, and which enlarging at the sides covers the clavicles. The sternum of the chameleon and the frog is composed of four bones, the first of which is very large.

Spine. - The back bone comprehends the vertebrae which occupy the upper part of the back, including those of the loins. In the chameleon there are 22; in the crocodile 19, and in the gray lizard 21.

The vertebrae of the tail form the posterior extremity of the spiral column. Their number is always proportional to its length. The tail of the crocodile is furnished with 50 vertebrae; that of the crocodile 33, and that of the gray lizard 60. All these vertebrae are furnished with transverse, oblique, and spinous processes, excepting those towards the end of the tail, which are usually destitute of the oblique processes.

Femur. - The bones of the feet bear a considerable resemblance to those of other animals. The fore feet are composed of the scapula, the humerus, the cubitus and radius, the bones of the carpus and metacarpus, and the joints of the toes.

Scapula. - The scapula or shoulder blade is sometimes single, and sometimes double, in the animals belonging to this order. The frog, the chameleon, and the salamander, have only one; but it is of such a length that it extends from the dorsal spine to the sternum, with which it is articulated, answering the purpose of a clavicle. In the tortoises and crocodile, there are two should-blades, viz. one on the back, and one placed anteriorly, and articulated with the sternum. These also perform the functions of the clavicle. The humerus is articulated on the one hand with the scapula, and with the two bones, the cubitus and radius of the arm, on the other. The two latter bones, the cubitus and radius, are placed parallel to each other, between the humerus and the bones of the carpus and metacarpus. These latter are situated between the two bones of the forearm, and the phalanges or joints of the toes.

The hind feet are composed also of the femur or thigh-bone, the tibia, and the peronea of the leg; the bones of the tarsus and metatarsus, and the phalanges or joints of the toes. These, excepting that they differ somewhat in structure, bear so near a resemblance to those of the fore feet, that it would be quite unnecessary to enumerate or describe them particularly.

2. The Muscles. - The muscles are the instruments of motion. The muscles of the back of the crocodile take their origin from the vertebrae and ribs, and they are attached by means of their tendons, to the bands or rings which are formed by the tubercles of the back. These tendons act in different directions; some of them pull these bands from above downwards, while others pull them from below upwards. The use of these muscles is apparently to lock together more strongly the rings of which the tubercles of the back are composed.

The muscles of the abdomen in the same animal, as the abdominal ones, are not only different from those of other quadrupeds in number, but also in their situation and structure. The external muscle is placed upon the ribs, and the internal under them, immediately above all the viscera, which it embraces in the manner of a peritoneum. The internal muscle is attached on one side to the bones of the pelvis, and to the transverse processes of the lumbar vertebrae; and on the other it terminates in a broad tendon, which envelopes all the intestines in the form of a membrane. The fibres of these two muscles are disposed lengthwise.

3. The Viscera. - The parts contained in the three great cavities of the body are the viscera. These are the brain, the heart, the lungs, the stomach, the intestines, the liver, the spleen, and the kidneys.

The brain is situated within the cavity of the skull. The brain, in reptiles, is in general of small size. The brain of the chameleon, which is of a reddish or grayish red colour, is not more than a line in diameter. The same organ in the crocodile is very small, and similar to that of fishes. The cavity within which it is contained, does not exceed 14 lines in length, and about 12 in breadth and depth.

The heart is a strong muscular body, from which the great arteries proceed, and in which the great veins terminate. From the contractile force of this organ, the blood receives its first impulse. The heart in this order of animals is small. It has in general been considered as having one ventricle and two auricles; differing from the heart of the more perfect animals, which is furnished with two ventricles and two auricles. But from the observations of later naturalists, it would appear that the structure of the heart of reptiles has not been accurately described; for, according to some anatomists and physiologists, the heart of this order of animals is really double; that is, consisting of two auricles which have a direct communication with each other, and two ventricles as in other animals.

The lungs which constitute the principal organ of respiration, are spongy cellular bodies, in which the bronchia or air-vessels are ramified. The substance of which the lungs of reptiles are composed, is not flabby and parenchymatous like those of quadrupeds, but they consist of a bundle of vesicles divided into two lobes. The lungs of the turtle are remarkable for a vesicle which adheres to their surface on the left side, and which may be contracted and dilated at the pleasure of the animal. It is conjectured, that it is by means of this...
Physiology.

Stomach.

The stomach, which is destined to receive the food, is situated between the gullet and the intestinal canal. This organ in reptiles is very light that of birds. The stomach of a crocodile four feet long is not larger than four inches in length, and the same in breadth; and although the fibres of which it is composed are neither so strong, nor so numerous, as those of the stomach of birds, they form a body which is incapable of extension or enlargement. This renders it extremely difficult to believe what is said of the crocodile, of its prodigious voracity, swallowing animals of so considerable a size, since it is neither furnished with teeth fit for the mastication of its food, nor a stomach of sufficient capacity to receive so great a quantity.

Small intestines.

The intestines form a canal composed of different convolutions, extending from the stomach to the anus. It is quite unnecessary to enter into a minute description, than merely to state, that they are divided, as in other animals, into great and small. In the crocodile and other reptiles, the intestines going out from the stomach, form two great convolutions similar to those of birds. They are afterwards convoluted in different ways, till they reach the bottom of the cavity and terminate in the anus.

Liver.

The liver is the organ destined for the secretion of bile. In this order of animals it is large, and divided into two unequal lobes, between which the heart is situated. The right lobe is somewhat larger, and the gall bladder occupies the middle of this lobe.

Spleen.

The spleen is an organ placed on the left side. In this situation it is exposed to the pressure of the diaphragm and the abdominal muscles. The spleen of frogs is double, and of an oblong form. In the crocodile it is oval, somewhat oblong and equal at the two extremities. The substance of which this organ is composed, consists of a great number of large whitish points on a dark red ground.

Kidneys.

The kidneys are bodies of an oval lengthened form, situated within the abdomen, and destined for the secretion of urine. In the frog, between the kidneys and the testicles, there are certain appendages which resemble some kind of leaves. The kidneys are attached to the back, having at their posterior extremity the seminal vessels. The urinary bladder is situated near the orifice of the anus.

Sect. II.—Of the Physiology, Manners, and Habits of Reptiles.

We shall now, according to the arrangement proposed, make a few observations on the physiology, manners and habits of reptiles.

From the small proportion of brain, and dull habits of reptiles, it seems to be justly concluded that their senses are not very acute.

Sense of Sight.—Of all the senses, that of sight is probably the most perfect among reptiles; but as their most common haunts are on the shores of the ocean, or the margins of lakes and of stagnant waters, and on the banks of rivers, where the rays of the sun are strongly and incessantly reflected, it was necessary that the eyes of these animals should be protected from the too powerful impressions of light. For this purpose the moveable eye-lids, and the nictitating membrane, are peculiarly fitted; as by their means the animal is enabled to diminish the quantity of light received into the eye. The peculiar power which many of them possess also of contracting and dilating the pupil at pleasure, like the cat, and some other animals, which seek their prey in the dark, extends the utility of this organ, and renders it more sensible and delicate. From this peculiar structure of the eye, the animal is enabled to see objects at a considerable distance, and it is thus fitted to pursue its prey in the dark, or to discern the objects under the surface of the water; circumstances which are highly necessary for the situation in which many of the tribes of reptiles are placed, and exactly accommodated to their habits and mode of life.

Sense of Hearing.—This sense in reptiles is probably not very acute. The structure of the internal scutum is considerably different from that of the more perfect animals. Indeed some of the parts which seem to render perception more acute, are wanting in these animals. There is neither cochlea nor fenestra ovalis, and the semicircular canals are destitute of extremitics. The membrane of the tymanum is very thick, and the bone immediately connected with it is of a very irregular figure. But, besides, these animals have no external ear whatever, by which means the vibrations of the air might be collected, and condensed in the seat of sensation. In place of these external parts, there are only very narrow openings, which can admit but a small number of vibratory undulations. As a farther proof of the dulness of this sense in these animals, few of them emit any sound, excepting a harsh breathing; whence it may be concluded, that their perception of sound is very indistinct, or they are destitute of the organs necessary to express it; otherwise, with these requisites, the habit of hearing distinctly would very soon improve the power of expression.

Sense of Smelling.—Almost all reptiles are sup- posed with the external organs of this sense. The nostrils of the crocodile are placed in a round space, perfect.

Dr. Townsend, in some experiments which he made with the water lizard, very justly concludes, that their sense of smell is extremely acute. "I kept, says he, a considerable number of water lizards, in a jar, which I filled with a black, soft, and spongy substance; those of the tortoise and lizard occupy the extremity of the snout, and consist of two very distinct openings. It appears, indeed, from anatomical inspection, that the nerves which terminate in these organs are of a very large size, which circumstance leads us to conclude, that the sense of smelling must be pretty acute. But when it is considered that a great proportion of reptiles have their abode in the midst of putrid marshes, it would incline us to suppose that the sense of smelling is not very acute.
EPETOLOGY.

Physiology.

Toads, which will suffer their natural food to remain before them untouched, yet seize it instantly on the smallest motion it makes. It was from a knowledge of this instinct that I was able in winter to feed my constant companion and favourite pet, Muscidura.

Before the flies, which were her usual food, had disappeared in autumn, I collected a great quantity as provision for winter. When I laid them before her, she took no notice of them; but the moment I moved them with my breath she sprang and ate them. Once when flies were scarce, I cut some flesh of a tortoise into small pieces, and moved them by the same means, she seized them, but instantly rejected them from her tongue. After I had obtained her confidence, she ate from my fingers dead as well as living flies.

"Frogs will fly at the moving shadow of any small objects, and both frogs and toads will soon become so tame as to sit on one's hand and be carried from one side of the room to the other, to catch the flies as they settle on the wall. At Gottingen, I made them my guards for keeping these troublesome creatures from my dessert of fruit, and they acquitted themselves to my satisfaction. I have seen the small tree-frogs eat humble-bees, and not without a battle; they are in general obliged to reject them, being incommoded by their stings and hairy roughness; but at each attempt the bee is further covered with the viscid matter from their tongue, and is then easily swallowed.

"Nothing appears more awkward and ludicrous than a frog engaged with a large worm or little snake; for nature seems to have put a restraint upon their voracity, by forming them—very inapt to seize and hold their larger prey. One of my largest frogs, whether the ranula temporaria, or excelsus, I forget, swallowed in my presence an anguis fragilis near a span long, which in its struggles, frequently got half its body out again; when completely swallowed, its contortions were very visible in the flaccid sides of the conqueror."

S O N S E  O F  T A S T E .—If the perception of taste is to be taken in proportion to the sensibility of the organ which is the seat of it, this sense in reptiles must be considered as the feeblest of the whole. The tongue of most reptiles is either to be considered as an instrument for seizing its prey, than as an organ destined for the perception of taste; and for theformer purpose it is remarkably fitted, both from its structure and mechanism, by which means the animal can project it instantaneously from its mouth, and also from the viscid fluid which is secreted on its surface. We have already described, in speaking of the anatomy of reptiles, this peculiarity of structure in the tongue of the chameleon.

S O N S E  O F  T O U C H .—This sense cannot be supposed to be very acute in this order of animals. Most of them have the body covered with hard scales, with large tubercles, or with a strong bony substance. In a great number belonging to this order, the extremities of the feet even are furnished with scales; and the toes are so united together, that they can only be applied with difficulty to the surface of bodies. And if in some lizards it is found that the toes are long, and distinctly separated from each other, the inferior surface is covered, either with a hard skin or with very thick scales, which must undoubtedly deprive this part of all sensibility. The sense of touch, therefore, in reptiles, may, in general, be considered as dull and imperfect.

CIRCULATION OF THE BLOOD.—In animals which have been usually dignified with the name of perfect, and which are furnished with a double heart, the blood which has been collected from all parts of the body, returns to the right side of the heart; is thence conveyed to the lungs; from the lungs it passes to the left side of the heart, and thence is again distributed through the body. But this course of the blood can only go on when the function of respiration continues without interruption; because on the cessation of the action of the lungs, the circulation through them is interrupted; and therefore, without some other structure of the heart, the circulation through the body must stop, and the death of the animal ensue.

Many of the animals included under the order of Peculiari-reptiles are distinguished by a peculiarity of structure, by which allows the circulation to go on during the necessary interruption of the function of respiration to which they are subjected. The blood therefore, instead of passing through the lungs, is conveyed through an oblong opening, called foramen ovale, situated between the two auricles, and is discharged directly from the pulmonary artery into the aorta. Hence it is that these animals come under the denomination of cold-blooded. This diminished temperature of the blood is ascribed to the less complicated circulation which goes on in their system. For the blood in the course of the circulation being less exposed to the action of the air in the lungs, undergoes fewer of these changes, on which, according to the present chemical theory of respiration, the temperature of the body, or animal heat, depends.

RESPIRATION.—The function of respiration exhibits one of the greatest peculiarities in the animals belonging to the order of reptiles. For, as in these animals the structure of the thorax, and the other parts necessary to the process of respiration in other animals, are quite different, the means also by which it is conducted in them must also be different. It is to Dr Townson that we are indebted for the elucidation of this part of the physiology of reptiles. This naturalist, as he himself observes, at least revived a doctrine which had been acknowledged by former physicians, but to whom it seems to have been distinctly known. Among these mentions Laurenti, who, in his Synopsis Reptilium, has derived the character of his class from the peculiar mode of respiration of these animals, of which he says that they are furnished with lungs, but are destitute of diaphragm and ribs, but by means of the gular pouch the air is alternately drawn into this reservoir, and by its contractions propelled to the lungs.

In quadrupeds, Dr Townson observes, there are no perceptible motions in the throat, excepting those which accompany the process of deglutition; but in the frog tribe, whether they are awake or asleep, if they are not excluded from the air, there are some remarkable motions of the throat which are quick and constant; these are the motions which are subservient to inspiration. The bony and muscular parts, which in hot-blooded Process of animals are the mechanical instruments of inspiration, are entirely wanting in this order of amphibians. It must then be by means of some other contrivance, that they are enabled to fill the lungs with air. In the hot-blooded
ERPETOLOGY

Physiology.血ed animals the alternate contraction and dilatation of the thorax effects this, but in this tribe the same purpose is accomplished by the dilatations and contractions of the throat. When the cavity of the throat is enlarged, the air rushes through the nostrils and fills it; the nostrils being closed by their proper muscles, the glottis is opened; the muscles designed for this office contract, diminish the cavity of the throat, and impel the air which is contained in it into the lungs; and in this way, he adds, is inspiration performed in these animals.

"When the lungs, says he, were laid bare, I have observed that these did not inflate, if the frog, exhausted with pain and loss of blood, or when the nostrils were covered with it, opened its mouth to take a greater supply of air, till the throat contracted; this, he says, was the immediate consequence. Likewise, if I put a tube down the throat, the glottis and mouth being by this kept open, the lungs collapsed, and in this state remained; but as soon as the tube was removed, respiration immediately recommenced; nothing similar to this is to be observed in hot-blooded animals.

Expiration is very easily accomplished; for, the glottis and the nostrils being open, the lungs by their own contraction from a state of distention, and by their own weight, aided by that of superincumbent parts, will gradually expel the air; but the muscles which cover the sides act also on this occasion, and in their croakings, (which, in the time of their amours, are heard to a great distance), with great force. But in the ordinary expirations of these animals, no more than in quadrupeds, do the lungs wholly collapse; if not viewed with attention, no motion is ever perceived in their sides, though there is a regular contraction and distention. They likewise have the faculty of compressing one lobe of the lungs singly, by the contraction of the muscles of that side; this is easily induced by touching them gently on the side with a pin or other sharp body.

As these animals are known to be able to live a much longer time without air than those with hot blood, it is said by many that they require slower. But although probably they do not vitiate so much air, they respire very rapidly. Man respires about twenty times in a minute: and, according to Fargus, birds, which breathe the quickest of all hot-blooded animals, from 25 to 50; but the esculent frog (rana esculenta), respires about 70 times in a minute; the rana variabilis (a species of toad), about 100, and the tree frog (rana arborea), so rapidly that I could not reckon the number of the motions of its throat. The contractions of the throat I have considered as inspirations; yet, as the nostrils do not close with each contraction, I cannot venture to affirm that at each the whole contents of the throat are driven into the lungs. As there is frequently one contraction in four or five greater than the rest, it may be that the greatest quantity of air is driven into them. When these animals sleep, and in cold weather, these motions are slower and more feeble.

According then to the doctrine which I have advanced on the mechanism of respiration in the frog tribe, which may easily be subjected to experiment, and then thrown aside, if it bears not this test, but candidly received if it does, their lungs possess no secret power of dilatation, any more than those of hot-blooded animals. In both, this organ is inactive in respiration, which process principally differs in this, that, whilst in the hot-blooded the air is sucked into the lungs by the expansion of the thorax; it is driven into them, in the frog tribe, by the motions of the throat.

"Let us now proceed to examine anatomically the mechanism subservient to respiration; and when, for the sake of brevity, in speaking of the throat, I make use of the terms of muscles of inspiration and expiration, I mean by the former those muscles which serve for forming a vacuum in the throat, and by the latter those which serve to diminish it.

Instruments of Respiration. — When the skin is stripped off from the throat, a broad muscle comes into view, which is the mylo-hyoides. It covers the whole throat, being extended from the end of the maxilla to the condyles; its fibres run transversely, and are inserted into the maxilla through its whole length. In the middle, from the point of this bone, it becomes thin and membranous, but at the condyles thicker; it is not united with the os hyoideum, as in man, but slightly connected with the skin. When the cavity of the throat is diminished, its muscular fibres are seen evidently to contract, but chiefly at the condyles, where the muscle is thickest. Thus, this muscle seems well adapted to assist in driving the air from the throat into the lungs; nevertheless, if it be cut away, respiration continues.

The mylo-hyoides being cut away, the genio-hyoidei appear; and, under these, in the middle, is the muscle of the tongue; the muscle at the point of the maxilla, the sterno-hyoides and the coraco-hyoides are likewise seen. The genio-hyoides, which are slat where the sterno-hyoides are inserted in the os hyoideum, from their direction and connection, ought, one would think, greatly to assist in drawing the os hyoideum forwards, and thus much diminish the cavity of the throat; yet these being cut away, respiration continues.

The sterno-hyoides are strong and powerful; they rise from the whole length of the last bone of the sternum, and are inserted all along the os hyoideum. As the os hyoideum is not in the same direction as the sternal, but higher, and its cornua, which are fastened by the stylo-hyoides, likewise higher and oblique, these muscles in their contractions draw this bone downwards and backwards, and thus form a cavity in the throat. These are the principal muscles used in forming this cavity, and when they are cut respiration ceases.

The coraco-hyoides rise from the inferior side of the neck of the scapula, and are inserted into the os hyoideum near the insertions of the sterno-hyoides. They direct the movements of the os hyoideum, and draw it downwards; one being cut, this bone loses its natural direction and inclines to the other side.

If we search deeper, we find the stylo-hyoides muscles, otherwise the constrictores medii pharyngis, (a) of which there are three pairs (c). One pair, which is stronger

(b) Either the stylo-hyoides or these constrictors are wanting.

(c) In the common toad (Rana Bufo), and in the Rana variabilis, I only found two pairs.
at the same time giving a peculiar cry during the course of this process. So strongly is the male attached to the female, that nothing can disturb or interrupt his operations. Nay, what will appear still more surprising, in an experiment by Spallanzani, in which the head of a male frog was cut off in this situation, the animal continued for some time to impregnate the ovum as they were excluded, and died only at the end of four hours.

When the ovum of the frog is examined with the Ova of the microscope, a small point is distinguished, black on the frog, one side and white on the other, placed in the centre of a globule, whose glutinous and transparent substance is surrounded with two concentric membranes, which are analogous to the shell of the egg. At the end of a certain time, which is longer or shorter, according to the temperature of the season, the embryo begins to be developed, and is afterwards known by the name of tadpole. Spallanzani has observed, that the process of incubation or hatching in the ova of the toad goes on, although the temperature of the atmosphere does not exceed 6° above zero of Reaumur’s thermometer, which is equal to about 39° of Fahrenheit.

It is unnecessary to mention, that the ova of the frog are deposited and hatched in water. It may be observed also that this process is interrupted in the ova of the toad, which happen to be dry on the earth, unless they are supplied with moisture.

The tadpole, as the process of incubation proceeds, Progress of and the organs which are destined to perform the functions of life are developed, exhausts the glutinous matter with which it is surrounded; this gradually dilates; and the more it increases in volume, the less is the quantity of its mass. It becomes at length only a light and almost invisible substance, from which the tadpole makes a short occasional excursion in the water, in making its first efforts in swimming; but returns again, finding itself either unable to procure its food, or to support itself long in the water on account of the shortness of the fins, which have not yet attained their full size. But as the little animal advances in its growth, the glutinous matter, its former habituation, being entirely dissipated, it roams at large in the waters.

According to the observations of Swammerdam, a tadpole is about six lines in length at the end of 15 days after it has been deposited by the female. The first traces of the hind feet may then be seen; and the piece of the toes is marked with so many small protuberances. In this stage of its progress the little animal exhibits a very different appearance from that which it assumes after the change it is to undergo. The mouth is not placed at the anterior part of the head, but on the lower surface; and when it wishes to seize any object for its prey, or to expel the air from its lungs by expiration, its motion in turning its body is so rapid and instantaneous, that the eye can scarcely follow it.

In a tadpole of 36 days old the hind legs are protruded; but the fore legs are some days later, so that to see them at the same period the animal must be opened, at least the external covering which veils in some measure, or disguises its future form. At last, at the end of about two months of confinement, which is about the middle of June, the young frog having reached its perfect form, and acquired sufficient strength, bursts from its prison. It contrives at first to contract its covering...
ERPETOLOGY.

Physiology. covering by elevating its back; by this the skin is torn near the head of the animal, which passes through the opening. That part of the membrane which formed the mouth of the tadpole is retracted over the body; the fore legs are successively unfolded; and the skin pushed to the posterior extremity of the body, leaves the whole of it, as well as the hind legs and the tail, uncovered. The tail then gradually diminishing in volume, at last entirely disappears, so that the smallest trace of it no longer remains in the perfect animal.

According to the situation of the countries in which they are found, the temperature of the climate, and the period and duration of the rainy seasons in tropical regions, the time of the turtle depositing its eggs is regulated. At this season the female quits the ocean, and often, it is said, makes a voyage of 300 leagues to find a safe and convenient spot for the reception of the embryos of her future offspring. The male, according to the accounts of some naturalists, accompanies the female in this expedition, with the view of reconducting her to their former haunts. We are informed that they arrive in such multitudes on the banks of the Oronoko about the beginning of March, that there is not sufficient space on the shore to contain them, so that vast numbers are seen with their heads above water, waiting the departure of those on land, that they may occupy their place. When the turtle has reached the shore, she fixes on a spot covered with sand or gravel, digs with her flippers, in a place beyond the reach of the tide, one or more holes of about a foot broad and two feet deep; and there deposits her eggs to the number of more than a hundred. She then covers them with a little sand, but so lightly, that the action of the rays of the sun may not be interrupted hatching them. The turtle deposits her eggs commonly at three different times, a period of fourteen days intervening between each time. The danger to which these animals are exposed, when the light of day favours the pursuit of their enemies, and perhaps also, it has been conjectured, the fear of suffering from the burning rays of the sun, make them almost always prefer the darkness and temperate coolness of night to come on shore for this purpose.

The period of hatching is longer or shorter according to the temperature of the climate. In more temperate regions, it continues about 20 or 25 days. At the island of St Vincent, (one of the Cape de Verde islands), this process is completed in 27 days; and Guimilia, the historian of the river Oronoko asserts, that three days only are required for hatching on the banks of this river. He places, he says, a stick near the place where the turtle deposited her eggs, and at the end of three days, so great is the influence of the sun upon the sand, the small turtles had made their appearance.

Travellers who have had opportunities of observing the small turtles soon after they are hatched, when they are only about an inch long, inform us, that in this state they do not quit their holes during the day, being instinctively warned to protect themselves in this manner from the heat of the sun, and the voracity of birds of prey, but they wait till night to make their way to the ocean. "I have been often astonished, (says Guimilia), when I have observed that the place where they have been hatched, being sometimes half a league distant from the river, they direct their course towards it without any deviation by the shortest possible way. I have sometimes carried the young turtle to a great distance from the water. I have covered them up and made covered holes for them that they might wander. But I no sooner left them at liberty, than they took the direct course to the river, without turning either to the right hand or to the left. The instinct with which these little animals are impressed, conducts them towards the nearest waters, where they find safety and proper food. They move on very slowly, and as yet too feeble to resist the force of the waves, great numbers are thrown back by the surge on the sea shore, where sea fowl, crocodiles, tigers, and other animals are in waiting to devour them, so that but a small number escapes the numerous dangers to which they are constantly exposed.

It is also at the return of the spring season that the alligator deposits its eggs. It lays about 100 in the lagoon, a space of one or two days; and in the same way as the turtle covers them with sand, and, it is said, rolls itself round the place, that it might be the better concealed from its enemies. Having thus secured its future offspring, it returns to the water, when the process of hatching goes on by the heat of the sun. About the time that the necessary period has elapsed for the evolution of the young animal, it is said that the female returns, accompanied by the male, scapes up the sand, and uncovering the eggs, breaks the shell, to allow the young animal to escape. It is said that the young alligator, before it leaves the egg, is at least six inches long, and that it is rolled up, having its head placed in the centre. When the shell is broken with a stick, they bite it furiously, and sink their teeth in this substance. This seems not improbable, since it is recorded by different naturalists, that the teeth of the young alligator are completely formed before it leaves the egg.

The mode of propagation, so far as it has been observed among the tribe of lizards, is similar to that of the frog. The male remains for some time on the back of the female, embracing her closely. This does not prevent them from running about, or leaping from branch to branch. When the female is about to deposit her eggs, she makes a hole in the earth of about two inches deep, at the foot of a tree or wall; in that the egg is dropped and covered with earth, and, as in the other tribes, the process of incubation is accomplished by the heat of the sun.

But some species of lizards are viviparous. This is considered by naturalists as exactly the same mode of propagation as in the others which are produced from eggs, with this difference only, that the process of incubation goes on in the former within the body of the female, and the young are excluded completely formed.

The Eggs of Reptiles.—The size of the eggs of this order of animals is always proportioned to that of the female by whom they are produced. From the smallest species of lizard to the huge crocodile, they may be found of every size. The smallest are scarcely more than two lines in diameter, while the largest are three inches long.

The covering of these eggs is different in the different tribes. In the greatest number, but especially in the eggs of the turtle, it is flexible, soft, and similar to moistened parchment. The eggs of the crocodile, and of some large lizards, are covered with a shell of a hard, calcareous
Chap. II.  

**ERPE TOLOGY.**

Physiology. - A calcareous substance, like that of the eggs of birds. It is, however, considerably thicker, and consequently less brittle.

In India and America, these eggs are very much sought after, and are esteemed by the natives a very rich and delicate food. About the time that the turtle deposits its eggs on the banks of the Oronoko, the adjoining inhabitants repair to the banks of that river with their families, for the purpose of collecting them; and they not only live upon them at this time of the year, but dry them, that they may carry them home to be laid up in store for their future sustenance.

It is said that the Indians are extremely fond of the eggs of the alligator, which they search out with great industry, and rejoice when they discover the place where they have been deposited. They bake them when they prepare them for food, and although the young animal has begun to be evolved, or is nearly formed, they are not less scrupulous in eating them.

**FOOD OF REPTILES.** - It is only in extraordinary cases that reptiles abstain from food for any length of time. When they are at perfect liberty, and find that kind of food which is suited to their nature, they in general indulge in it voraciously. Frogs and lizards feed on bees, worms, snails, beetles, and different species of winged insects. Some of the toads live on aquatic plants; the turtles find in the water or on the land, vegetables and shell-fish; the crocodile is carnivorous, and devours, grasshoppers, fishes, sea-fowl, and turtles; and when pressed by hunger, attacks men, but especially, it is said, the negro race, whom he prefers to others. This latter fact has probably no foundation whatever. The very largest crocodiles, which are more easily seen and avoided, it is said, employ some artifice in seizing their prey. They watch about the margin of stagnant waters, and lie there covered with mud, like a fallen tree, remain immovable, and patiently wait the favourable moment to seize some unsuspecting animal. Sometimes, when they swim down any large river, they stop at the most frequented places, and raise only the upper part of their head above the surface of the water. In this attitude, which leaves the eyes at liberty, they surprise the animals which come to cool themselves, or to drink in the river. As soon as they perceive any one, they plunge under the water, swim towards it, and seize it by the limbs, drag it along to drown it, and afterwards make it their prey.

**ABODE OF REPTILES.** - Reptiles, like plants, are profusely distributed over the whole surface of the globe; but from their nature and habits are more abundant and numerous in some places than in others. Some tribes live entirely on dry land, while others are confined to the bottom of the water. Others may be considered as intermediate tribes, living on the confines of the two elements, exhibiting in them the degrees and shades of different habits, which result from the diversity of forms. Among those which have their abode on dry land, as many of the tortoises, most of the lizards, the chameleons, some prefer dry and elevated situations, while others dwell in caverns or in the holes of rocks; and as these are different in their economy and habits, as we find that they are different in their motions; while the one is sluggish and inactive, moving slowly, the others spring or creep rapidly among the branches of trees. Almost all of them, however, take the water, as well as the reptiles which remain constantly in the water, to come to the surface from time to time to expire the air of the atmosphere. The intermediate tribes, such as have their usual haunts on the limits of the land and water, can only exist in climates which correspond to their temperament. And thus they are found in innumerable multitudes in the immense extent of morass in the deluged savannahs of the new continent, where the moisture of the atmosphere and the temperature of the climate are favourable to their reproduction.

In Kamtschatka, where the cold of winter is so rigorous, no species of toad, of frog, or even of serpent, is ever seen. Lizards, however, are very numerous, which are regarded by the inhabitants with a superstitious horror. They suppose that they are sent by some evil deity, as spies on their actions, or to predict their death; and hence it is that they use every precaution to secure themselves against their malevolent effects. Wherever they find them they cut them to pieces, that they may not be able to return to the malignant being by whom they have been sent to witness against them. Should the animal accidentally make its escape, they are seized with the most violent grief and despair. They expect every moment the approach of death, and sometimes hang on, by their fears and terror, what they so much dread. All this contributes still more to increase and strengthen this ridiculous and groundless superstition.

**REPRODUCTIVE POWER OF REPTILES.** - Many of the animals belonging to the order of reptiles undergo very considerable changes, in the reproduction of different parts of the body, either in the ordinary processes of nature, or when they are deprived of them by accident. The casting of the skin, and its reproduction in different reptiles, as in the toad and newt, may be regarded as a natural operation in some way necessary to the economy of these animals. It is observed, that the water-newts frequently cast their skins; and these are occasionally seen floating in the waters which they inhabit. The skin is sometimes so perfect, that it exhibits the whole form of the complete animal.

The following account of this process by Bonnet will, no doubt, be interesting to the reader.

"When, says he, the period of change approaches, the fine skin is observed detaching from the body. The head first loses it; then the rest of the anterior part; next the middle, and then the posterior part. Sometimes the spoil, cast by the head, forms like a gauze collar or cravat around the neck; or it is adjusted on the head, like a capuchin or hand-dress.

"The commencement of separation, from the back and belly, is discovered by viewing the newt obliquely from one side, in a strong light. The skin of the belly is further detached, because it falls down by its own weight.

"Approaching spoliation is recognised by conspicuous and unequivocal symptoms. The back, viewed obliquely, appears whitish, and as if covered with a spider's web. This is the effect of the spoil beginning to separate. If closely examined with the naked eye, or a magnifier of small power, it seems composed of minute scales covering the callosities or tubercles, which shagreen the body of the newt. But, when examined with..."
Physiology. with more attention, and in a favourable light, this epidermis is discovered to be a beautiful reticulation, the meshes of which are visible to the naked eye.

Many observations could be made on the texture of this delicate membrane; and these might greatly tend to elucidate the nature and origin of the epidermis, which, notwithstanding all the researches of physiologists, are so little known; and newts would afford frequent opportunities for deeply investigating the point.

"From particular attention to the newts in my possession, I have observed, that there is not the smallest resemblance between this operation and what is exhibited by caterpillars, and many other insects. The skin is detached here and there, and often in different sized plates; and the change is slow, for it occupies one or two days, and I have even known it take three. During spoliation, the newt continues moving about in the water, with all the usual motions of newts that undergo none; therefore it is no disease, and it does not affect them as it does insects. While the change is going on, the animal darts on its prey, holds and devours it.

"Sometimes spoliation is difficult to be accomplished; but in these cases the newt knows to practise certain manoeuvres to facilitate the operation, which I have often beheld with pleasure. It alternately raises and depresses the right arm and left leg at the same time, with gentle vibrations of the whole body. It frequently darts suddenly toward the surface of the water, and the next moment precipitates itself to the bottom; and these manoeuvres I have seen continued above half an hour. But the sudden exertion, in all its motions, indicated that the newt was impatient at the tediousness of the change.

"When most of the spoil is thrown off, and the animal, to disengage itself from the rest, rapidly rises to the surface, it seems carried along in a cloud; for the whiteness, firmness, and semitransparency of the spoil, floating around it, is no imperfect representation of a cloud.

"I never observed the fingers employed in detaching the spoil. Both young newts and those full grown east several successive skins; some of large size are in my possession, that have done so before me. Reproducing limbs throw off the epidermis as well as the original.

"I have seen the skin of the head, which formed like a collar or cravat round the neck, gradually come down the belly of a large newt that had lost the arms, and fasten like a tight girdle.

"Nothing can accurately be said of the number and interval of mutations. Between the 14th of July and the 7th of September, a newt has changed its skin 11 times.

2d change 14th July. 6th change, 6th August.
3d. 20th.
4th. 22nd.
5th. 30th.
6th. 11th. 6th Sept.

* Spallanzani's Tracts, iii. 36. Del. yellow's Trav. coloue. ""

"Spoliation sometimes makes a slight change in the text of this fortunate; the manner in which toads throw off the old cuticle is quoted by Dr Shaw, as related by Mr Schneider, from Grignon, who was an eye witness of it. The skin splits or cracks in a longitudinal direction, both above and below, and the animal pulls off these of the left side with its left foot, and, delivering it into the right foot, applies it to its mouth and swallows it. It then performs the same process on the right side, and, delivering the cuticle into the left foot, swallows it like the former.

But the most remarkable circumstance in the economy of these animals is the reproduction of mutilated limbs, such as the legs, the tail, and even the eyes. The complete set of experiments to ascertain these curious facts, were made by Spallanzani and Bonnet. The following is an account of some of these experiments in the words of the author.

"Experiment. The right arm and left leg of a newt amputated. — On the 6th of June, I cut the right arm and left leg off a large newt, very near the body. A stream of florid blood spouted a minute and a half from each wound; however, the vessels soon closed, and the newt was apparently as well as those unamputated. But it will easily occur that it did not swim with equal facility.

"When about a month had elapsed, I began to perceive a papilla, of a violet grey colour, near the edge of the trunk or section. This was the origin of a new arm and leg, which gradually increased; and, from the 14th of July, the two papilla continued growing on the subsequent days, but more in length than thickness. They became minute stumps; and, on the first of August, were about two lines long. A kind of cleft, hardly perceptible, announces the appearance of two toes which nature labours to produce, or rather to expand, on the new foot. No cleft appears on the originating arm.

"The two toes were easily recognised on the 7th. They were real miniatures, and truly most minute. The stump of the arm continued nearly as it was on the first of the month, but is now somewhat larger; but as yet there is no indication of fingers.

"It is pleasing to observe the little hand fully unfolding, while only three fingers of unequal length are visible: the middle one is the longest. The arm has made no sensible progress. The new foot had four toes also of unequal length, the first and second of which are longest; other two only begin to appear; the fourth is scarcely perceptible. One can never tire contemplating these miniatures, and admiring the wonders of the organic kingdom.

"Evolution advanced every day. On the 22d of July and August, the regenerated members began to deepen in arm colour, so that the line, discriminating the old parts from the new, was no longer so conspicuous; but the black specks on the toes of unamutilated newts were still imperceptible.

"I continued my observations on the daily evolution of the members; and the following were their dimensions of length on the 20th of September.

<table>
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<tr>
<th>Old Members</th>
<th>New Members</th>
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<tr>
<td>Arm, 4 lines</td>
<td>Arm, 2 1/2</td>
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<tr>
<td>Cubit, 3 1/2</td>
<td>Cubit, 2 1/2</td>
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<tr>
<td>Thigh, 3</td>
<td>Thigh, 2 1/2</td>
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<tr>
<td>Leg,</td>
<td>Leg,</td>
</tr>
</tbody>
</table>
Chap. II.

**ERPETOLOGY.**

It is this primitive state which we design by the word physiology, germ; and which we comprehend, when the organic whole is expanded to a certain extent. But there is here a term beyond which we cannot ascend; for the organic whole either becomes so minute or so transparent, that it escapes all research and our most perfect instruments.

"The dimensions of the old and new members, in length, were as follows, on the 2d of September.

<table>
<thead>
<tr>
<th>Old Members</th>
<th>New Members</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arm, 3½ lines</td>
<td>Arm, 2½</td>
</tr>
<tr>
<td>Cubit, 3½</td>
<td>Cubit, 2½</td>
</tr>
<tr>
<td>Longest finger, 1½</td>
<td>Longest finger, 1½</td>
</tr>
</tbody>
</table>

"Experiment.—The tail of a newt amputated transversely. Something important would have been wanting, had I neglected amputation of the tail, which is a very intricate great organic substance. It is formed of a series of minute vertebrae, with arteries, veins, and nerves; and it is covered with muscles and flesh.

"The tail of a large newt is more than two inches long, and about half an inch thick, formed like an ear, and terminated by a soft point. Much might be said of the figure, proportions, and position of this organ, and with respect to the functions it has to exercise; but these would be details foreign to my purpose: I only mean to confirm what Sig. Spallanzani has advanced concerning the admirable reproduction of the members.

"When the tails of large newts were amputated near the origin, I never succeeded in obtaining reproduction; the whole died in a certain time; and for several weeks preceding death, a kind of whitish cotton mould grew on the wound, the filaments of which were several lines in length. Nevertheless, I cannot think that this affected the animal's life, for I had seen similar mould, or cottony filaments, on wounds occasioned by amputating the arms and legs. These filaments gradually disappeared, and unequivocal signs of reproduction soon became visible. Thus a good observation was never obtained, unless the tail was divided about the middle, and by a section perpendicular to the axis. A stream of blood, as thick as a hog's bristle, always spouted from the wound. The large vessel, from which it flows, is situated near the vertebra, and its orifice is visible by the naked eye; it immediately closes; and the orifice is distinguished by a reddish or brownish point.

"The tail of newts is very sensible, which is particularly evident in the slenderest part. A portion cut off will retain life, and move whole hours; and when life seems entirely extinct, we have only to prick the pointed extremity, that motion may be renewed; it rises and falls alternately, and with greater force, according to the period that has elapsed since the operation. The motion of this separated part bears great resemblance to that which is peculiar to certain apodal worms; it is undulatory, and evidently depends on irritability, which is extremely active in so muscular an organ.

"Immediately after the operation, the area of the cut exhibits a very-long ellipse; the two extremities almost terminating in a point. The smallest diameter is about a line across, and the largest five or six. In the centre are the vertebrae, or blood-vessels; the rest of the area seems full of small oblong, clear white substances.
ERPETOLOGY.

Chap. II.

On the same day, 24th August, I amputated a physiology.
reproduced hand and arm the third time; and on the
13th October, performed the fourth operation; the
limbs being then in the same state as those mutilated
by the third amputation.

Thus it is fully established, that every member,
successively reproduced, contains new sources of repara-
tion; and that they are actually existing, though the
member is extremely minute.

From these successive mutilations of reproduced
members, I have thought the extremity of the leg and
arm became a little thicker than usual, as if from a re-
flux of the nutritive fluids into the extremity, by such
repeated amputations.

This season was particularly favourable to my ex-
periments, being always dry and warm. A mercurial
thermometer, in the shade, completely isolated, on a
large terrace, stood at 95° and 93°, on the 14th and 15th
of August. Most of summer it stood between 79° and
81°; and the temperature of the apartment, where the
newt was kept, differed very little from that of the
open air.

EXPERIMENT.—When a large newt was treated
as has just been related, I made another experiment on
one of similar size, to obtain comparative results.

The left arm and thigh were severed 2d June 1778.
Reproduction of new members commenced in the be-
inning of July: two well-shaped toes were then on
the foot. On the 11th, new limbs had replaced the
old; they seemed completely repaired: they were
only miniatures of most delicate texture. This day I
amputated the reproduced hand and foot.

A new foot, with two distinct toes, was perceptible
on the 22d; and three were visible on the 24th. But the
new hand had not appeared; at least there was no evi-
dence of originating fingers. The thermometer now
stood about 84°. However, a new hand, with three
perfect fingers, was seen on the 25th.

The reproduced hand and foot being a full line long
on the 31st, I then cut them off. Both appeared again,
August 1st, with three well shaped fingers and toes.
On the 24th, the hand had acquired its four fingers,
and the foot five toes, all visible, though excessively
small.

I then cut off the hand and foot for the third time.
The fingers and toes were a full line long 15th October;
four of which appeared, but the fifth toe was yet imper-
cise.

Next I performed a fourth amputation; it also
was followed by reproductions. Various occupations
having interrupted me, a fifth amputation was not made
before 26th August 1779.

The longest finger was then about oneline and a third,
the longest toe one and a half in length, deep coloured,
and very slender. The hand had four fingers; the first
and fourth imperfect. The foot had only three toes,
more distant from each other than usual. Both the
fingers were as imperfect 30th October 1780: the fourth
scarcely visible, and consisting only of a sharp point;
and no more than three toes on the foot. The newt
had then diminished greatly in size, and was very brown.
It ate little, and seldom; it remained long at the sur-
face, unable to get to the bottom of the water; and its
belly was almost always very much inflated.

These are two experiments, therefore, which concur
Physiology

in establishing the same fact, viz. that the reproduced members of a newt, though still in miniature, are equally provided with respiratory organs as the old limbs; and that they begin to unfold after the new members are cut off."

To these curious experiments we shall only add the account of another, concerning the reproduction of the eyes of newts.

"Experiment. — On the eyes of newts. This is a cruel experiment; and sensible minds will hardly pardon the observer’s cruelty, though it arises from an evident desire to discover new facts and enlarge our knowledge of the animal economy. Therefore, I fear the compassionate reader will revolt further still at what is yet to be related. But I beg he will consider, that animals, which, after losing one, or even several limbs, continue greedily devouring the prey presented, undoubtedly cannot experience the sensation of pain to the excess which our own sensations lead us to imagine. We are very insufficient judges of what pains within an animal so remote from us in the scale of living beings. Let it not be thought, that by these reflections, I mean to lessen the natural repugnance of every humane mind to make animals suffer. The benignity of nature itself will inspire man with this precious sentiment to prevent the enormous abuse that his power might exert over the animals which she has subjected to his dominion.

Yet let me ask, whether a rational person abuses his empire over animals, by making them suffer only for his own instruction, or that of his fellow creatures.

"With a scalpel, I extracted the right eye of a large newt, September 13, 1792; but I did not obtain the globe without much injury to the tunics. It was the first time of performing the operation, and before I had acquired the peculiar dexterity necessary for success, and afterwards learned by experience. Thus the utmost disorder ensued in the eye, and the crystalline lens started out on my nail. This is a beautiful object; no larger than a millet seed, and quite transparent. I thought that I beheld one of the spherical lenses with which Lieuwenhock discovered so many wonders. But contact of the air soon tarnished the minute lens; it dried and became disfigured.

"A deep bloody wound in the socket of the eye was the consequence of this cruel operation. And the reader will not be surprised if I hardly expected any thing from it, and that the newt would probably remain blind for ever. How great was my astonishment, therefore, when, on the 31st of May 1795, I saw a new eye formed by nature. The iris and cornea were already well shaped, but the latter wanted its peculiar transparency, which is very considerable in these animals. Impatience to arrive at the most important part of the prodigy has induced me to omit the progress of it; and observe that nature certainly began with closing the wound.

Eyes regenerated.

The cornea was nearly as transparent as that of the other eye, with which it was frequently compared. The iris had also acquired the yellow gilded colour, which characterises this species of newt. In short, the eye was so perfectly renewed, that no vestige existed of the uncommon operation that the animal had undergone. During the remainder of this and the following month, the cornea always became more transparent; and now, when I wrote these remarks, 9th November 1790, it is equally perfect as the other; but the reproduced eye seems a little smaller than the entire one; and the iris, or golden circle, goes only half round the ball.

"It would still be necessary to extract the reproduced eye, to ascertain, by dissection, whether it contains a crystalline lens similar to the original. But I confess, that, as yet, I have not had resolution to subject the newt to the most barbarous of all operations; and I shall probably await its death for satisfying my curiosity.

"Hibernation or Torpidity of Reptiles. — The best of the atmosphere is so necessary to animals, that when the periodical return of the seasons reduces the best of the countries in the neighbourhood of the equator to the cool temperatures of places situated in higher latitudes, reptiles lose their activity; the heat of their blood diminishes; their strength decreases; they retire in winter into obscure retreats, in holes of rocks, in the mud at the bottom of lakes, or else they seek shelter among the roots of plants which grow on the banks of rivers: but the cold increasing, they fall into a state like that of profound sleep; and this torpor is so great, that no noise disturbs or awakens them. They seem alike insensitive to violent blows or severe wounds. Reptiles are subject to this state of torpidity only in those countries where the variations of temperature at different seasons of the year is considerable; and indeed it seems to be a wise regulation of nature, that some of the animals functions should be suspended during that period of the year when the supply of food is cut off. This is the case with reptiles which inhabit countries distant from the equator, whose food consisting of insects, worms, &c. can only be obtained in the warmer season of the year. Accordingly, about the end of autumn, the reptiles, which have been vigorous and active in the summer, conceal themselves in the earth, or under the water, where they remain in the torpid state till the return of the genial warmth of spring. In Britain, frogs are found at the bottom of stagnant water, or in marshy places, where the water of springs issues from the earth, the temperature of which continues uniform through the whole year.

In this state of torpor and inaction, nothing of the animal remains but the form, and those functions only go on, which are essentially necessary to existence during this long period of torpidity, which sometimes continues more than six months. The total mass of the body of reptiles sustains only small loss of substance, but the external parts, such as are exposed to the action of the cold, and more distant from the centre of heat, undergo in the most of animals a considerable change.

But even in countries where the change of seasons is so great, and the diminution of temperature such as to oblige the animals belonging to this order to retire during that season, there are in particular circumstances some remarkable exceptions. One of these is mentioned by Townsend in his travels in Hungary: "The town of Gran (he says) is favoured with a fine spring of tepid water, of meer use, I believe, to the frogs than to its other inhabitants. My Ciceroni assured me that this animal is not torpid here during the winter, but is then seen in numbers in the pond in the town which receives its water from this spring. This is uncommon (continues the same author), but not surprising. For these
three years, I have kept a favourite tree frog, which is as gay in winter as in summer, provided she has warmth and enough to eat. The German stoves, which keep the room warm all night, have been very favourable to her. In this, hibernation differs from sleep, that whereas the latter admits of little variation, and can never be laid aside, or through art receive a substitute; the former greatly varies, and may be supplied by warmth and food. The Alpine marmot, in some high valleys in Savoy, hibernates, I am told, eight or ten months in the year. In other parts of the Alps, it does not hibernate half that time; and when kept warm, and well fed, its annual sleep entirely forsakes it, but not its diurnal. The same warmth that keeps alive the frog, keeps alive the insects on which it feeds, which in their turn will find food from the vegetable world, the mediate or immediate support of every living being, kept in vegetation by the same cause.19

Abstinence of Reptiles.—The singular instances of abstinence which have been recorded of many of the animals belonging to this order, are not the least of the peculiarities by which they are distinguished. It is conjectured by some zoologists, that the texture of the skin, which has few pores, and from which consequently the waste by perspiration is very small, enables them to endure long abstinence. The turtle and the crocodile can live two months without any kind of nourishment. It is no unusual circumstance to keep turtle on the decks of ships, during a passage of seven or eight weeks, from the West Indies, without any food whatever, only occasionally moistening the eyes with salt water.

The toad has lived eighteen months entirely deprived of food, and excluded from the air; so that the functions of digestion and respiration, so necessary and essential to animal existence in general, must have been totally suspended. We have already mentioned, in the natural history of the toad, Herissant's experiments on this subject before the French academy; and it would be superfluous to repeat the account of them here.

In the same place we have also given our opinion of the extreme improbability of toads, or indeed, it may be added, any animal whatever, having existed for any length of time inclosed in wood or stone, according to the vagaries stories which have been propagated of such having been discovered. The experiments of Herissant, above alluded to, afford a direct proof of the contrary.

Tenacity of Life.—Many of the tribes of reptiles are not less remarkable for being extremely tenacious of life. They not only live when deprived of their limbs and are otherwise annihilated, but absolutely seem to be little injured when some of the organs essential to life in other animals, and without which they could not exist for a moment, have been removed. The experiments of Redi on the land tortoise, which we have related in the natural history of that animal, in p. 271, are a proof of this fact.

Age of Reptiles.—Of the age of reptiles not much is known. But, from the few well authenticated instances which are recorded, it may be fairly presumed, that the period of the life of many tribes is very long. This, indeed, might have been concluded to be the case with cold-blooded animals, which can sustain total abstinence for such a length of time, as are so extremely tenacious of life, and repair so easily the loss of different parts of the body: but, on the other hand, when it is considered that they have no fixed haunts where they can remain always undisturbed, that from their amorphous nature they live alternately on the land and in the water, and that they are constantly exposed to the vicissitudes of the seasons, it is not possible to conceive but these changes from wet to dry, and from hot to cold, must greatly affect the animal frame, and limit the period of their lives. But without entering into any train of reasoning on the subject, the facts which have been recorded, and some of which we have related, clearly shew, that individuals among reptiles arrive at a very great age. The age of the land tortoise, which was kept in Lambeth gardens, and which we have mentioned in p. 271, was at least 120 years. The common toad, of which the history of one kept by Mr Ascot in Devonshire, that lived to the age of 40 years, is given in p. 286, is an instance of the remarkable length of life of so small an animal.

Some species of the turtle do not reach their full size till they are 20 years old; and it is said that they live more than a century.

The age of the crocodile can only be conjectured. It is supposed that this animal, which does not reach its full size of 25 feet long in less time than 32 years, may live seven times this period, so that the age of the crocodile has been calculated at 200 years.

Manners, &c. of Reptiles.—There are probably few animals which discover so much tranquillity and composure in their manners and habits, in general, as reptiles. Less agitated within by violent passions, and less affected from external objects than other animals, they are calm, mild, and peaceable. And if the crocodile, which of all the animals belonging to this order is the most voracious and destructive, is to be regarded as an exception, the ferocious habits for which he is distinguished, are owing to the great size of body which he must support; and, besides, how many tribes may be opposed to this sanguinary family, whose character is quite the reverse. Let us only compare the character of the crocodile with the gentle habits of the small gray lizard, or with the manners of the frog.

But notwithstanding this favourable character of reptiles, which may be considered in some measure as negative, it is to be observed, that, in their manners and habits, they never discover that choice of means, that series of combinations, or that kind of foresight, which in many other animals we behold with wonder and admiration. If sometimes they assemble together in great numbers, this by no means exhibits the character of that social union which takes place among gregarious animals, for it discovers no foresight or order. This bond of union is founded in no connection with each other, on providing no means for their mutual safety or protection. They produce no common work; they do not join together in search of prey, nor are they united in making any general attack on their enemies. Like the beaver, birds, or bees, they construct no permanent asylum; but when they fix on any particular place of abode on the shores, in the clefts of rocks, or in the hollow of trees, it is not a commodious habitation which they prepare for a certain number of individuals, and which they endeavour to appropriate to different purposes,
which is established among the different orders of animals. Fortunately, a great number of frogs, toads, lizards, and crocodiles, are destroyed before they are hatched. Many quadrupeds, as several species of monkeys, the ichneumon, and other animals, as well as several species of aquatic birds, search for their eggs on the shores, and feed on them with avidity. All the small reptiles which live in the water, which crawl in the mud of marshes, or creep on the earth, become the prey of fishes, of serpents, of birds, and of quadrupeds.

The tiger attacks the crocodile; and is sometimes successful in seizing its prey. The hippopotamus is a terrible enemy to the same animal; and is the more to be dreaded, as from his habits, he is enabled to pursue it to the bottom of the water. The cougar, although a less ferocious animal than the tiger, destroys many alligators. He waits in ambush on the banks of the great rivers for the approach of the young ones, and at the moment they raise their head above the water, he seizes them and tears them to pieces. But when he attacks those that are large and vigorous, he often meets with a bold and effectual resistance. It is in vain that he fastens his talons in their eyes; these huge reptiles drag him to the bottom of the water and devour him.

But man is perhaps the most dangerous enemy of the crocodile; sometimes he attacks him by open force, and sometimes by means of stratagem. The Africans, as soon as they perceive one of these animals on the bank of a river, advance towards him, having only in their hand a stick of very hard wood, or an iron rod about eight or ten inches long, and well sharpened at the ends; they hold this fierce instrument by the middle, and when the reptile, which advances towards them, opens his wide mouth, they introduce the rod of iron, which they turn with dexterity, so that the monster finds that he is unable to close his jaws. The pain from the wound, and instinct to reach a place of safety, make him retreat into the water, where he soon perishes by suffocation and the loss of blood. It is said, that some negroes are so bold and dexterous, as to swim under the body of the crocodile, and to pierce him in the skin of the belly; which is almost the only place on which a wound can be inflicted.

In some countries the natives employ stratagem to take this dreadful animal. In Egypt, they dig a deep ditch in the path which he follows in proceeding from the river. This is covered with branches of trees, and with a small quantity of earth; they then set up loud shouts, at which the crocodile is terrified, and returning the same way to the water, he passes over the ditch, falls into it, and is either killed or taken in snares.

The Indians successfully employ another mode of destroying the crocodile. They introduce into the body of a small animal, newly killed, a quantity of arsenic or quicklime, so secured, that the moisture cannot reach it; and this animal is exposed to the view of the crocodile. This is undoubtedly the most certain, and the least dangerous expedient.
INDEX.

ABDOMEN,
Abstinence of reptiles, p. 308
of the toad, 308
Age of reptiles, ib.
toad and tortoise, ib.
turtle, ib.
crocodile, ib.
Alligator, 301
history of, by Catesby ib.
by Ulloa, 292
Anatomy of reptiles, 306
Anus, 308
includes the parts of generation, ib.
Apostol lizard, 305
Arms of newt regenerated, 316
Bardisic, species of lizard, 205
error concerning, ib.
Biped lizard, 305
Breeding time of frog, 313
turtle, 314
alligator, ib.
Bull frog, 283
singular for the sound of its voice, ib.
popular notion of, ib.
C
Calipash of the turtle, 308
Calipee, ib.
Chalcides lizards, 305
annulated, ib.
Chameleon, division of, 300
history of, ib.
tongue, structure of, peculiar, ib.
changes of colour, ib.

Chameleon, errors concerning this change, and its abstinence, p. 300
Characters, generic, 269
Circulation of the blood in reptiles, 314
in peculiarities, ib.
Classification of different naturalists, 269
Common frog, 281
history of, ib.
Cordylos, division of, 297
lizard, ib.
Crocodile, common, 290
history of, ib.
less formidable than represented, 201
hunted with dogs, ib.
kept by the African monarchs, ib.
exhibited by the Romans, ib.
American, or alligator, ib.
history of, ib. and 293
Guanetic or Indian, 291

D
Draco, 289
volumes, ib.
peepers, ib.

Dragons, flying, 289
history of, ib.
American, ib.
a fictitious monster, 200
history of an artificial one, at Oxford, ib.
one at Hambergh, ib.

Ears of reptiles, 307
Eatable frog, 281
history of, ib.

Eggs, division of, p. 302
size of, ib.
coverings, ib.
of turtle used as food, ib.
of alligator also as food, ib.
Enemies of reptiles, ib.
Erpetology, introduction to, ib.
study of, important, ib.
Expiration, process of, ib.
Eyes of reptiles, ib.
newts regenerated, ib.

F
Feet of reptiles resemble those of quadrupeds, 32
are furnished with toes, ib.
bones of, ib.
Frog, common, ib.
history and changes of, ib.
tadpole, the larva of, ib.
structure of, ib.
food of, ib.
green, or edible, ib.
employed as food, ib.
ball, ib.
remarkable for the sounds it emits, ib.
popular notion of, in America, ib.

G
Galatea lizard, 68
Galesp lizard, ib.
ERPETOLOGY

Lacerta xelina, p. 298
fasciata, ib.
quinquelineata, ib.
interpunctata, ib.
bullaria, ib.
orrucuta, ib.
lobata, ib.
heliocope, ib.
turtles, ib.
platura, ib.
plica, ib.
japonica, ib.
notatica, ib.
tiliguerta, ib.
deserti, ib.
arguta, ib.
algira, ib.
velox, ib.
uralensis, ib.
sepa, ib.
chameleons, ib.
africana, ib.
pumila, ib.
gecko, ib.
dubia, ib.
perfoliata, ib.
mantianica, ib.
sinensis, ib.
vittata, ib.
fimbriata, ib.
tetradaeactyla, ib.
caudiverbera, ib.
schneideriana, ib.
harrmanniana, ib.
spectator, ib.
sincus, ib.
rufovena, ib.
longicauda, ib.
mabouya, ib.
ociodus, ib.
guttata, ib.
ocellata, ib.
salamandra, ib.
vulgaris, ib.
palustria, ib.
aquatica, ib.
maculata, 315
chalciodes, ib.
sperma, ib.
anguina, ib.
ap, ib.
hypes, ib.
lembricoides, ib.

Logs of new regenerated, 316, 317
Life, tenacity of, in reptiles, 320
Lizards proper, division of, 297
green, ib.
monitory, 295
prodigious number of, at Balbec, 303
some viviparous, 314
supersition of the natives of
Kamutschaka concerning, 315
Loggerhead turtle, 279

Loggerhead turtle, great strength and
fierceness of, p. 279
yields lamp oil, ib.

M
Manners of reptiles, 320
ib.
Monitor lizard, 295
extremely beautiful, ib.

N
Natter-jack, a species of the toad, 287
Newt, division of, 303
common, history of, 304
is viviparous, ib.
great water, ib.
common water, ib.
history of, ib.
casts its skin, ib.
spotted water, 305
history of casting its skin, 316
number of times, ib.
arm and leg, regenerated, ib.
progress of, ib.
another experiment, 317
tail of, regenerated, ib.
eyes of, regenerated, 319

O
Oviparous quadrupeds, reptiles so de-
nominated, 268

P
Pipa, or Swinam toad, 288
history of, singular, ib.

Physiology of reptiles, 306

R
Rana,
divided into three sections, ib.
temporaria, 281
esculenta, ib.
pipiens, 282
catesbeana, ib.
ocellata, ib.
virginica, ib.
ova, ib.
cyanophyllytia, ib.
spine, ib.
cerulea, 283
vespertina, ib.
riddle, ib.
sitibanda, ib.
levierana, ib.
igna, ib.
sala, ib.
paradoxa, ib.
zebra, 284
bicolar, ib.
leucophyllytia, ib.
quadrirrincis, ib.
castanea, ib.
fasciata, ib.
arbores, ib.
8 x 2

Rana,
ERPETOLOGY.

Tadpole, history of, p. 281
structure and changes of, ib.
singular one, 284
changes and evolution of, 319
Tail of reptiles, not in all, 308
newt regenerated, 317
Exstudo, classification of, 270
from number of claws insufficient, ib.
into land and sea tortoises, ib.
greec, ib.
margintae, 272
geometrics, ib.
radiata, 273
indica, ib.
rugosa, ib.
europae, ib.
lutaria, 274
carinata, ib.
carolina, ib.
sulcata, ib.
tabulata, ib.
concentrica, 275
picta, ib.
guttata, ib.
sieque, ib.
amosa, ib.
serrata, ib.
possilia, ib.
triarinarata, ib.
sacabra, 276
scripta, ib.
galeata, ib.
denticulata, ib.
pennevanica, ib.
longicollis, ib.
caspica, ib.
erox, ib.
granulata, ib.
fimbriata, ib.
serpentina, ib.
squamata, ib.
coriaceae, ib.
mydas, 278
orentta, 279
imbricata, ib.

Reproduction, members regenerated, 318
Reproductive power of reptiles, 315
Reptile properly applied to these animals, 268
Reptiles, anatomy of, 306
have not all teeth, 307
classification, 269
generic characters, ib.
abstinence of, the toad, ib.
the food of, ib.
are extremely voracious, ib.
habits in watching for prey, ib.
habit of, in different situations, ib.
none but lizards in Kamtschatka, ib.
superstitition of the natives concerning, ib.
abode, ib.
reproductive power of, ib.
enemies of, 321
Respiration, process of, 311
inspiration, ib.
expiration, 312
mechanism, ib.

Ribs, S
Salamander, division of, 303
history of, ib.
is viviparous, ib.
popular errors concerning, ib.

Scapula, 309

Snakes, division of, 302
history of, ib.

Serpent lizard, 305

Skin of reptiles renovated, 315
history and progress of, ib.

Sparks lizards, division of, 305
history of, ib.

Species, number of, in the order, 306

Food, common, 285
history of, ib.
age, 286
not poisonous, ib.
error concerning, ib.
diabolic, ib.
emits a peculiar smell, ib.
tadpole of, voracious, ib.
used as food, 287
Surinam, economy of, in hatching eggs, ib.
casts its skin, ib.

Tongue, an instrument for seizing the prey, 307

Tongue, error supposing the crocodile has none, 321
structure of the chameleon, ib.

Torpidity of reptiles, 279

Tortoise, common land, 270
description of, ib.
native country, ib.
great age, ib.
tensions of life, ib.
abstinence, ib.
history of one, ib.
margintae, ib.
geomctrics, ib.
terrapin of Dampier, 273
radiated, ib.
Indian, ib.
wrinkled, ib.
speckled, ib.
employed as food, ib.
mud, ib.
carinated, 274

peculiar structure of, ib.
of prodigious strength, ib.
united, ib.
tabular, ib.
concentric, 275
is a delicate food, ib.
painted, ib.
spotted, ib.
elegant, ib.
arculated, ib.
serrated, ib.
little, ib.
triarinated, ib.
rough, 276
lettered, ib.
galeated, ib.
denticulated, ib.
pennsylvanian, ib.
long-necked, ib.
Caspian, ib.
fierce, ib.
shagreened, ib.
fimbriated, ib.
snake, ib.

calyx, ib.

Shell got from the hawksbill turtle, made of obtaining and preparing, ib.
employed as ornaments by the Greeks and Romans, ib.
an article of trade, ib.

Townson, Mr. on respiration, 311
illustration or proof, 312

Tree-frog, peculiar structure and economy, 285

Trunk of the body, 307

Turtle distinguished from tortoises, 277
coriaceae, ib.
prodigious size of, 278

Turtle,
ERRATI, in general, something that wanders, or is not regular: hence it is the planets are called erratic stars.

ERRHINES, in Pharmacy, medicines which when smuffed up the nose promote a discharge of mucus from that part. See Materia Medica Index.

Errhines prepared of cephalic herbs are of singular service in oppressive pains of the head, a hemi crania, lethargic disorders, weakness of memory, stuffings of the head, and coryza, mucous defluxions of the eyes, drowsiness, vertigo, and in cases where the malignant humour generated by the fœtus venerea are lodged in the membranes of the nostrils.

ERROR, in Philosophy, a mistake of our judgment, giving assent to that which is not true.

Mr. Locke reduces the causes of error to these four; first, want of proofs; secondly, want of ability to use them; thirdly, want of will to use them; and, fourthly, wrong measures of probability.

He observes upon the first of these causes of error, that the greatest part of mankind want conveniences and opportunities of making experiments and observations themselves, or of collecting the testimony of others, being prevented by the necessity of their condition. Upon the second of these causes, he observes, that there are many, who, from the state of their condition, might bestow time in collecting proofs, but yet are not able to carry a train of consequences in their heads, nor weigh exactly the preponderancy of contrary proofs and testimonies, merely from the difference in men's understandings, apprehensions, and reasonings. Thirdly, he remarks, that though some have opportunities and leisure enough, and want neither parts, learning, nor other helps, that they never come to the knowledge of several truths within their reach, either upon account of their attachment to pleasure or business; or otherwise because of their laziness or aversion to study. The fourth cause of error, viz. wrong measures of probability, he imputes, 1. To the practice of taking for principles propositions that are not in themselves certain and evident, but, on the contrary, doubtful and false. 2. To received hypotheses. 3. To predominant passions or inclinations. And, 4. To authority, or the giving up our assent to the common received opinions either of our friends or party, neighbours or country.

The causes of error in philosophy, or the reasons why all former philosophers have through so many ages erred, according to Lord Bacon, are these following:


EROS Loci. Boerhaave is said to have introduced the term, from the opinion that the vessels were of different sizes for the circulation of blood, serum, and lymph; and that when the larger-sized globules were forced into the lesser vessels by an error of place, they were obstructed. But this opinion does not seem well grounded.

ERUCA, in general, denotes caterpillars of all kinds.

The caterpillar state is that through which insects pass before they arrive at perfection. See Larva, Entomology Index.

ERUDITION, denotes learning or knowledge; and chiefly that of history and antiquity, of languages and of books, which is the result of hard study and extensive reading. The Scajlers were men of deep erudition: the writings of M. Launoy, a priest of the Oratory, are full of erudition.

Mr. Locke says, it is of more use to fill the head with reflections than with points of erudition. If the mind be not just and right, ignorance is better than erudition, which only produces confusion and obscurity. M. Balzac calls a heap of ill chosen erudition the baggage of antiquity.

ERUPTION, in Medicine, a sudden and copious excretion of humours, as pus or blood: it signifies also the same with exanthems, any breaking out, as the pustules of the plague, small-pox, measles, &c.

ERUPTION of Volcanoes. See Aetna, Vesuvius, and Volcano, Geology Index.

ERVUM, the LentIL: A genus of plants, belonging to the diadelphus class; and in the natural method ranking under the 32d order, Papilionacei. See Botany Index.

ERYMANTHUS.
ERYMANTHUS, a mountain, river, and town of Arcadia, where Hercules killed a prodigious bear, which he carried on his shoulders to Eurystheus; who was so terrified at the sight, that he hid himself in a brazen vessel.

ERYNGIUM, Sea-Holly, or Eryngo; a genus of plants belonging to the pentandria class, and in the natural method ranking under the 45th order, Umbelliferae. See Botany Index.

ERYSIMUM, Hedge-Mustard; a genus of plants, belonging to the tetradynamia class, and in the natural method ranking under the 29th order, Siliqueae. See Botany Index.

ERYSIPelas, in Medicine, an eruption of a fiery or acrid humour, from which no part of the body is exempted, though it chiefly attacks the face. See Medicine Index.

ERYTHEA, or Erythia, an isle adjoining, according to the ancients, either to or a part of Gades; nowhere now to be found by the description given of it by ancient authors. The poets assign this to be the habitation of the fabulous Geryon, disarmed by Hercules, who drove away his cattle.

ERYTHRE, in Ancient Geography, a port-town of Aetolia, on the Corinthian bay. Another Erythre of Bocotia, near Platea and Mount Citharon. A third Erythre, a town of Ionia in the Hither Asia, situated in the peninsula, at its extremity, with a cornominial port. The Erythreans laid claim to the Sibyl Herophile, as their countrywoman, surnamed hence Erythras. Erythre was famous for an ancient temple of Hercules.

ERYTHREA, a town of Crete, situated in the south-east of the island, at theemporoty Erythreum. ERYTHREUM MARE, erroneously called Rubrum by the Romans. Thus the ocean that washes Arabia and Persia, and extends a great way farther, is demoniastic. Hence it is, Herodotus says, that the Ephrates and Tigris fall into the Mare Erythreum. He also calls it the South Sea, on which the Persians dwell. It takes its name, not from its colour, the terror of the Romans, who translated Erythreum Rubrum; but from Erythras, son of Persaeus and Andromeda, whose kingdom lay on the confines of that sea; whence its name Erythreum.

ERYTHRINA, Coral Tree; a genus of plants belonging to the diadelphie class; and in the natural method ranking under the 32d order, Papilionacea. See Botany Index.

ERYTHRINUS, in Ichthology, a species of Sargus. See Ichthology Index.

ERYTHROIDES, in Anatomy, the first of the proper tunics or coats which cover the testicles.

ERYTHRONIUM, Dog's-tooth Violet; a genus of plants belonging to the hexandria class; and in the natural method ranking under the 11th order, Sarraceneae. See Botany Index.

ERYTHROXYLON, a genus of plants, belonging to the deeracnia class. See Botany Index.

ERYX, a son of Bunus and Venus, who relying upon his strength, challenged all strangers to fight with him in the combat of the cestus. Hercules accepted his challenge after many had yielded to his superior dexterity; and Eryx was killed in the combat, and buried on the mountain, where he had built a temple to Venus. Virg. Aen. 5. v. 402. A mountain of Sicily near Doroanum, which received its name from Eryx, who was buried there. This mountain was so steep, that the houses which were built upon it seemed every moment ready to fall. Dedalus had enlarged the top, and inclosed it with a strong wall. He also consecrated there to Venus Eryxiana a golden beaker, which resembled life so much, that it seemed to exceed the power of art.

ERZERUM, or Erzeron, a city of Turkey in Asia, and capital of Armenia, or Taurusania. It is a pretty large town, five days' journey from the Black sea, and from the frontiers of Persia. It stands in a delightful plain, at the foot of a chain of mountains, which hinder the Frat, or Euphrates, from falling into the Black sea. A neighbouring hill supplies very fine springs, which not only water the fields, but the streets of the town. Erzerum is surrounded with double walls, defended by pentagonal towers; but the ditches are neither deep nor well kept up. The beglerbeg, or bashaw of the province, lives in the seraglio, which is very ill built. They reckon that there are 18,000 Turks at Erzerum, 6000 Armenians, and 10,000 Greeks. The Armenians have a bishop and two churches; and the Greeks have also a bishop, but the church is a miserable place. The last are mostly bazaars, inhabiting the suburbs, who work the copper brought from the neighbouring mountain. They drive a great trade in copper utensils and for, particularly martenskis. Five or six days journey from the town: there are oaks that produce plenty of gall-nuts, which are brought hither. This place is the thoroughfare and resting place of all the merchants trading to the Indies, especially when the Arabs are watching for their prey round Aleppo and Bagdad. E. Long. 40° 50" N. Lat. 39° 46'.

ESARHADDON, the son of Semacherib, and his successor in the kingdom of Assyria. He is said to have reigned 20 years at Nineveh, from the year 3394 to 3322; besides which he reigned 13 years at Babylon, in all 42 years. He died in the year of the world 3336, and was succeeded by Sesostrichus. Esarhadon, in the opinion of Sir Isaac Newton, seems to be the Sardenapalus who died, as Ciecrabros says, of old age, after the revolt of Syria; the name Sardenapalus being derived from Assurhadon Pal.

ESCALADE, or Escalade, a famous attack of a wall or a rampart, carried on with ladders, to pass the ditch, or mount the rampart; without proceeding in form, breaking ground, or carrying on regular works to secure the men.

When the troops are prepared to pass the ditch, either with the assistance of boards, hurdles, and fascines, when it is muddy, or with small boats of tin, or baskets covered with skins or old cloth, when it is deep and filled with water, a party must be placed on the counter-scarp, opposite to the landing-place, ready to fire at the garrison if they are alarmed, and oppose the mounting on the rampart. If the ditch is dry, the ladders are fixed in some place farthest distant from the entrenchment; and as soon as they get upon the rampart, they put themselves in order to receive the enemy; if the entrenchment should be surprised and silently overcome, the detachment hastens to break open the gate, and to let in the rest of the party. If the ditch is wet, the rampart high, and provided with a revetment, it will be
ESCA, ESC. [ 327 ]

ESCALADE. be difficult to surprise the town in this way; but if there is no revetment, the troops may hide themselves along the outside of the rampart till all are over. Since the invention and use of gunpowder, and the walls of cities have been flanked, they are seldom taken by escalade.

ESCALONIA, a genus of plants belonging to the portendria class. See BOTANY INDEX.

ESCAPE, in Law; a violent or privy evasion out of some lawful restraint, without being delivered by due course of law. There are two sorts of escapes, voluntary and negligent. Voluntary, when a man arrests another for felony or other crime, and afterwards lets him go freely by consent; in which case, the party that permits such escape is held guilty, committed, and must answer for it. Negligent escape, on the contrary, is where one is arrested, and afterwards escapes against the will of the person that arrested him, and is not pursued with fresh suit, and retaken before the person pursuing hath lost sight in him. By Stat. 8 and 9 Will. III. c. 26, the keepers of prisons conning at escapes shall forfeit 500l.; and in civil cases the sheriff is answerable for the debt.

ESCHALOT, or SALLLOT. See ALLIUM.

ESCHAR, in Surgery, the crust or scab occasioned by burns or caustic medicines.

ESCHARA, in Natural History, the name of a species of coralline, &c. the characters of which are these: they are of a stony or coral-like hardness, and resemble a woven cloth in their texture; and the microscope informs us, that they consist of arrangements of very small cells, whose surfaces appear much in that form. Linnaeus makes it a species of millepore, in the class of lithophytes.

ESCHEAT, in Law, signifies any land or tenements that casually fall to a lord within the manor. It is one of the consequences of tenure in chivalry: (See FEUDAL SYSTEM, KNIGHT-SERVICE, and TENURE). It is the determination of the tenue or dissolution of the mutual bond between the lord and tenant, from the extinction of the blood of the latter by either natural or civil means: if he died without heirs of his blood, or if his blood was corrupted and stained by commission of treason or felony; whereby every inheritable quality was entirely blotted out and abolished. In such cases the land escheated or fell back to the lord of the fee; that is, the tenure was determined by breach of the original condition, expressed or implied in the feudal donation. In the one case, there were no heirs subsisting of the blood of the first feudatory or purchaser, to which heirs alone the grant of the feud extended: in the other, the tenant, by perpetrating an atrocious crime, showed that he was no longer to be trusted as a vassal, having forgotten his duty as a subject; and therefore forfeited his feud, which he held under the implied condition that he should not be a traitor or a felon. The consequence of which in both cases was, that the gift being determined, resulted back to the lord who gave it.

The word escheat is sometimes used for the place or circuit within which the king or other lord is intitled to escheats; also for a writ to recover the same from the person in possession after the tenant's death.

ESCHEAT, in Scots Law, is that forfeiture which is incurred upon a person's being denounced a rebel. See LAW, Part III. 3° dixvi. 12.

ESCHEVIN, or ESCHEVIN (Scabius), in the French and Dutch polity, a magistrate elected by the inhabitants of a city, to take care of their common concerns, the good order, convenience, and decoration of the city, &c.

At Paris there were formerly a provôt and four eschevins; in most other cities a mayor and eschevins. In Languedoc, Provence, and Dauphiné, they were called consuls; at Toulouse, capitouls; and jurats at Bordeaux.

Anciently the eschevins were the assessors and counsellors of the comites or judges of cities; on which account they were called in some places pairs, porrs; they even took cognizance of petty causes themselves.

Du Cange observes, that the judges and their assessors, who were chosen by the inhabitants, were called scabini, è eschevins, and their college scabinarium or è eschevinage.

"In Holland, the scabini or eschevins judge of all civil affairs at first hand. They also take cognizance of criminal matters: and if the criminal confess himself guilty, they can see their sentence executed without appeal. They can even give torture. The number is not the same in all cities; at Amsterdam there are nine, at Rotterdam seven, &c.

ESCHRATITES, or ESRAKITES, a sect of philosophers, among the Mahometans, who adhere to the doctrines and opinions of Plato. The word is derived from the Arabic prw schraca, which in the fourth conjugation prw anchemac; signifies "to shine, glitter like the sun," so that Eschrakite seems to import "illuminated." The Eschrakites, or Mahometan Platonists, place their highest good and happiness in the contemplation of the Divine Majesty; despising the gross imaginations of the Alcoran touching paradise. They are very careful in avoiding all vice; they preserve an equal and easy temper, love music, and divert themselves with composing little poems or spiritual songs. The sheikds or priests, and the chief among the preachers of the imperial mosques, are Eschrakites.

ESCLAIRCISSEMENT, a French term adopted into our language, signifying the explaining or clearing up of some difficulty or obscurity.

ESCORT, a French term, sometimes used in English authors to denote a convey or company of armed men, attending some person or thing, in a journey or voyage, to defend or secure it from insults. Some derive the word from the Latin cohors.

ESCOUADE, or SQUAD, is usually the third or fourth part of a company of foot; so divided for mounting guards, and for the more convenient relieving of one another. It is equivalent to brigade of a troop of horse. See BRIGADE.

ESCUAGE, in our old custom, a kind of knighthood, called service of the shield, by which the tenant was bound to follow his lord to the war on his own charge. See the articles CHIVALRY, FEUDAL SYSTEM, and KNIGHT-SERVICE.

ESCULAPIUS. See ÆSCULAPIUS.

ESCULENT, an appellation given to such plants, or the roots of them, as may be eaten: such are beets, carrots, artichokes, leeks, onions, parsnips, potatoes, radishes, scorroneurs, &c.

ESCURIAL,
ESCURIAL, a royal residence of Spain, situated about 15 miles north-west of Madrid. It is the largest and most superb structure in the whole kingdom, and perhaps one of the finest in Europe. The word is Arabic, meaning "a place full of rocks." It is built in a dry barren spot, surrounded with rugged mountains, insomuch that every thing which grows there is owing to art. This place was chosen, it is said, for the sake of the stone wherewith the fabric was built, which is got from a mountain just by, and is very durable; and the design of erecting it was to commemorate a victory which Philip II. obtained over the French (but by the assistance of the English forces) at St Quentin, on St Laurence's day, in the year 1557. The Spanish description of this structure forms a sizeable quarto volume, and it is said that its founder expended upon it six millions of ducats. The apartments are decorated with an astonishing variety of paintings, sculpture, tapestry, ornaments of gold and silver, marble, Jasper, gems, and other curious stones, surpassing all imagination. This building, besides its palace, contains a church, large and richly ornamented; a mausoleum; cloisters; a convent; a college; and a library, containing about 50,000 volumes; besides large apartments for all kinds of artists and mechanics, noble walks, with extensive parks and gardens, beautified with fountains and costly ornaments. The Fathers that live in the convent are 200, and they have an annual revenue of 12,000l. It was begun by Philip in 1556, five years after the battle; and completed in 22 years. It consists of several courts and quadrangles, which altogether are disposed in the shape of a gridiron, the instrument of the martyrdom of St Laurence: the apartments where the king resides form the handle. The building is a long square of 640 by 580, and the height up to the roof is all round 60 feet, except on the garden side, where the ground is more taken away. At each angle is a square tower 200 feet high. The number of windows in the west front is 200; in the east front 366. The orders employed are Doric and Ionic. There are three doors in the principal front. Over the grand entrance are the arms of Spain, carved in stone; and a little higher in a niche, a statue of St Laurence in a deacon's habit, with a gilt gridiron in his right hand, and a book in his left. Directly over the door is a basso-relievo of two enormous gridirons in stone. This vast structure, however, with its narrow high towers, small windows, and steep sloping roof, exhibits a very uncouth style of architecture; at the same times that the domes, and the immense extent of its fronts, render it a wonderfully grand object from every point of view. The church, which is in the centre of all, is large, awful, and richly but not affectedly ornamented. The cupola is bold and light. The high altar is composed of rich marbles, agates, and jaspers of great rarity, the produce of this kingdom. Two magnificent catafalques fill up the side arcades of this sanctuary: on one the emperor Charles V. his wife, daughter, and two sisters, are represented in bronze, larger than life, kneeling; opposite are the effigies of Philip II., and of his three wives, of the same materials, and in the same devout attitude. Underneath is the burial-place of the royal family, called the Pantheon. Twenty-five steps lead down to this vault, over the door of which is an inscription denoting, that.

Hic locus, siveer mortuatis erexitis Catholicae Re-
gnum, &c.

was intended by Charles the emperor; resolved upon by Philip II. begun by Philip III. and completed by Philip IV. The mausoleum is circular, 36 feet diameter, incrustated with fine marbles in an elegant taste. The bodies of the kings and queens lie in tombs of marble, in niches, one above the other. The plan of these sepulchres is grand, and executed with a princely magnificence; but, as a modern traveller observes, in a style rather too gay, too light, and too delicately fitted up for the idea we are apt to form of a chapel destined for the reception of the dead. The collection of pictures dispersed about various parts of the church, sacristy, and convent, has been considered as equal, if not superior, to any gallery in Europe, except that of Dresden. Formed out of the spoils of Italy, and the wasted cabinet of that unfortunate dilettante Charles I. of England, it contains some of the most capital works of the greatest painters that have flourished since the revival of the art. In the sacristy is an altar called La santa Forma: this is a kind of tabernacle or custodia of gems, marbles, woods, and other precious materials, inlaid in gilt bronze; in which, rather than in the excellence of the workmanship or taste of the design, consists the merit of this rock of riches. Before it hangs a curtain, on which Coello has represented Charles II. and all his court in procession, coming to place this Forma. This is esteemed one of the most curious collections of portraits in the world; for all the persons are drawn with the greatest strength of colour and truth of expression, and are said to be perfect resemblances not only of the monarch and grandees, but even of the monks, servants, and guards. The statues, busts, and medallions of the Escorial, are not in any great number, or very remarkable for their excellence: but the library contains a most precious collection of manuscripts, many fine drawings, and other curiosities. Notwithstanding the coldness of the exposure, the late king, for the sake of hunting, used to pass here several months in the year; and to make the place less inconvenient to his attendants and to the nobility, he built an entire new town adjoining to it.

ESCUTCHEON, or SCUTCHEON, in Heraldry, is derived from the French escusson, and that from the Latin scutum, and signifies the shield wherein coats of arms are represented.

Most nations of the remotest antiquity were wont to have their shields distinguished by certain marks painted on them; and to have such on their shields was a token of honour, none being permitted to have them till they had performed some honourable action.

The escutcheon, as used at present, is square, only rounded off at the bottom.

ESDRAS, a Jewish priest, and doctor of the law. Artaxerxes Longimanus sent him with rich presents for the use and ornament of the temple at Jerusalem, rebuilt under Zerubbabel; the king also ordered the neighbouring governors to provide him with what conduced to the pomp of the Jewish religion, and to exempt the priests from paying taxes. He is supposed to be the collector of the Canon of Scripture; and that, by divine inspiration, he added some things which happened
ESN [ 329 ]

ESK, the name of several rivers both in England and Scotland, particularly one which forms part of the boundary between the two kingdoms. It runs from north east to south west, and gives name to the district of Eskdale.

ESKIHISSAR. See STRATONICEA.

ESKIMAUX. See ESQIAUIM.

ESNE, or ENSH, a considerable town of Upper Egypt. It is governed by an Arabian prince and by a cachet, dependent on the bey of Girze. The Mahometans have several mosques here, and the Coptic a church served by two priests. "Esne (says Abulfeda,) remarkable for its public baths and its commerce, is built on the westward of the Nile, between Assuan and Cous-Bea, but nearer to the latter. It acknowledges, adds the geographer of Nubia, the Coptic for founders. Its well cultivated territory abounds in grain and palm-trees. It is surrounded by gardens filled with fruit-trees. Oros the traveler here several ancient monuments constructed by the Copts, and some superb ruins." This description answers to Esne in our time, which is situated on the edge of a rich country, and shaded by groves of orange trees loaded with fruits and flowers. This town, formerly called Latopolis, revered Minerva and the fish Latos (Strabo) contains within its boundary an antique temple. Thick walls inclose it on three sides. Six large fluted columns, crowned by a capital ornamented with the palm leaf, form the façade of it; 18 others support the roof, which is composed of large squares of marble; the building is surrounded by a frieze, and innumerable hieroglyphics cover its exterior aspects.

A little to the south of the town are seen the ruins of a monastery founded by St. Helena, and near it, the burying-place of the martyrs, adorned with tombs crowned by cupolas, supported by arcades. The inhabitants of Esne having revolted against the persecution of Dioclesian, that emperor destroyed this town and put them to the sword. This place, consecrated by religion, is become a celebrated pilgrimage among the Copts. They repair thereto from the most distant provinces of the kingdom. In the chain of mountains which stretches to the eastward of the Nile, and nearly opposite Esne, are quarries of a soft stone, called Barom. It is made use of for kitchen utensils. It hardens in the fire, and forms excellent kettles and pans, which give no bad taste to the victuals. This stone is probably the leptis attarci, or pet-stone.

ESPELAIERS, in Gardening, are rows of trees planted about a whole garden or plantation, or in hedges, in such a manner as to enclose quarters or separate parts of a garden; and are trained up regularly to a lattice of woodwork in a close hedge, for the defense of tender plants against the injuries of wind and weather. They are of admirable use and beauty in a kitchen-garden, serving not only to shelter the tender plants, but screen them from the sight of persons in the walks.

The trees chiefly planted for espaliers are apples, pears, and some plums; some plant apples graffed upon paradise stocks; but as these are of short duration, it is better to plant those graffed upon crabstock, or upon what the gardeners call Dutch stocks; which will both cause them to bear sooner, and prevent their growing too luxuriant. The best kinds of apple for this purpose, are the golden pippen, nonpareil, renette, &c. and the best sorts of pear, are the jargonelle, blanquet, &c. These last, if designed for a strong moist soil, should be graffed upon quince stocks; but for a dry soil upon free stocks.

While the trees are young, it will be sufficient to drive a few stakes into the ground on each side of them; fastening the branches to these in a horizontal position, as they are produced. This method will do for the three first years; after which an espalier should be made of ash-poles, whereof there must be two sorts, larger and smaller; the former to be driven upright into the ground a foot asunder, and the latter, or slender poles, to be nailed across these, at about nine inches. Some prefer to this another sort of espalier, made of square timber cut to any size; these are, indeed, more sightly, but withal vastly more expensive.

When the espalier is thus framed, the branches are to be fastened to it with osier twigs; observing to train them in a horizontal position, and at equal distances. Fruit trees thus managed are preferable to any others; not only as bearing better-tasted fruit, but as taking up very little room in a garden, so as to be less hurtful to plants which grow in the quarters.

ESPLANADE, in Fortification, the sloping of the parapet of the covered-way towards the champaign.

ESPLEES, in Law, the general products which lands yield, or the profit or commodity that is to be taken or made of a thing.

ESPOUSALS, in Law, signify a contract or promise...
ESSO [330]

Exposals mete made between a man and a woman to marry each other; and in cases where marriages may be consummated, exposals go before. Marriage is termed an exposal de present.

The exposals among the Jews were either by writing, or by a piece of silver given and received, or by cohabitation. Amongst the Greeks, after the parents and friends of the young couple had finished their negotiation, the couple themselves pledged their faith to each other, the man swearing that he would be constant and true, the woman that she would marry him, and make him master of all she had. Then they ratified their agreement by a kiss and joining right hands.

Amongst the Romans the exposals consisted in an engagement of friends on both sides, whether absent or present, in public or without witnesses. But the common way was by writings drawn up by common consent, and sealed by both parties: besides this, the man sent a ring to the woman, consisting of iron and without a stone.

ESQUILAE, in Ancient Geography, one of the seven hills of Rome, which Varro will have to be two, viz. Cipsias and Oppius; also Mos Esquiline, so called from Esquilineus; and this again from Escabius, the watch or guard Romulus kept here, from which he may be entertained of his colleague Titus Tatius. On the east side it reached the city walls; on the south, the Via Lavicana; on the west, the wide valley between Mount Coritius and the Palatine; on the north, the Mens Vivimis; on the east side was the Porta Esquilina. This hill by some of the ancients was called Suburra, from the street Subura to the north of it:

by the poets, Esquiline.

ESQUIMAUX, a people of North America, inhabiting all that vast tract of land known by the name of Labrador, or New Britain. They differ very considerably, both in aspect and manners, from the other American nations; agreeing in most respects with the inhabitants of West Greenland. See New Britain and Greenland.

ESQUIRE (from the French esce, and the Latin secutum, in Greek σκοτία, which signifies a hide, of which the shields were anciently made, and afterwards covered; for in the time of the Augustales the shields had a covering of leather), originally he that attended a knight in time of war, did carry his shield; whence he was called secuir in French, and scutifer, or armiger, i.e. armourbearer, in Latin. Hotoman says, that those whom the French call esquire, were a military kind of vassals, having jus scutis, viz. liberty to bear a shield, and in it the ensigns of their family, in token of their gentility or dignity. But this addition hath not of long time had any relation to the office or employment of the person to whom it hath been attributed, as to carrying of arms, &c. but hath been merely a title of dignity, and next in degree to a knight. For those to whom this title is now due, see the article COMMONALTY. Officers of the king's courts, and of the king's household, counsellors at law, justices of the peace, are only esquires in reputation; and he who is a justice of peace has this title only during the time he is in commission, and no longer, if he is not otherwise qualified to bear. A sheriff of a county being a superior officer, bears the title of esquire during his life; in respect of the great trust he has in the commonwealth. The chiefs of some ancient families are esquires by prescription; and in late acts of parliament for poll money, many wealthy persons commonly reputed to be such, were ranked among the esquires of this kingdom.

There is a general opinion, that every gentleman of landed property who has 300 l. a-year, is an esquire; which is a vulgar error: for no money whatsoever, or landed property, will give a man properly this title, unless he comes within one of the above rules: and no person can ascribe this title where it is not due, unless he pleases; there being no difficulty in drawing the line by the accounts given above and in the article COMMONALTY: but the meaner ranks of people, who know no better, do often basely prostitute this title: and, to the great confusion of all rank and precedence, every man who makes a decent appearance, far from thinking himself any way ridiculed by finding the superscription of his letters thus decorated, is fully gratified by such an address.

ESQUIRES of the king, are such as have that title by creation, wherein there is some formality used, as the putting on of their necks a collar of SS. and bestowing on them a pair of silver spurs, &c.

ESBRAKITES. See ESBRAKITES.

ESSAY, a trial or experiment for proving the quality of any thing; or an attempt to learn, whether or not any invention will succeed.

ESSAY, in literature, a peculiar kind of composition, the character whereof is to be free, easy, and natural; not tied to strict order and method, nor worked up and finished like a formal system.

ESSEAYING, or ASSAYING, in Chemistry and Metallurgy, signifies the examination of a small quantity of any ore or mineral by fire, in order to discover the quantity of metal it contains. This is very necessary for those who intend to deal largely in metallurgic operations, in order to avoid unnecessary expence, by becoming previously acquainted with the nature of the ore. See Chemistry Indens; and ORES, Reduction of.

ESSAY-Hatch, is the miners term for a little trench or hole, which they dig to search for shod or ore.

ESSEDARIAB, a sort of gladiators, mentioned by Seneca, Suetonius, and Tully, who on some occasions engaged one another out of chariots called ecesca. The ecesca was a sort of heavy chariot from which the Gauls and Britons engaged the Romans. See GLADIATOR.

ESSENCE, in Metaphysics, that which constitutes the particular nature of each genus or kind, and distinguishes it from all others: being nothing but that abstract idea to which this name is affixed, so that every thing contained in it is essential to that particular kind.

This Mr Locke calls the nominal essence; in contradistinction to the real essence, or constitution of substances on which this nominal essence depends. Thus the nominal essence of gold is that complex idea the word gold stands for; let it be, for instance, a body, yellow, weighty, malleable, fusible, and fixed: but its real essence is the constitution of its inessential parts, on which these qualities and all its other properties depend, which is wholly unknown to us.

ESSENES, or ESSENIANs, in Jewish antiquity,
one of the three ancient sects among that people. They allowed a future state, but denied a resurrection from the dead. Their way of life was very singular: they did not marry, but adopted the children of others, whom they bred up in the institutions of their sect: they despised riches and all things in common, and never changed their clothes till they were entirely worn out. When initiated, they were strictly bound not to communicate the mysteries of their sect to others; and if any of their members were found guilty of enormous crimes, they were expelled.

Pliny tells us, that they dwelt on the west side of the lake of Asphalites; and that they were a solitary kind of men, living without women or money, and feeding upon the fruit of the palm-tree: he adds, that they were constantly recruited by new-comers, whom the surges of ill fortune had made weary of the world: in which manner the sect was kept up for several thousands of years, without any being born among them. The reason why we find no mention made of them in the New Testament, may be their recluse and retired way of life, no less than their great simplicity and honesty, whereby they lay open to no censure or reproach.

ESSENTIAL, something necessarily belonging to a thing, from which it cannot be conceived distinct: thus the primary qualities of bodies, as extension, figure, number, &c., are essential or inseparable from them in all their changes and alterations.

ESSENTIAL OILS are such as are really contained in a plant, and are drawn from it by distillation in an alembic with water; they are thus called, in contradistinction to empyreumatic oils, which are raised by a wicked fire to the family of Capel. The county of Essex is divided into nineteen hundreds, and contains twenty-seven market-towns, 415 parishes, 125 vicarages, and 1100 villages. It sends eight members to parliament; namely, two for the county, and two for Colchester, Harwich, and Maldon. The air in the inland parts is healthy; but in the marshes near the sea it producesague, particularly in the part called the Hundreds. However, the fertility of the unwashed part is very great; and even the higher grounds of this county are very fruitful. About Saffron Walden, the earth, after bearing saffron three years, it is said, will produce good barley for 18 years successively without any manure. Its product, which is very plentiful, consists of corn, most excellent saffron, cattle, fowl, fish, and particularly oysters. The chief manufactures of this county are cloth, stuffs, and particularly hains. The principal rivers besides the Thames are the Stour, which falls into the German sea at Harwich; the Lea, its western boundary, falls into the Thames below Stratford; the Blackwater runs through the heart of the county, and passing by Chelmsford is joined by the Chelmer, and from thence runs into the German sea; the Coln runs by Halstead to Colchester, and so into the sea. The Roding which rises northwards, near Dunmow, runs into the Thames near Barking. All these rivers abound in most sorts of fish.

In the year 1801, the total number of inhabitants in the county of Essex amounted to 256,437 persons. Of these 111,356 are males, and 115,081 are females. In 1811 the population was 252,473, of whom 69,590 lived in towns, and 182,883 in the country.

ESTATE, in Law, signifies the title or interest that a person has in lands, tenements, or other effects; comprehending the whole in which a person hath any property, and will pass the same.

Estates are either real or personal; otherwise distinguished into freeholds, which descend to heirs; or chattels, that go to executors or administrators.

A fee-simple is the simplest estate our law admits of. See Fee.

Estates are obtained several ways: as, by descent from a father to a son; by conveyance or grant from one person to another; by gift or purchase; by deed or will. See Descent, Succession, Tenure, &c.

Estates, in a political sense, is used either to denote the dominions of some prince, or the general classes into which the people are divided.

In Britain, the estates are the king, lords, and commons; or rather the lords and commons, who meet the king in parliament, for reforming abuses, and enacting good and wholesome laws.

ESTHER, a canonical book of the Old Testament; containing the history of a Jewish virgin, dwelling with her uncle Mordecai at Shushan, in the reign of Ahasuerus, one of the kings of Persia.

The great beauty of this maid raised her to the throne of Persia; whereby she had an opportunity to save her countrymen, whose destruction was plotted by Haman, a favourite of that prince.

The learned men are not agreed what this Ahasuerus was. Archbishop Usher supposed him to be Darius Hystaspes, and Artystona to be Esther. Scaliger makes the same with Xerxes, and his queen Hestoreis to be Esther. Josephus, on the contrary, positively asserts, that the Ahasuerus of the scripture, is the Artaxerxes Longimanus of profane story; and the Septuagint, throughout the whole book of Esther, translates Ahasuerus by Artaxerxes. Most people subscribe to this last opinion; and indeed the extraordinary kindness showed by Artaxerxes to the Jews, can scarcely be accounted for otherwise than by supposing that they had so powerful an advocate as Esther to solicit for them.

ESTHONIA, is a province of the Russian empire, and part of Livonia. It is bounded on the east by the Baltic sea, on the north by the gulf of Finland, to the west by Ingris, and on the south by Lettonia. It is divided into six districts: 1. Harrian; 2. Wirland; 3. Alentakin; 4. Wich; 5. Jever; and, 6. Odepan. The principal towns are, Revel, Wisenberg, Borchholm, Narva, Nylot, Helarga, Dorpat, St Elia, Pernia, and Roderick. In former times the inhabitants of this country carried.
ried on a good trade in corn, which was dried in stores; but wars have much depopulated the country, insomuch that not a fourth part of it is inhabited, and a great number of gentlemen’s seats lie in ruins.

ESTOLLE, or CROSS ESTOLLE, in Heraldry, a star with only four long rays in form of a cross; and, accordingly, broad in the centre, and terminating in sharp points.

ESTOPHEL (formed of the French estouper, appliquer, obstipare, “to stop or block up”), in Law, an impediment or bar of action, arising from a man’s own act or deed; against which a man is forbidden, by law, to speak; though it be to say the truth.

ESTOVERS, in Law, is used by Bracton, for that sustenance which a man, committed for felony, is to have out of his lands or goods for himself and his family during imprisonment. In Stat. 6 Edw. I. it is used for an allowance in meat or clothes. In some manors, the tenants have common of estovers; that is, necessary stores or allowances out of the lord’s wood: in which last sense, estovers comprehends houses, hay-bate, and plow-bate; so that if a man have in his grant these general words, de raisionabil estoverio in bosco, &c., he may thereby claim all three.

Estovers is also used for alimony, which, if the husband cannot pay, there is, besides the ordinary process of excommunication, a writ at common law, de estoveris habendis, in order to recover it.

ESTRAY, or STRAY, signifies any tame beast, as sheep, oxen, swine, and horses, or swans, found within a lordship, and not owned by any man; in which case being ‘crying, according to law, in the church, and two market towns adjoining, if it be not be claimed by the owner within a year and a day, it becomes the lord’s of the soil where found. If the owner claims it within the year and day, he must pay the charges of finding, keeping, and proclaiming them; and he may seize it, without telling the marks or proving his property, which may be done at the trial if contested. If the beast stray within the year to another lordship, the first lord cannot retake it. An estray must be fed and kept, uninjured, and without labour, till it is reclaimed or the limited time expires.

ESTREAT, or EXTRACT, in Law, is used for the true copy or transcript of some original writing, especially of amercements or penalties set down in the rolls of a court, to be levied by the bailiff or other officer, on every offender.

ESTREMADURA, a province of Spain, has New Castile on the east, Leon on the north, Andalusia on the south, and Portugal on the west. It is 175 miles in length, and 100 in breadth; and its principal towns are Calatrava, Menda, and Badajoz, on the river Guadiana; Alcantara, on the Tagus; and Cuda and Placentia, to the north of this river.

This province enjoys a very pure and healthful air, and its mountains are full of wild and tame animals; they having woods and forests for the one sort, and pastures for the other. The fields are planted with fruit-trees, which bear all kinds of delicious fruit. The vineyards produce excellent wines of all colours, and the fields yield plenty of corn.

ESTREMADURA, a province of Portugal, near the mouth of the Tagus or Tejo, bounded on the north by Beira, on the east and south by Alentejo, and on the west by the Atlantic ocean. It is about 88 miles in length, and 45 in breadth. This province is divided into six comarcas, viz. Litoria, Lisbon, Tomar, Santarem, and Alfarque, to the north of the Tagus; and that of Setubal, to the south of this river. These are likewise the principal towns. Estremadura is equal, if not preferable, to any other province in Spain or Portugal. The district of Santarem produces such plenty of corn, and feeds so many flocks of sheep, that it may enter into competition with Sicily. The fruits and the wines are all excellent; and it was here that the sweet oranges brought from China were first planted, and of which there are large quantities transported to foreign parts, with the wines and other fruits. The fields are covered with flowers almost all the year, from which the bees collect large quantities of fine honey. The olive-trees are numerous, from which they have excellent oil. The rivers abound with good fish, and the mountains have quarries of several kinds.

ETCHING, a method of engraving on copper, in which the lines or strokes, instead of being cut with a tool or graver, are eaten in with aquafortis. See Engraving.

Etching is of a later invention, though not very modern, than engraving with the tool; of which it was at first only an imitation, that was practised by painters and other artists, who could much sooner form their hands to, and attain a faculty of, working in this way, than with the graver. But being then nevertheless considered as a counterfeit kind of engraving, and therefore inferior to the other, it was cultivated in a very confined manner; the closeness of the resemblance of the work to that performed by the tool, being made the test of its merit, and consequent- ly the principal object of all those who pursued it. This servile confinement of the art of etching to the imitation of the original kind of engraving, was a great cause of retarding its advancement towards perfection, as many of the most able masters cramped their talents with the observance of it: this may be seen in the instances of Sadeler, Swanenburg, Villanous, and particularly Le Bosse; who, in his treatise on engraving, has laid down as a principle, that the perfection of this kind consists in the close similitude of the work with that done by the tool. This absurd prepossession has been since worn out; and the method of working with aquafortis has been so far improved, that instead of being now deemed a spurious kind of engraving, it evidently appears, in many modern works, the foundation of an excellence that could never have been produced without it: since, though the neatness and uniformity of the hatches, which attend the use of the tool, is more advantageous with respect to portraits; yet the liberty and facility of the other manner gives a much greater opportunity to exercise the force of genius and fancy in history-engraving; where the effect of the whole, and not the minute exactness in finishing all the parts, constitutes the principal value.

There are two methods practised of engraving in this way; the one with a hard varnish or ground, the other with a soft. The first was formerly much used, being better accommodated to the purpose of the engraving with the tool; as the firmness of the body of the varnish gave more opportunity of retouching the lines,
The combination of the use of the tool and aquafortis, which are now both employed in many cases, has, however, given that perfection to engraving which it possesses at present. The truth and spirit of the outline that the method of working with aquafortis affords, and the variety of shades which the different kinds of black produce in this way, as well as other means of expressing the peculiar appearance and character of particular subjects, furnish what was defective in the sole use of the tool; while, on the other hand, the exactness and regularity of the lines, which are required for finishing many kinds of designs, are supplied by the graver; and by a judicious application of both, that complete finishing is obtained, which either of them alone must necessarily want.

The manner by which this art is performed, is the covering the surface of the plate with a proper varnish or ground, as it is called, which is capable of resisting aquafortis, and then scoring or scratching away, by instruments resembling needles, the parts of this varnish or ground, in the places where the strokes or hatches of the engraving are intended to be; then, the plate being covered with aquafortis, the parts that are laid naked and exposed by removing the ground or varnish, are corroded or eaten away by it; while the rest, being secured and defended, remain untouched.

There are two methods of etching, as has been already observed; the difference of which from each other consists, as well in the difference of the varnish or ground, as in that of the aquafortis, adapted to each kind; but the general methods of performing them are alike in both. These varnishes or grounds are distinguished by the names of hard and soft: for in their consistence, or the resistance they give to the needles, lies their essential variation from each other. The hard varnish, it is with good reason conjectured, was not the first in use: but soon took place of the other; and was, for some time, the most received in practice, on account of its admitting the work to be made more like that of the graver; the soft has, however, since, in its turn, prevailed to the exclusion of it in some degree, except in the case of particular subjects; but not so entirely as to take away the expediency of showing how it is performed. The manner of etching with the soft varnish is now, however, one of the most important objects of the art of engraving; and it is at present in universal use, sometimes alone, but more frequently intermixed with the work of the tool, and in some cases with great advantage, even where the whole is intended to pass for being performed by the graver.

Preparation of the soft varnish; according to Mr Lawrence, an eminent English engraver at Paris. "Take of virgin wax and asphaltum, each two ounces; of black pitch and Burgundy pitch, each half an ounce. Melt the wax and pitch in a new earthen-ware glazed pot; and add to them, by degrees, the asphaltum finely powdered. Let the whole boil till such time as that, taking a drop upon a plate, it will break, when it is cold, on bending it double two or three times between the fingers. The varnish being then enough boiled, must be taken off the fire; and letting it cool a little, must be poured into warm water, that it may work the more easily with the hands, so as to be formed into balls; which must be rolled up, and put into a piece of taffety for use."

It must be observed first, that the fire be not too violent, for fear of burning the ingredients; a slight simmering will be sufficient; secondly, that while the asphaltum is putting in, and even after it is mixed with them, the ingredients should be stirred continually with the spatula; and thirdly, that the water, into which this composition is thrown, should be nearly of the same degree of warmth with it, to prevent a kind of cracking that happens when the water is too cold.

The varnish ought always to be harder in summer than in winter; and it will become so if it be suffered to boil longer, or if a greater proportion of the asphaltum or brown resin be used. The experiment above mentioned, of the drop suffered to cool, will determine the degree of hardness or softness that may be suitable to the season when it is used.

Preparation of the hard varnish used by Callot, commonly called the Florence varnish. Take four ounces of fat oil very clear, and made of good linseed oil, like that used by painters: heat it in a clean pot of glazed earthen-ware, and afterwards put to it four ounces of mastick very well powdered; and stir the mixture briskly till the whole be well melted; then pass the whole mass through a piece of fine linen into a glass bottle with a long neck, that can be stopped very securely; and keep it for the use that will be below explained.

Method of applying the soft varnish to the plate, and of blackening it. The plate being well polished and burnished, as also cleansed from all greasiness by chalk or Spanish white, fix a hand-vice on the edge of the plate where no work is intended to be, to serve as a handle for managing it when warm: then put it upon a chafing-dish, in which there is a moderate fire; observing to hold it so that it may melt: then cover the whole plate equally with a thin coat of the varnish; and while the plate is warm, and the varnish upon it in a fluid state, beat every part of the varnish gently with a small bell or dauber made of cotton tied up in taffety; which operation smooths and distributes the varnish equally over the plate.

When the plate is thus uniformly and thinly covered with the varnish, it must be blackened by a piece of flambeau, or of a large candle which affords a copious smoke; sometimes two or even four such candles are used together for the sake of dispatch, that the varnish may not grow cold: which if it does during the operation, the plate must then be heated again, that it may be in a melted state when that operation is performed: but great care must be taken not to burn it; which, when it happens, may be easily perceived by the varnish appearing burnt and losing its gloss. The following expedient is made use of for the more commodiously.
Etching. Blackening the varnish, being particularly necessary when the plates are large: Fix a strong hook in the roof of the room, through which pass four pieces of cord of equal length, at the end of which are fixed four iron rings of about four inches in diameter, for supporting the corners of the plate. The plate being thus suspended in the air, with the varnished side downwards, may be blackened with great convenience: but this is not, however, absolutely requisite, except in the cases of large plates that could not, without difficulty, be held up; unless this or some other such contrivance were made use of.

It is proper to be very cautious in keeping the flambeau or candle at a due distance from the plate, lest the wick touch the varnish, which would both sully and mark it. If it appear that the smoke has not penetrated the varnish, the plate must again be placed for some little time over the chafing-dish; and it will be found, that, in proportion as the plate grows hot, the varnish will melt and incorporate with the black which lay above it, in such a manner that the whole will be equally pervaded by it.

Above all things, the greatest caution should be used in this operation, to keep all the time a moderate fire; and to move frequently the plate, and change the place of all the parts of it, that the varnish may be alike melted everywhere, and kept from burning. Care must also be taken, that during this time, and even till the varnish be entirely cold, no filth, spangles, or dust, fly on it; for they would then stick fast, and spoil the work.

Method of applying the hard varnish. This is precisely the same as for the soft; being spread equally over the warm plate with the taffeta-ball, and smoked in the same manner: only after it is smoked, it must be baked, or dried over a gentle fire of charcoal, till the smoke from the varnish begins to decrease; taking care not to overheat the plate, which would both soften it and burn the varnish.

The plate being thus prepared, and an exact drawing of the outlines of the design made upon thin paper, the other side of the paper must be well rubbed with chalk or Spanish whitening, or, which is better, with red chalk scraped to a powder; and the loose chalk is cleared off with a linen rag; then the stained side of the paper is laid upon the varnish, fixing the corners to the plate with wax or wafers, to prevent its shifting; and with a blunt needle or pointer the drawing is slightly traced, and communicates to the varnish an exact outline of the design to be etched.

A variety of pointers is necessary for the work. Those used for the broad large strokes ought to be very blunt, exceeding round, and well polished at the point; the sole of a shoe answers very well for polishing the points. The finest ought to be as sharp as a needle. If any scratches or false strokes happen in the working, they are to be stopped up with a hair-pencil dipped in Venetian varnish, mixed with lamp black, by which means these places will be defended from the action of the aquafortis.

The next operation is that of eating or corroding the plate with aquafortis; in order to which, a border of soft wax (being a composition of bees wax melted and tempered with a little Venice turpentine and talc) must be fastened round the plate about an inch high, in the form of a little wall or rampart, to contain the aquafortis. At one of the corners of this border a gutter is usually made, which serves for pouring commodiously the aquafortis off the plate. The plate being thus bordered, take a due quantity of the refineries aquafortis; mix it with half its quantity of common water, and pour it gently on, till it rise above a finger's breadth above the surface of the plate; when, if all things have been rightly conducted, it will be seen that the aquafortis will soon exert its action in the hatches which have been strongly touched; but those more weakly engraved will appear at first clear, and of the colour of the copper. The menstruum must therefore be suffered to continue on the plate till its effects become visible on the more tender parts: then the aquafortis should be poured off, the plate washed with clean water, and dried before the fire; then take a small pencil dipped into the Venetian varnish, and cover with it the lighter parts of the plate. This being done, the aquafortis must again be poured on, and suffered to continue a longer or a shorter time, according to the strength of the menstruum, or the nature of the engraving; when it must be again poured off as before, and the plate immediately washed with water.

It may not be improper to observe, that, when the aquafortis is on the plate, a feather should be used to cleanse away the foulness of the verdigris that gathers in the hatches when the aquafortis operates on them, and to give it more room to exert its action; for by moving the aquafortis to and fro on the plate by the feather, and brushing away the black saline matter where it appears to be formed, the hatches will be cleansed, and the aquafortis exert its whole force equally on every part.

The plate being thus sufficiently corroded by the aquafortis, and well washed with water, it must be warmed at the fire, and the border of wax removed; after which it must be made hotter till the varnish melts; then it must be well wiped with a linen cloth, and afterwards rubbed well with oil of olives; when it will be ready to be retouched and finished by the graver. See the article Engraving.

ETECELLES, in fabulous history, a son of Oedipus and Jocasta. After his father's death, it was agreed between him and his brother Polyneices, that they should both share the royalty, and reign alternately each a year. Eteocles by right of seniority first ascended the throne; but after the first year of his reign had expired he refused to give up the crown to his brother, according to their mutual agreement. Polyneices, resolved to punish such an open violation of a solemn engagement, went to implore the assistance of Adrastus king of Argos. He received that king's daughter in marriage, and was soon after assisted with a strong army headed by seven famous generals. These hostile preparations were seen by Eteocles, who on his part did not remain inactive. He chose seven brave chiefs to oppose the seven leaders of the Argives, and stationed them at the seven gates of the city. He placed himself against his brother Polyneices, and he opposed Menalippos to Tydeus, Polyphontes to Capanes, Megareus to Eteocles, Hyperbius to Parthenopeus, and Laethenos to Amphiaras. Much blood was shed in light and unavailing skirmishes, and it was at last agreed between the two brothers
borders that the war should be decided by single combat. They both fell in an engagement conducted with the most inveterate fury on either side; and it is even said that the names of these two brothers, who had been so inimical one to the other, separated themselves on the burning pile, as if sensible of resentment, and hostile to reconciliation.

ETERNITY, an attribute of God, expressing his infinite or endless duration. See LOGIC and METAPHYSICS.

ETERNITY, in Mythology, a divinity among the Romans, who had neither temples nor altars. They represented it under the figure of a woman, who held the sun in one hand and the moon in the other; her symbols were a phoenix, globe, and elephant.

ETESIÆ, or ETESIAN WINDS, are such as blow at stated times of the year, from what part soever of the compass they come. They are so called from the Greek word ἐτέσια, "year," being yearly or anniversary winds, such as the names call nonscous and tradewinds, which in some parts of the world continue constantly blowing for certain stated seasons of the year. Thus, the north winds, which, during the dog-days, constantly blow upon the coasts of Egypt, and hinder all ships from sailing out of Alexandria for that season, are called etesias in Caesar's Commentaries. In other authors, the west and east winds are called eotesia, when they continue blowing for certain seasons of the year.

Cellarius endeavours to prove that those winds are properly etesian which blow from that part of the horizon which is between the north and west about the time of the solstice. In ancient writers, they are represented as of a very mild and gentle nature; and were called by mariners somnificus and delicietus, from their sleeping or easing to blow in the night.

ETFUS, a town of Upper Egypt, celebrated on account of the sublime temple of Apollonius, which, Denon observes, is "the most beautiful of all Egypt, and next to those of Thebes, the largest. Being built (he adds) at a period when the arts and sciences had acquired all their splendour, the workmanship of every part is equally beautiful, the hieroglyphics are admirably executed, the figures more varied, and the architecture of a higher order than in the Theban edifices, the building of which must be referred to an earlier age. My first care was to take a general plan of the building."

"Nothing can be more simply beautiful than these edifices; nothing more picturesque than the effect produced in the elevation, by the various dimensions belonging to each member of the harmonious whole. This superb edifice is seated on a rising ground, so as to overlook not only its immediate vicinity, but the whole valley; and at the foot of this greater temple, but on a considerably lower level, is a smaller one, at present almost buried. The only part still visible is in a hollow surrounded with rubbish, where may be seen a little portico of two columns, and as many pilasters, a peristyle, and the sanctuary of the temple included within a pilastered gallery. A single column, with its capital rising from the ruins, to the height of forty feet above the ground, and the angle of a wall 100 feet beyond, shews that there formerly existed a court in the front of the temple. It is remarkable of this monument, notwithstanding the skill displayed in its construction, that the gates are not exactly in the middle of the sides. It seems to have been dedicated to the evil genius, for the figure of Typhon is seen in relief on the four sides of the plinth, which surmounts each of the capitals. The whole frieze, and all the paintings within, appear descriptive of Isis defending herself against the attacks of this monster."

ETHELBAULD, ETHELBERT, ETHELRED, ETHELWOLF, ETHER, ETHERIAL, ETHERIDGE, SIR GEORGE, a celebrated wit and comic genius in the reign of Charles II. and James II. descended from an ancient family in Oxfordshire, and born in 1636. He travelled in his youth; and, not being able to confine himself to the study of the law, devoted himself to the gayor accomplishments. His first dramatic performance, or Love in a Tub, appeared in 1664, and introduced him to the leading wits of the time: in 1668, he produced a comedy called She would if she could; and, in 1676, he published his last comedy, called the Man of Mode, or Sir Fopling Flutter; which is perhaps the most elegant comedy, and contains more of the real manners of high life than any one the English stage was ever adorned with. This piece he dedicated to the beautiful duchess of York, in whose service he then was; and who had so high a regard for him, that when, on the accession of James II., she came to be queen, she procured his being sent ambassador first to Hamburg, and afterwards to Ratisbon, where he continued till after his majesty quitted the kingdom. Our author being addicted to certain gay extravagances, had greatly impaired his fortune; to repair which, he paid his addresses to a rich widow; but she, being an ambitious woman, had determined not to condescend to a marriage with any man who could not bestow a title upon her; on which account he was obliged to purchase a knighthood. None of the writers have exactly fixed the period of Sir George's death, though all seem to place it not long after the Revolution. Some say, that on this event he followed his master King James into France; and died there; but the authors of the Biographia Britannica mention a report, that he came to an untimely death by an unlucky accident at Ratisbon; for that after having treated some company with a liberal entertainment at his house there, where he had taken his glass too freely, and being, through his great complaisance, too forward in waiting on his guests at their departure, flushed as he was, he tumbled down stairs and broke his neck, and so fell a martyr to mirth and folly. As to Sir George's literary character, he certainly was born a poet, and seems to have been possessed of a genius whose vivacity needed no cultivation: for we have no proofs of his having been a scholar. His works, however, have not escaped censure on account of that licentiousness which in general runs through them, which renders them dangerous to young unguarded minds; and the more so, for the lively and genuine wit with which it is gilded over, and which has therefore justly banished them from the purity of the present stage.

ETHICS, the doctrine of manners, or the science of
ETNA, or Ætna, a famous burning mountain of Sicily, and the largest in Europe. See Ætna.

ETOIA, a country of ancient Greece, comprehending all that tract now called the Despotat, or Little Greece. It was parted on the east by the river Evmus, now the Fidari, from the Locrenses Ozois; on the west, from Arcamnia by the Acheulous; on the north, it bordered on the country of the Dorians and part of Epirus; and, on the south, extended to the bay of Corinth.

The Eotolians were a restless and turbulent people; seldom at peace among themselves, and ever at war with their neighbours; utter strangers to all sense of friendship or principles of honour; ready to betray their friends upon the least prospect of reaping any advantage from their treachery: in short, they were looked upon by the other states of Greece no otherwise than as outlaws and public robbers. On the other hand, they were bold and enterprising in war; insured to labour and hardships; undaunted in the greatest dangers; jealous defenders of their liberties, for which they were, on all occasions, willing to venture their lives, and sacrifice all that was most dear to them. They distinguished themselves above all the other nations of Greece, in opposing the ambitious designs of the Macedonian princes; who, after having reduced most of the other states, were forced to grant them a peace upon very honourable terms. The constitution of the Eotian republic was copied from that of the Achæans, and with a view to form, as it were, a counter alliance; for the Eotolians bore an irreconcilable hatred to the Achæans, and had conceived no small jealousy at the growing power of that state. The Cleomenic war, and that of the allies, called the social war, were kindled by the Eotolians in the heart of Peloponnesus, with no other view but to humble their antagonists the Achæans. In the latter, they held out, with the assistance only of the Eleans and Lacedæmonians, for the space of three years, against the united forces of Achæa and Macedon; but were obliged at last to purchase a peace, by yielding up Philip all Arcamnia. As they parted with this province, much against their will, they watched all opportunities of wresting it again out of the Macedonian's hands; for which reason they entered into an alliance with Rome against him, and proved of great service to the Romans in their war with him: but growing insolent upon account of their services, they made war upon the Romans themselves. By that warlike nation they were overcome, and granted a peace on the following severe terms: 1. The majesty of the Roman people shall be revered in all Eotia. 2. Eotia shall not suffer the armies of such as are at war with Rome to pass through her territories, and the enemies of Rome shall be likewise the enemies of Eotia. 3. She shall, in the space of 100 days, put into the hands of the magistrates of Corcyra all the prisoners and deserters she has, whether of the Romans or their allies, except such as have been taken twice, or during her alliance with Rome. 4. The Eotolians shall pay down in ready money, to the Romans, in general in Eotia, 200 Euboic talents, or the same value as the Athenian talents, and engage to pay 50 talents more within the six years following. 5. They shall put into the hands of the consuls...
ETO [337]

ETO

hometanes were afterwards dispossessed of this country by the famous prince of Epirus, George Castriot, commonly called Scanderbeg; who, with a small army, opposed the whole power of the Ottoman empire, and defeated these barbarians in 22 pitched battles. That hero, at his death, left great part of Etolia to the Venetians; but, they not being able to make head against such a mighty power, the whole country was soon reduced by Mahomet II. whose successors hold it to this day.

ETO, a town of Bucks, situated on the river Thames, across which there is a bridge leading to Windsor. Eton has been long celebrated for its school and college, which were founded by Henry VI.; and King's college in the university of Cambridge admits none into the number of its fellows, who have not been brought up at Eton. It lies west from London, at the distance of about 20 miles.

The scholars of Eton school have a festival which has been celebrated from time immemorial, called the Montem, the observance of which was at first biennial, but is now triennial, on the 1st of August in every third year. It commences by a number of the scholars taking post on the bridges, and guarding every other avenue around Windsor and Eton, as soon as the day begins to dawn.

They are generally selected on account of their fine figures and superior activity. Their dresses are all fanciful, composed of silks, satins, &c. some of them very richly embroidered, and chiefly in the appearance of running footmen, having poles in their hands, and denominated salt-bearers, who demand salt of every passenger they meet, by which they mean a contribution, and peremptorily insist on receiving it. The contribution being given, which consists of whatever the person pleases to bestow, a printed paper is delivered, containing their motto, together with the date of the year; and this being produced to any other salt-bearer, exemptes the passenger from the payment of any further contributions during that day. The motto is,

"Pro more et monte. Vivunt ren et regina."

They continue paying contributions in this manner from the dawn of day till about three o'clock in the afternoon, at which time the procession closes. It commences at noon, and consists of the queen's and other bands of music;—several standards carried by different students:—all the boys of Eton, two and two, dressed in the uniform of officers; those belonging to the king's foundation, wear blue, the rest scarlet uniform, swords, &c.—the grand standard bearer,—the captain or head boy of Eton school;—the lieutenant, or second boy,—his majesty, attended by the prince of Wales, and other male branches of the royal family on horseback, with their suite;—the queen and princesses in coaches, attended by their suite,—band of music, followed by a great concourse of the nobility and gentry in their carriages, and on horseback.

The procession begins in the great square at Eton, proceeding through Eton to Slough, and round to Salt-hill, where the whole of the boys pass in review before the king and queen, and ascend the montem, where an oration is delivered, and the grand standard is displayed with much activity and grace by the standard-bear.
ETYMOLOGY, that part of grammar which considers and explains the origin and derivation of words, in order to arrive at their first and primary significations, whence Quintilian calls it originativa. The word is formed of the Greek, ἀριστός, ὄρθος, "true," and λέγω, dico, "I speak!" whence λέγω, dicunt, &c. and thence Cicero calls the etymology modus et veritatis; though Quintilian chooses rather to call it originativa.

A judicious inquiry into etymologies is thought by some of considerable use; because nations, who value themselves upon their antiquity, have always looked on the antiquity of their language as one of the best titles they could plead; and the etymologists, by seeking the true and original reason of the notions and ideas fixed to each word and expression, may often furnish an argument of antiquity, from the traces remaining thereof, compared with the ancient uses. Add, that etymologies are necessary for the thorough understanding of a language. For, to explain a term precisely, there seems a necessity for recurring to its first imposition, in order to speak justly and satisfactorily thereof. The force and extent of a word is generally better conceived when a person knows its origin and etymology.

It is objected, however, that the art is arbitrary, and built altogether on conjectures and appearances; and the etymologists are charged with deriving their words from where they please. And indeed it is no easy matter to go back into the ancient British and Gaulish ages, and to follow, as it were, by the tracks, the various imperceptible alternations a language has undergone from age to age; and as these alternations which sometimes seem mere errors of spelling to us, it is easy to take a mere imagination or conjecture for a regular etymology; so that it is no wonder the public should be prejudiced against a science which seems to stand upon precarious a footing. It must certainly be owned, that etymologies are frequently so far fetched, that one can scarcely see any resemblance or correspondence therein. Quintilian has shown, that the ancient etymologists, notwithstanding all their learning, fell into very ridiculous derivations.

The etymologies of our English words have been derived from the Saxon, Welsh, Wallachian, Danish, Latin, Greek, &c.

In the present work, the etymologies of terms are generally noted, where their obviousness does not render it unnecessary, or their obscurity or unimportance obscure.

EVACUANTS, in Pharmacy, are properly such medicaments as diminish the animal fluids, by throwing off some morbid or redundant humour; or such as thin, attenuate, and promote the motion and circulation thereof.

EVACUATION, in Medicine, the art of diminishing, emptying, or attenuating, the humour of the body.

EVAGRIUS SCHOLASTICUS, a famous historian, born at Epiphania, about the year 336. He professed the profession of an advocate, from which he was called Scholasticus, which name was then given to the pleaders at the bar. He was also tribune and keeper of the prefect's dispatches. He wrote an ecclesiastical history, which begins where Socrates and Theodoret ended theirs; and other works, for which he was rewarded by the emperors Tiberius and Mauricius. M. de Valois published at Paris a good edition of Evagrius's ecclesiastical history, in folio; and it was reprinted at Cambridge in 1620, in folio, by William Beadling, with additional notes of various authors.

EVANDER, a famous Arcadian chief, called the son of Mercury, on account of his eloquence, brought a colony of his people into Italy, about 60 years before the taking of Troy; when Pausanias, who then reigned over the Aborigines, gave him a large extent of country, in which he settled with his friends. He is said to have taught the Latins the use of letters, and the art of husbandry. He kindly received Hercules when he returned from the conquest of Geryon, and he was the first who raised him altars. He gave Alexander assistance against the Latuli, and distinguished himself by his hospitality. It is said that he first brought the Greek alphabet into Italy, and introduced there the worship of the Greek deities. He was honoured as a god after death, and his subjects raised him an altar on Mount Aventine.

EVANGELISTS, the inspired authors of the gospels. The word is derived from the Greek εὐαγγέλιον, formed of εὖ, bene, "well," and γέγονεν, "angel or messenger."

The denomination evangelists was likewise given in the ancient church to such ministers as preached the gospel up and down, without being attached to any particular church, being either commissioned by the apostles to instruct the nations, or of their own accord abasing every worldly attachment, and consecrating themselves
to the sacred office of preaching the gospel. In which sense some interpreters think it is that St. Philip, who was one of the seven deacons, is called the evangelist, in the 21st chapter of the Acts of the Apostles, verse 6. Again, St. Paul writing to Timothy, ep. ii. cap. iv. ver. 5, bids him do the work of an evangelist. The same apostle, Eph. iv. 11, ranks the evangelists after the apostles and prophets.

EVANID, a name given by some authors to such colours as are of no long duration, as those in the rainbow, in clouds before and after sunset, &c. Evanid colours are also called fantastic and emphatical colours.

EVANTES, in antiquity, the priestesses of Bacchus, thus called, because in celebrating the orgia they ran about as distracted, crying, Eovan, evoun, old evon.

See Bacchanalia.

EVAPORATION, in Natural Philosophy, signifies the conversion of fluids into vapour, so that it becomes specifically lighter than the atmosphere. See Chemistry and Meteorology Index.

EVASION, in Law, is used for any subtle endeavour to set aside truth, or to escape the punishment of the law, which will not be endured. Thus, if a person says to another that he will not strike him, but will give him a pot of ale to strike him first, and accordingly he strikes, the returning of it is punishable; for no man shall evade the justice of the law by such a pretence to cover his malice.

EVATES, a branch or division of the druids, or ancient Celtic philosophers. Strabo divides the British and Gaulish philosophers into three sects; bardes, evates, and druids. He adds, that the bardes were the poets and musicians; the evates, the priests and naturalists; and the druids were moralists as well as naturalists: but Marcellus and Hœnins reduce them all to two sects, viz. the Bardes and Druids.

EUBAGES, an order of priests or philosophers among the ancient Celts or Gauls: some will have the eubages to be the same with the druids and sarmoists of Diodorus; and others, that they were the same with what Strabo calls Evates.

EUBOA, in Ancient Geography, an oblong island, stretching out between Attica and Thessaly, opposite to Boetia; from which it is separated by a narrow strait called Euripus. This island, never exceeding 40, nor ever falling short of two miles in breadth, is in length 110 miles, and in compass 365, according to Pliny. Now Nécrófont, from its principal town, which was anciently called Chalae.

EUCHARIST, the sacrament of the Lord's supper, properly signifies giving thanks.—The word in its original Greek, ἐκκολαγώ, literally imports thanksgiving; being formed of ἐκ, bene, "well," and κολαγία, grace, and ἐκκολαγώ, is the equivalent of the English word "communion." This sacrament was instituted by Christ himself; and the participation of it is called communion.

As to the manner of celebrating the eucharist among the ancient Christians, after the customary oblations were made, the deacon brought water to the bishop and presbyters, standing round the table, to wash their hands; according to that of the psalmist, "I will wash my hands in innocency, and so will I compass thy altar, O Lord." Then the deacon cried out aloud, "Mutually embrace and kiss each other;" which being done, the whole congregation prayed for the universal peace and welfare of the church, for the tranquillity and repose of the world, for the prosperity of the age, for wholesome weather, and for all ranks and degrees of men. After this followed mutual salutations of the minister and people; and then the bishop or presbyter having sanctified the elements by a solemn benediction, he brake the bread, and delivered it to the deacon, who delivered it to the communicants, and after that the cup. Their sacramental wine was usually diluted or mixed with water. During the time of administration, they sang hymns and psalms; and having concluded with prayer and thanksgiving, the people saluted each other with a kiss of peace, and so the assembly broke up.

EUCHITES, or Euchites, a sect of ancient heretics, who were first formed into a religious body towards the end of the fourth century, though their doctrine and discipline subsisted in Syria, Egypt, and other eastern countries, before the birth of Christ; they were thus called because they prayed without ceasing, imagining that prayer alone was sufficient to save them. Their great foundation were those words of St. Paul, (Thessalonians, v. 17) Pray without ceasing. The word is formed of the Greek, ἐν, prayer, whence supplices, the same with the Latin preces, "prayers." They were also called Enthusiasts and Messalians; a term of Hebrew origin, denoting the same as Euchites.

The Euchites were a sort of mystics, who imagined, according to the oriental notion, that two souls resided in man, the one good and the other evil; and who were zealous in expelling the evil soul or demon, and hastening the return of the good spirit of God, by contemplation, prayer, and singing of hymns. They also embraced the opinions nearly resembling the Manichean doctrine, and which they derived from the secrets of the oriental philosophy. The same denomination was used in the 12th century, to denote certain fanatics who infested the Greek and eastern churches, and who were charged with believing a double Trinity, rejecting wedlock, abstaining from flesh, treating with contempt the sacraments of baptism and the Lord's supper, and the various branches of external worship, and placing the essence of religion solely in external prayer, and maintaining the efficacy of perpetual supplications to the Supreme Being for expelling an evil being or genius, which dwelt in the breast of every mortal. This sect is said to have been founded by a person called Lucoperus, whose chief disciple was named Tychicus. By degrees it became a general and invidious appellation for persons of eminent piety and zeal for genuine Christianity, who opposed the vicious practices and insolent tyranny of the priesthood; much in the same manner as the Latins comprehended all the adversaries of the Roman pontiff under the general term of Waldenses and Albigenses.

St. Cyril of Alexandria, in one of his letters, takes occasion to censure several monks in Egypt, who, under pretence of resigning themselves wholly to prayer, led a lazy, scandalous life. A censure likewise applicable to monasteries in general.

EUCHOLOGIUM, εὐχολογία, a Greek term, signifying literally a discourse on prayer. The word is formed of ἐν, prayer, and λογία, discourse.

The Euchologium is properly the Greek ritual, wherein are prescribed the order and manner of every
thing relating to the order and administration of their ceremonies, sacraments, ordinances, &c.

F. Guar has given us an edition of the Greek Euchologium in Greek and Latin, with notes, at Paris.

EUCLID OF MEGARA, a celebrated philosopher and logician, flourished about 400 B.C. The Athenians having prohibited the Megareans from entering their city on pain of death, this philosopher disguised himself in women's clothes to attend the lectures of Socrates. After the death of Socrates, Plato and other philosophers went to Euclid at Megara, to shelter themselves from the tyrants who governed Athens. Euclid admitted but one chief good: which he sometimes called God, sometimes Spirit, and sometimes Providence.

EUCLID OF ALEXANDRIA, the celebrated mathematician, flourished in the reign of Ptolemy Lagus, about 277 B.C. He reduced all the fundamental principles of pure mathematics, which had been delivered down by Thales, Pythagoras, Eudoxus, and other mathematicians before him, into regularity and order, and added many others of his own discovering: on which account he is said to be the first who reduced arithmetic and geometry into the form of a science. He likewise applied himself to the study of mixed mathematics, and especially to astronomy, in which he also excelled. The most celebrated of his works is his Elements of Geometry, of which there have been a great number of editions in all languages; and a fine edition of all his works was printed in 1703, by David Gregory, Savilian professor of astronomy at Oxford.

EURASIA, (of e, well, and agora, temperature), in Medicine, an agreeable well proportioned mixture of qualities, whereby a body is said to be in good order, and disposed for a good state of health.

EUVOMETER, an instrument for ascertaining the purity of the atmospherical air, or the quantity of pure oxygen or vital air contained in it, chiefly by means of its diminution, or the absorption of it by exposing certain substances to its action. Several kinds of eudiometers have been invented. See Chemistry Index.

EUDOSIA, (Athens, before her conversion to Christianity), a celebrated lady, the daughter of Leonius, a philosopher of Athens; who gave her such a learned education, that at his death, he left her only a small legacy, saying she was capable to make her own fortune: but pleasing at Athens without success against her two brothers, for a share in her father's estate, she carried her cause personally by appeal to Constantinople; recommended herself to Pulcheria, the sister of the emperor Theodosius the younger; embraced Christianity, was baptized by the name of Eudosia, and soon after married to the emperor. Their union lasted a considerable time: but a difference at last taking place, on account of the emperor's jealousy, excited by Chrysapis the eunuch, she retired to Jerusalem, where she spent many years in building and adorning churches and in relieving the poor. Dupin says, that she did not return thence till after the emperor's death: but Cave tells us, that she was reconciled to him, returned to Constantinople, and continued with him till his death; after which she again went to Palestine, where she spent the remainder of her life in pious works. She died in the year 450, according to Dupin; or 459, according to Cave: the latter observes, that on her deathbed, she took a solemn oath, by which she declared herself entirely free from any stains of unchastity. She was the author of a paraphrase on the eight first books of the Old Testament in heroic verse; and of a great number of poems, which are lost.

EUROXIAN, a party or sect of heretics in the fourth century, so denominated from their leader Eu- doxius, patriarch of Constantinople, a great defender of the Arian doctrine. The Euroxians adhered to the errors of the Arians and Eunomians, maintaining, that the Son was created out of nothing; that he had a will distinct and different from that of the Father, &c.

EVE. See VIGIL.

Eve, the mother of all mankind; who being deluded by the serpent, occasioned the fall, and all its dismal consequences. See ADAM.

EVELYN, JOHN, a most learned and ingenious writer and natural philosopher, was born at Wotton in Surry, the seat of his father, in 1620. After making the tour of Europe, he returned to England about the year 1651, and lived very retired at his rural retreat, Say's Court, near Deptford in Kent; where his disgust at the violence and confusion of the times operated so far upon his studious disposition, that he actually proposed to Mr Boyle the establishing a kind of college of physicians of the same turn of mind, where they might associate together without fear of interruption. It was owing to Mr Evelyn's gratitude to the place of his education, that Oxford became possessed of the famous Arundelian marbles; which he persuaded the Lord Henry Howard to bestow on that university. He was very assiduous in transmitting to the Royal Society whatever fell within the compass of his inquiries; and used humbly to style himself a "pioneer in the service." When the number of books he published is considered, the many he left behind him unfinished and unpublished, and the variety of subjects on which he employed his time, his industry and application are astonishing. "His life (says the honourable Mr Walpole) was a course of inquiry, study, curiosity, instruction, and benevolence. The works of the Creator, and the mimic labours of the creature, were all objects of his pursuit. He unfolded the perfections of the one, and assisted the imperfections of the other. He adored from examination; was a courtier that flattered only by informing his prince, and by pointing out what was worthy for him to countenance; and was really the nearest neighbour of the Gospel, for there was no man that might not have been the better for him. He was one of the first promoters of the Royal Society, a patron of the ingenious and indigent, and peculiarly serviceable to the lettered world; for, besides his writings and discoveries, he obtained the Arundelian marbles for the university of Oxford, and the Arundelian library for the Royal Society: nor is it the least part of his praise, that he who proposed to Mr Boyle the erection of a philosophical college for retired and speculative persons, had the honesty to write in defence of active life against Sir George Mackenzie's Essay on Solitude. He knew that retirement in his own hands was industry and benefit to mankind; but in those of others, laziness and inutility." There are five small prints of this gentleman's journey from Rome to Naples, drawn and etched by him; and among his published works are, 1. A Character of England; 2. The State of France; 3. An Essay on
the first book of Lucretius De rerum natura: 4. The French gardeners; 5. A Panegyric on King Charles II.’s coronation; 6. Fumifugium, or the inconveniences of the air and smoke of London dissipated; 7. The History and Art of Engraving on Copper; 8. A parallel between the ancient architecture and the modern; 9. Sylva, or a discourse of forest trees; and several others. This amiable gentleman died, full of age; and honour, in 1706. His son John Evelyn, born in 1654, distinguished himself by his elegant translations and poems; he was one of the commissioners of the revenue in Ireland; but died early in life, in 1698.

EVERGETES, a surname signifying benefactor, given to Philip of Macedon, and to Antigonus Doson, and Ptolemcy of Egypt. It was also commonly given to the kings of Syria and Pontus, and we often see among the former an Alexander Evergetes, and we often see among the latter a Mithridates Evergetes. Some of the Roman emperors also claimed that epithet of Benevolent and Humane.

EVERGREEN, in Gardening, a species of perennials, which continue their verdure, leaves, &c. all the year: such are hollies, phillyrea, lauristinaces, bays, pines, firs, cedars of Lebanon, &c.

EVERLASTING PEA. See LATHYRUS, BOTANY INDEX.

EYES-DROPPERS. See EYES-DROPPERS.

EVE SHAM, or EVESHOLM, commonly called Bessam, a town of Worcestershire, seated on a gentle ascent from the river Avon, over which there is a bridge of seven arches. It is 95 miles from London, 14 miles from Worcester, and has a harbour for barges. It is an old borough, reckoned the second in the county; and sends two members to parliament. It had formerly an abbey with a mitred abbot; which abbey when standing was one of the largest and most stately of any in the kingdom. It was governed by a bailiff, till King James I at the request of his son Prince Henry, gave it a charter for a mayor, 7 aldermen, 12 capital burgesses, a recorder, and chamberlain, who are all of the common council, with 24 other burgesses called assistants. Four of the aldermen, and the mayor for the time being, are justices of the peace; and of oyer and terminer, and of gaol delivery, for all offences in the corporation, except high treason; and the corporation has power to try and execute felons within the borough. Here are two parish-churches; but the bells of both have been removed to a beautiful old tower which was one of the gates of the abbey. The town is noted for the great victory obtained near it by Prince Edward, afterwards King Edward I, over Simon Montfort, the great earl of Leicester, who was killed in the battle. There is an open prospect from hence of the spacious valley called the vale of Eveham or vale of Gloucester, which so abounds with the best of corn, as well as pasture for sheep, that it is reckoned the granary of all these parts. The vale runs all along the banks of the Avon, from Twkesbury to Pershore, and Stratford in Warwickshire, and the river is so far navigable. It has a weekly market and four fairs. The market-house, built by Sir Edward Hobbs, has its upper apartments used by the corporation for a sessions-house, and formerly for the assizes of the county. There are considerable garden grounds around the place, the produce of which supplies the adjacent towns.

EUGENE, FRANCIS, prince of Savoy, descended from Carignan, one of the three branches of the house of Savoy, and son of Eugene Maurice, general of the Swiss and Grisons, governor of Champagne, and earl of Soissons, was born in 1663. Louis XIV. to whom he became afterwards so formidable an enemy, thought him so unpromising a youth, that he refused him preference both in the church and the state, thinking him too much addicted to pleasure to be useful in either. Prince Eugene, in disgust, quitted France; and, retiring to Vienna, devoted himself to the imperial service. The war between the emperor and the Turks afforded the first opportunity of exerting his military talents; and every campaign proved a new step in his advancement to the highest offices in the army. He gave the Turks a memorable defeat at Zenta; commanded the German forces in Italy, where he foiled Marshal Villeroi in every engagement, and at length took him prisoner. Our limits do not allow a detail of his campaigns; but Prince Eugene distinguished himself greatly, when the emperor and Queen Anne united against the exorbitant power of Louis XIV. He died at Vienna in the year 1736; and was as remarkable for his modesty and liberality, as for his abilities in the field and the cabinet.

EUGENIA, the YAMBO; a genus of plants, belonging to the iocosandria class; and in the natural method ranking under the 19th order, Hesperideae. See BOTANY INDEX.

EVICATION, in LAW, signifies a recovery of lands or tenements by law.

EVIDENCE, that perception of truth which arises either from the testimony of the senses or from an induction of reason.

EVIDENCE, in LAW, signifies some proof by testimony of men upon oath, or by writings or records. It is called evidence, because thereby the point in issue in a cause to be tried is to be made evident to the jury; for probatitio debet esse evidentia. The system of evidence, as now established in our courts of common law, is very full, comprehensive, and refined; far different from, and superior to, any thing known in the middle ages; as far superior in that as in all other improvements and refinements in science, arts, and manners.

The nature of evidence during the ages of ignorance was extremely imperfect, and the people were incapable of making any rational improvement. Thus it was the imperfection of human reason that caused the invention and introduction of the ordeal, as an appeal to the Supreme Being. As men are unable to comprehend the manner in which the Deity carries on the government of the universe, by equal, fixed, and general laws, they are apt to imagine, that in every case which their passions or interest render important in their own eyes, the Supreme Ruler of all ought visibly to display his power in vindicating innocence, and punishing vice.

EVIL, in Philosophy, &c. is either moral or natural. Moral evil is the disagreement between the actions of a moral agent, and the rule of those actions, whatever it is. Natural evil is, whatever destroys or any way disturbs the perfection of natural beings: such as blindness, diseases, death, &c.

King’s Evil, or Scrophula. See MEDICINE INDEX.

EVIL-MERODACH, the son and successor of Nebuchad-
mazzar the great, king of Babylon, succeeded to the crown in the year of the world 3443; but governed the kingdom during the indisposition of his father, who, after seven years, having recovered his understanding, once more ascended the throne; and, as some believe, imprisoned his son Evil-Merodach. In this confinement it is supposed that Evil-Merodach made an acquaintance and friendship with Jeboimach king of Judah, who had been carried to Babylon by Nebuchadnezzar. However that was, it is certain, that soon after his succession to the throne, he delivered the king of Judah out of prison, after a confinement of 37 years, heaped many favours on him, and placed him above all the other kings who were at the court of Babylon, (2 Kings xxv. 27. Jer. lii. 31.) Evil-Merodach reigned but one year, according to the chronology of Archbishop Usher; but Dr Prideaux will have him to have reigned two years; and was succeeded by Neriglissar his sister's husband, who having been at the head of a conspiracy that put him to death, reigned in his stead. Others will have it, that this prince was immediately succeeded by his son Belshazzar.

EULER, LEONARD, professor of mathematics, member of the imperial academy of Petersburgh, ancient director of the royal academy of Berlin, fellow of the royal society of London, as also correspondent member of the royal academy of sciences at Paris, was born at Basil, April 25. 1707, of a respectable parents. The years of his infancy were passed in a rural retreat at the village of Richeau, of which place his father was minister. Being sent to the university of Basil, he attended regularly the different professors. As his memory was prodigious, he performed his academical tasks with uncommon rapidity; and all the time he gained by this was consecrated to geometry, which soon became his favourite study. The early progress he made in this science, only added new ardour to his application; and thus he obtained a distinguished place in the attention and esteem of Professor John Bernouilli, who was at that time one of the first mathematicians in Europe. In 1723, M. Euler took his degree as master of arts; and delivered on that occasion a Latin discourse, in which he drew a comparison between the philosophy of Newton and the Cartesian system, which was received with the greatest applause. He afterwards, at his father's desire, applied himself to the study of theology and the oriental languages. Though these studies were foreign to his predominant propensity, his success was considerable even in this line; however, with his father's consent, he returned to geometry as his principal object. He continued to avail himself of the counsels and instructions of M. Bernouilli; he contracted an intimate friendship with his two sons Nicholas and Daniel; and it was in consequence of these connexions that he became afterwards the principal ornament of the academy of Petersburgh. The project of erecting this academy, which had been formed by Peter the Great, was executed by Catherine I.; and the two young Bernouillis being invited to Petersburgh in 1725, promised Euler, who was desirous of following them, that they would use their utmost endeavours to procure for him an advantageous settlement in that city. In the mean time, by their advice, he applied himself with ardour to the study of physiology, to which he made a happy application of his mathematical knowledge; and he attended the medical lectures of the most eminent professors of Basel. This study, however, did not wholly engross his time: it did not even relax the activity of his vast and comprehensive mind in the cultivation of other branches of natural science. For while he was keenly engaged in physiological researches, he composed A Dissertation on the Nature and Propagation of Sound, and an answer to the prize-question regarding the rolling of ships; to which the academy of sciences adjudged the second rank, in the year 1727. From this latter discourse, and other circumstances, it appears that Euler had early embarked in the curious and important study of navigation, which he afterwards enriched with so many valuable discoveries.

M. Euler's merit would have given him an easy admission to honourable preferment, either in the magistracy or university of his native city, if both civil and academical honours had not been there distributed by lot. The lot being against him in a certain promotion, he left his country, set out for Petersburgh, and was made joint professor with his countrymen Messer Hermann and Daniel Bernouilli in the university of that city. At his first settling out in his new career, he enriched the academical collection with many memoirs, which excited a noble emulation between him and the Bernouillis; and this emulation always continued, without either degenerating into a selfish jentleness, or producing the least estrangement of friendship. It was at this time that he carried to new degrees of perfection the integral calculus, invented the calculation of sinuses, reduced analytical operations to a greater simplicity, and was thus enabled to throw new light on all the parts of mathematical science. In 1730, he was promoted to the professorship of natural philosophy; and in 1733 he succeeded his friend D. Bernouilli in the mathematical chair. In 1735, a problem was proposed by the academy which required an expedition, and for the solution of which several eminent mathematicians had demanded the space of some months. The problem was solved by Euler in three days, to the great astonishment of the academy: but the violent and laborious efforts it cost him threw him into a fever, which endangered his life, and deprived him of the use of his right eye. The academy of sciences at Paris, which in 1738 had adjudged the prize to his memoir concerning the Nature and Properties of Fire, proposed for the year 1740 the important subject of the sea tides; a problem whose solution required the most arduous calculations, and comprehended the theory of the solar system. Euler's discourse on this question was adjudged a masterpiece of analysis and geometry; and it was more honourable for him to share the academical prize with such illustrious competitors as Colin Maclearon and Daniel Bernouilli, than to have carried it away from rivals of less magnitude. Rarely, if ever, did such a brilliant competition adorn the annals of the academy; and no subject, perhaps, proposed by that learned body was ever treated with such accuracy of investigation and force of genius, as that which here displayed the philosophical powers of these three extraordinary men.

In the year 1741. M. Euler was invited to Berlin to augment the lustre of the academy, that was then rising...
Euler rising into fame. He enriched the last volume of the miscellaneous (mevelgen), of Berlin with five memoirs, which made an eminent, perhaps the principal, figure in that collection. These were followed with an astonishing rapidity by a great number of important researches, which are scattered through the memoirs of the Prussian academy; of which a volume has been regularly published every year since its establishment in 1744. The labours of Euler will appear more especially astonishing, when it is considered, that while he was enriching the academy of Berlin with a prodigious number of memoirs, on the deepest parts of mathematical science, containing always some new points of view, often sublime truths, and sometimes discoveries of great importance; he did not discontinue his philosophical contributions to the academy of Petersburg, which granted him a pension in 1742, and whose memoirs display the marvellous fecundity of Euler's genius. It was with much difficulty that this great man obtained, in 1766, permission from the king of Prussia to return to Petersburg; where he desired to pass the rest of his days. Soon after his return, which was graciously rewarded by the munificent Catherine II., he was seized with a violent disorder, which terminated in the total loss of his sight. A catarrh, formed in his left eye, which had been essentially damaged by too ardent application to study, deprived him entirely of the use of that organ. It was in this distressing situation that he dictated to his servant, a taylor's apprentice, who was absolutely devoid of mathematical knowledge, his elements of algebra; which, by their intrinsic merit, in point of perspicuity and method, and the unhappy circumstances in which they were composed, have equally excited applause and astonishment. This work, though purely elementary, discovers the palpable characteristics of an inventive genius; and it is here alone that we meet with a complete theory of the analysis of Diaphantus.

About this time M. Euler was honoured by the Academy of Sciences at Paris with the place of one of the foreign members of that learned body; and, after this, the academical prize was adjudged to three of his memoirs, Concerning the Inequalities in the Motion of the Planets. The same questions proposed by the same academy for 1770 and 1772 were designed to obtain from the labours of astronomers a more perfect theory of the moon. M. Euler, assisted by his eldest son, was a competitor for these prizes, and obtained them both. In this last memoir, he reserved for farther consideration several inequalities of the moon's motion, which he could not determine in his first theory, on account of the complicated calculations in which the method he then employed had engaged him. He had the courage afterward to review his whole theory, with the assistance of his son and Meusky Kraft and Lexell, and to pursue his researches until he had constructed the new tables, which appeared, together with the great work, in 1772. Instead of confining himself as before, to the fruitless integration of three differential equations of the second degree, which are furnished by mathematical principles, he reduced them to the three ordinates, which determine the place of the moon; he divided into classes all the inequalities of that planet, as far as they depend either on the elongation of the sun and moon, or upon the eccentricity, or the parallax, or the inclination of the lunar orbit. All these means of investigation, employed with such art and dexterity as could only be expected from analytical genius of the first order, were attended with the greatest success; and it is impossible to observe, without admiration, such immense calculations on the one hand, and on the other the ingenious methods employed by this great man to subdue them, and to facilitate their application to the real motion of the moon. But this admiration will become astonishment, when we consider at what period and in what circumstances all this was effected by M. Euler. It was when he was totally blind, and consequently obliged to arrange all his computations by the sole powers of his memory and his genius. It was when he was embarrassed in his domestic circumstances by a dreadful fire, that had consumed great part of his substance, and forced him to quit a ruined house, of which every corner was known to him by habit, which, in some measure, supplied the place of sight. It was in these circumstances that Euler composed a work, which, alone, was sufficient to render his name immortal. This book contains a breathing and tranquillity of mind which he displayed beyond need of description; and he derived them not only from the love of science, but from the power of religion. His philosophy was too genuine and sublime to stop its analysis at mechanical causes; it led him to that divine philosophy of religion which endows human nature, and can alone form a habit of true magnanimity and patience in suffering.

Some time after this, the famous Wenzel, by coaching the cataract, restored M. Euler's sight; but the satisfaction and joy that this successful operation produced, were of short duration. Some instances of negligence on the part of his surgeons, and his own impatience to use an eye, whose cure was not completely finished, deprived him of his sight a second time; and this relapse was accompanied with tormenting pain. He, however, with the assistance of his sons, and of Messrs Kraft and Lexell, continued his labours; neither the loss of his sight, nor the infirmities of an advanced age could damp the spirit of his genius. He had engaged to furnish the academy of Petersburg with as many memoirs as would be sufficient to complete its acts for 20 years after his death. In the space of seven years he transmitted to the academy by Mr Golswin, above 70 memoirs, and above 200 more, which were revised and completed by the author of this paper. Such of the memoirs as were of ancient date were separated from the rest, and form a collection that was published in the year 1783, under the title of Analytical Works.

Euler's knowledge was more universal than could be well expected in one who had pursued with such unremitting ardour mathematics and astronomy as his favourite studies. He had made a very considerable progress in medical, botanical, and chemical science. What was still more extraordinary, he was an excellent scholar, and possessed what is generally called erudition in a very high degree. He had read, with attention and taste, the most eminent writers of ancient Rome; the civil and literary history of all ages and nations were familiar to him; and foreigners, who were only acquainted with his works, were astonished to
find in the conversation of a man, whose long life seemed solely occupied in mathematical and physical researches and discoveries, such an extensive acquaintance with the most interesting branches of literature. In this respect, no doubt, he was much indebted to a very uncommon memory, which seemed to retain every idea that was conveyed to it, either from reading or from meditation. He could repeat the Aeneid of Virgil, from the beginning to the end, without hesitation, and indicate the first and last line of every page of the edition he used.

Several attacks of a vertigo, in the beginning of September 1783, which did not prevent his calculating the motions of the aeroastical globes, were, nevertheless, the forerunners of his mild and happy passage from this scene to a better. While he was amusing himself at tea with one of his grandchildren, he was struck with an apoplexy, which terminated his illustrious career at the age of 76. His constitution was uncommonly strong and vigorous; his health was good; and the evening of his long life was calm and serene, sweetened by the fame that follows genius, the public esteem and respect that are never withheld from exemplary virtue, and several domestic comforts which he was capable of feeling and therefore deserved to enjoy.

EULOGY, EULOGIA, in church history. When the Greeks have cut a loaf or piece of bread to consecrate it, they break the rest into little bits, and distribute it among the persons who have not yet communicated, or send it to persons that are absent; and these pieces of bread are what they call eulogies. The word is Greek, εὐλογία, formed of εὖ, well, and λόγος, word, dico, "I say, speak;" q. d. benedictum, "blessed."

The Latin church has had something like eulogies for a great many ages; and thence arose the use of their holy bread.

The name eulogy was likewise given to loaves or cakes brought to church by the faithful to have them blessed.

Lastly, The use of the term passed hence to mere presents made to a person without any beneficence. See the Jesuit Guetser, in his treatise de Benedictibus et Maledictibus, lib. ii. cap. 22, 24. &c. where he treats of eulogies thoroughly.

From a passage in Bolandus, on the life of St Melaine, cap. 4, it appears, that eulogies were not only of bread, but any kind of meat blessed and hallowed for that purpose. Add, that almost every body blessed and distributed eulogies; not only bishops and priests, but even hermits, though laymen, made a practice of it. Women also would-sometimes send eulogies.

The wine sent as a present was also had an eulogy. Bolandus remarks farther, that the eucharist itself was also called eulogy.

EULOGY, likewise means an encomium on any person, on account of some virtue or good quality.

EUMARIDES, of εὖμαρ, "easy," among the ancients, a kind of shoes common to men and women.—The eumarides were used for pomp and delicacy, being neat, and painted with various colours.

EUMENES, a Greek officer in the army of Alexander, son of a charioteer. He was the most worthy of all the officers of Alexander to succeed after the death of his master. He conquered Paphlagonia, and Cappadocia, of which he obtained the government, till the power and jealousy of Antigonus obliged him to retire. He joined his forces to those of Perdiccas, and defeated Craterus and Neoptolemus. Neoptolemus perished by the hands of Eumenes. When Craterus had been killed during the war, his remains received an honourable funeral from the hand of the conqueror; and Eumenes, after weeping over the ashes of a man who was once his dearest friend, sent his remains to his relations in Macedonia. Eumenes fought against Antipater and conquered him; and after the death of Perdiccas his ally, his arms were directed against Antigonus, by whom he was conquered A. U. C. 443, chiefly by the treacherous conduct of his officers. The fatal battle obliged him to disband the greatest part of his army to secure himself a retreat; and he fled with only 700 faithful attendants to a fortified place on the confines of Cappadocia, called Nero, where he was soon besieged by the conqueror. He supported the siege for a year with courage and resolution, but some disadvantageous skirmishes so reduced him, that his soldiers, grown desperate, and bribed by the offers of the enemy, had the infidelity to betray him into the hands of Antigonus. The conqueror, from shame or remorse, had not the courage to visit Eumenes; but when he was asked by his officers, in what manner he wished him to be kept, be answered, keep him as carefully as you would keep a lion. This severe command was obeyed; but the asperity of Antigonus vanished in a few days, and Eumenes, delivered from the weight of chains, was permitted to enjoy the company of his friends. Even Antigonus hesitated whether he should not restore to his liberty a man with whom he had lived in the greatest intimacy while both subservient to the command of Alexander; and these secret emotions of pity and humanity were not a little increased by the petitions of his son Demetrios for the release of Eumenes. But the calls of ambition prevailed; and when Antigonus recollected what an active enemy he had in his power, he ordered Eumenes to be put to death in the prison. His bloody commands were executed 315 years before the Christian era. Such was the end of a man who raised himself to power by merit alone. His skill in public exercises first recommended him to the notice of Philip; and under Alexander, his attachment and fidelity to the royal person, and particularly his military accomplishments, promoted him to the rank of a general. Even his enemies revered him; and Antigonus, by whose orders he perished, honoured his remains with a splendid funeral, and conveyed his ashes to his wife and family in Cappadocia. It has been observed, that Eumenes had such a universal influence over the successors of Alexander, that none during his lifetime dared to assume the title of king.

EUMENES I. King of Pergamum, who succeeded to his uncle Philocrates about 264 years before Christ. He made war against Antiochos the son of Seleucus, and enlarged his possessions by seizing upon many of the cities of the kings of Syria. He lived in alliance with the Romans, and made war against Prusias king of Bithynia. He was a great patron of learning; but being much given to wine, he died of an excess in drinking, after a reign of 22 years. He was succeeded by Attalus.
EUMENES II. succeeded his father Attalus on the throne of Asia and Pergamus. His kingdom was small and poor, but he rendered it powerful and opulent; and his alliance with the Romans did not a little contribute to the increase of his dominions after the victories obtained over Antiochus the Great. He carried his arms against Prusias and Antiochus, and died 100 years before Christ, after a reign of 40 years, leaving the kingdom to his son Attalus II. He has been admired for his benevolence and magnanimity; and his love of learning greatly enriched the famous library of Pergamus, which had been founded by his predecessors in imitation of the Alexandrian collection of the Ptolemies. His brothers were so attached to him and devoted to his interest, that they enlisted among his body guards to show their fraternal fidelity.

EUMENES, a celebrated orator of Athens about the beginning of the fourth century. Some of his harangues and orations are extant. An historical writer in Alexander's army.

EUENIDES, a name given to the Furies by the ancients. They sprang from the blood of the wound which Calus received from his son Saturn. According to others, they were daughters of Earth, and conceived from the blood of Saturn. Some make them daughters of Achaeon and Night, or Pluto and Proserpine. According to the more received opinions, they were three in number, Tisiphone, Megara, and Alecto, to which some add NEMEAS. Pitharch mentions only one called ADRASIA, daughter of Jupiter and Necessity. They were supposed to be the ministers of the vengeance of the gods. They were stern and inexorable; and were always employed in punishing the guilty upon earth, as well as in the infernal regions. They inflicted their vengeance upon earth by wars, pestilence, and dissensions, and by the secret stings of conscience; and in hell they punished the guilty by continual flagellation and torments. They were also called FURIA and ERINNYS. Their worship was almost universal; and people dared not to mention their names or fix their eyes upon their temples. They were honoured with sacrifices and libations; and in Achaia they had a temple, which when entered by any one guilty of a crime, suddenly rendered him furious, and deprived him of the use of his reason. In the sacrifices the votaries used branches of cedar and of alder, hawthorn, saffron, and juniper; and the victims were generally turtle doves and sheep, with libations of wine and honey. They were usually represented with a grim and frightful aspect, with a black and bloody garment, and with serpents writhing round their heads instead of hair. They held a burning torch in one hand, and a whip of scorpions in the other; and were always attended by Terror, Rage, Paleness, and Death. In hell they were seated around Pluto's throne, as the ministers of his vengeance.

EUMENIDIA, festivals in honour of the Eumenides, called by the Athenians Ευμενίδες, "venerable goddesses." They were celebrated once every year, with sacrifices of pregnant ewes, with offerings of cakes made by the most eminent youths, and libations of honey and wine. At Athens none but freeborn citizens were admitted, such as had led a life the most virtuous and unsullied.

EUMOLPIDES, the priests of Ceres at the celebration of her festivals at Eleusis. They were descended from Eumolpus, a king of Thrace, who was made priest of Ceres by Erechtheus king of Athens. He became so powerful after his appointment to the priesthood, that he maintained a war against Erechtheus. This war proved fatal to both. Erechtheus and Eumolpus were both killed, and peace was re-established among their descendants, on condition that the priesthood ever remained in the house of Eumolpus, and the regal power in the family of Erechtheus. The priesthood remained in the family of Eumolpus for 1200 years; and this is still more remarkable, because he who was once appointed to the holy office was obliged to remain in perpetual celibacy.

EUOMOLPUS, a king of Thrace, son of Neptune and Chione. He was thrown into the sea by his mother, who wished to conceal her shame from her father. Neptune saved his life, and carried him into Æthiopia, where he was brought up by a woman, one of whose daughters he married. An act of violence to his sister-in-law obliged him to leave Æthiopia, and he fled to Thrace with his son Iamarus, where he married the daughter of Tegyrius the king of the country. This connection to the royal family rendered him ambitious; he conspired against his father-in-law, and fled, when the conspiracy was discovered, to Attica, where he was initiated in the mysteries of Ceres of Eleusis, and made hierophant or high priest. He was afterwards reconciled to Tegyrius, and inherited his kingdom. He made war against Erechtheus king of Athens, who had appointed him to the office of high priest, and perished in battle about 1380 years before the Christian era. His descendants were also invested with the priesthood, which remained for about 1200 years in that family.

EUANIPUS, a native of Sardis in Lydia, a celebrated sophist, physician, and historian, who flourished in the 4th century, under the emperors Valentinian, Valens, and Gratian. He wrote "The lives of the Philosophers and Sophists," in which he frequently shows himself a bitter enemy to the Christians: also a "History of the Caesars," which he deduced from the reign of Claudius, where Herodian left off, down to that of Arcadius and Honorius. The history is lost; but we have the substance of it in Zosimus, who is supposed to have done little more than copy it.

EUONMIANS, in church history, Christian heretics in the 4th century. They were a branch of Arius, and took their name from Eunomius bishop of Cyzicus, whose confession of faith here follows, extracted from Cave's Historia Literaria, vol. i. p. 223.

"There is one God, uncreated and without beginning; who has nothing existing before him, for nothing can exist before what is uncreated; nor with him, for what is uncreated must be one; nor in him, for God is a simple and uncompounded being. This one simple and eternal being is God, the creator and ordainer of all things; first indeed and principally of his only-begotten Son; and then, through him, of all other things. For God begot, created, and made, the Son, only by his direct operation and power, before all things, and every other creature; not producing, however, any being like himself, or imparting any of his own proper substance to the Son: For God is immortal, uniform, indivisible; and therefore cannot communicate any part
Eunomius of his own proper substance is another. His alone is unbegotten; and it is impossible that any other being should be formed of an unbegotten substance. He did not use his own substance in begetting the Son, but his will only: nor did he begot him in the likeness of his substance, but according to his own good pleasure. He then created the Holy Spirit, the first and greatest of all spirits, by his own power indeed and operation immediate, yet not by the immediate power and operation of the Son. After the Holy Spirit he created all other things in heaven and on earth, visible and invisible, corporeal and incorporeal, mediate by himself, by the power and operation of the Son, &c.

Eunomius, a famous heresarch of the 4th century, the disciple of Eunomius, but abundantly more subtle than his master, as well as more bold in propagating the opinions of his sect, who after him are called Eunomiacs. He was ordained bishop of Cyzicus; but gave so much disturbance by the intemperance of his zeal, that he was deposed more than once. At last, tired with being tossed about, he petitioned to retire to the place of his birth, Decora in Macedonia; where he died very old about the year 374, after experiencing a variety of sufferings. The greatest part of his works are lost. There is, however, besides two or three small pieces, a confession of his faith remaining, which Cave inserted in his Historia Literaria, from a manuscript in Archbishop Tension's library. See the preceding article.

Eunuch, a castrated person. See the article Castration.—The word is formed from ευνουχος, q. d. λεγεται κατοικων ἄδειον, "guardian or keeper of the bed."

In Britain, France, &c. eunuchs are never made but upon occasion of some disease, which renders such an operation necessary; but in Italy they make great numbers of children, from one to three years of age, eunuchs, every year, to supply the operas and theatres of all Europe with singers. M. de la Lande, in his Voyage d'Italie, asserts, that there are public shops at Naples where this cruel operation is performed, and that over the door of these shops is inscribed Quis est eastrum ruegaxoi. But Dr Burney informs us, that he was not only utterly unable to see or hear of any such shops during his residence in that city, but was constantly told, both by the natives and English settled there, that the laws against such a practice were so numerous and severe, that it was never performed but with the utmost secrecy.

In the eastern parts of the world, they make eunuchs in order to be guards or attendants on their women. The seragelies of the eastern emperors are chiefly served and guarded by eunuchs; and yet, from good authority, we learn, that the rich eunuchs in Persia and other countries keep seragelies for their own use. Those who, out of an impudent zeal to guard themselves from sensual pleasures, made themselves eunuchs, were, by the council of Nice, condemned and excluded from holy orders. There are several severe prohibitions in Germany against the making of eunuchs; and in France an eunuch must not marry, yet even with the consent of the woman.

Though the practice of castration is detestable in every point of view; yet there appears no real foundation for the injurious opinion generally entertained of eunuchs, viz. that they are all cowards, and devoid of genius for literature or any solid study. "As to genius (says the author last quoted), I never found those of the first class in music deficient in intellectual abilities for more serious studies. Indeed I have seen real genius and dispositions for literary pursuits, in more than one great opera singer; and as for composition, and the theory of music, not only the best singers of the pope's chapel ever since the beginning of the last century, but the best composers, are among the sopranis in that service." With respect to the operation affecting the mind so much as to deprive it of all fortune in times of danger, there is great reason to doubt the fact: most of the generals of eastern monarchs having been at all times of this class; and the bravest stand that ever was made against Alexander the Great was at Gaza, under the command of one of Darius's generals, who was an eunuch. Ammianus Marcellinus gives an account of Menophilus, a eunuch, to whom Mithridates intrusted his daughter; which proves the possibility of such unfortunate persons possessing a heroism equal to that of the most determined Stoic.

It is very certain, that the ancients never supposed eunuchs to have been men of inferior intellects, or that they possessed less vigour of mind than other men. At least the Persians were not of this opinion; for Herodotus relates, that when they had taken possession of some Ionian cities, ουδες τοις επι της εν την θηραδια αληθειαν. It is certain, however, Herodotus says, in relating the melancholy story of Hermotimus, says, that ποιον τινα βιγματικα p. 66. τα με εισερχόμενοι να ενεργοι, οι ευνουχοι οι των ιεραματων της συγγενειας, "among the barbarians, the eunuchs are more valued than other men, on account of their universal fidelity." It appears from this passage of Herodotus, that in Persia eunuchs were far from being objects of contempt; and were even frequently promoted to the highest honours. This was indeed the case with Hermotimus. We find in Agathias, who was one of the Byzantine historians, that a general in the Roman army, named Narses, was an eunuch. This was in the latter ages. In Plutarch's Life of Aristides, Themistocles is related to have chosen an eunuch, whose name was Arneas, from among his prisoners, to send on a secret embassy to Xerxes. This surely may serve to show, that mental imbecility was not supposed by the Greeks to be the characteristic of eunuchism. The same story of the confidence placed in Arneas, who was one of the Persian king's eunuchs, is related also in the life of Themistocles. Aristotle paid such high respect to Hermias, who was an eunuch and governer of Atarneis, which is in Myisa, that he even offered sacrifices in honour of him; as Lucian informs us in his Dialogue entitled Eunuchus. This regard of Aristotle for Hermias has been often celebrated, and is mentioned by Suidas, Harpocration, and others.

Eunuchs, in church history, a sect of heretics in the third century, who were mad enough to castrate, not only those of their own persuasion, but even all others they could lay hold of. They took their rise from the example of Origen, who, misunderstanding the following words of our Saviour, "and eunuchs who made themselves eunuchs for the kingdom of heaven," castrated himself.

Evocati, soldiers among the Romans, who having served their full time in the army, went afterwards volunteers at the request of some favourite general; or which
which account they were called by the honourable names of Emeriti and Beneficiarii.

EVOCATION (Evocatio), among the Romans, a religious ceremony always observed by them in the undertaking of a siege, wherein they solemnly called upon the gods and goddesses of the place to forsake it and come over to them. Without the performance of this ceremony, they either thought that the place could not be taken, or that it would be a sacrilege to take the gods prisoners. They always took it for granted that their prayer was heard, and that the gods had deserted the place and come over to them, provided they were able to make themselves masters of it.

EUODIA, a genus of plants, belonging to the tetrahedria class. See Botany Index.

EVOLUTION, in Algebra, the unfolding or opening of a curve, and making it describe an evolvent. The word *evolutio* is formed of the preposition *ev*; “out;” and *voluere*, “I roll, or wind;” q. d. an unwinding or unrolling.

The equable evolution of the periphery of a circle, or other curve, is such a gradual approach of the circumference to rectitude, as that its parts do all concur and equally evolve or unbend; so that the same line becomes successively a less arc of a reciprocally greater circle: till at last they change into a straight line. In the Phil. Trans. No. 265. a new quadratrix to the circle is found by this means, being the curve described by the equable evolution of its periphery.

EVOLUTION, is also used for the extraction of roots out of powers: in which sense it stands opposed to involution. See Algebra.

EVOLUTION, in the art of war, the motion made by a body of troops, when they are obliged to change their form and disposition, in order to preserve a post or occupy another, to attack an enemy with more advantage, or to be in a condition of defending themselves the better.

It consists in doublings, counter-marches, conversions, &c. A battalion doubles the ranks, when attacked in front or rear, to prevent its being flanked or surrounded; for then a battalion fights with a larger front. The files are doubled, either to accommodate themselves to the necessity of a narrow ground, or to resist an enemy that attacks them in flank. But if the ground will allow it, conversion is much preferable; because, after conversion, the battalion is in its first form, and opposes the file-leaders, which are generally the best men, to the enemy; and likewise, because doubling the files in a new or not well-disciplined regiment, they may happen to fall into disorder. See Doubling.

EVOLVULUS, a genus of plants belonging to the pentadria class; and in the natural method ranking under the 29th order, Compositae. See Botany Index.

EUONYMUS, the Spindle Tree; a genus of plants belonging to the pentadria class; and in the natural method ranking under the 43rd order, Dilleniae. See Botany Index.

EUPATORIUM, Hemp Agrimony; a genus of plants belonging to the synangiaea class; and in the natural method ranking under the 49th order, Composite. See Botany Index.

EUPATRIDÆ, in antiquity, a name given by the Greeks to the nobility of Athens, as distinguished from the Geomori and Demiurgi. The Eupatridae, by Their se's establishment, had the right of choosing magistrates, teaching and dispensing the laws, and interpreting holy and religious mysteries. The whole city, in all other matters, was reduced to an equality. The Geomori were husbandmen, and inferior to the Eupatridae in point of fortune; the Demiurgi were artisans, and fell short of the Eupatridae in number.

EUPHONY, in Grammar, an easiness, smoothness, and elegance of pronunciation. The word is formed of *eupo-s*, "well;" and *phoinos*, "voice." Quintilian calls euphonia, "vocalitas." Scaliger, "facilitas pronunciationis."

Euphonia is properly a kind of figure whereby we suppress a too harsh letter, or convert it into a smoother, contrary to the ordinary rules. There are examples enough in all languages.

EUPHYMISM. See Oratory.

EUPHORBIA, Spurge; a genus of plants belonging to the dodecadria class; and in the natural method ranking under the 38th order, Tricoce. See Botany Index.

EUPHORBIA, in the Materia Medica, a gummo-resinous substance, which exudes from a large oriental tree, (Euphobia officinarum). See Materia Medica Index.

EUPHORBUS, a famous Trojan, son of Panthous. He was the first who wounded Patroclus, whom Hector killed. He perished by the hand of Menelaus, who hung his shield in the temple of Juno at Argos. Pythagoras, the founder of the doctrine of the metempsychosis or transmigration of souls, affirmed that he had been once Euphorbus, and that his soul recollected many exploits which had been done while it animated that Trojan's body. As a further proof of his assertion, he showed at first sight the shield of Euphorbus in the temple of Juno.

EUPHORION of Chalcis, a poet and historian, born in the 126th Olympiad. Suetonius says that Tiberius composed verses in imitation of Euphorion, Riansius and Parthenius; with whom he was charmed to such a degree, that he ordered their writings and their pictures to be kept in all the public libraries, among the ancient and celebrated authors.

EUPHRASIA, Eux-Bright; a genus of plants belonging to the didynamia class; and in the natural method ranking under the 40th order, Persoonia. See Botany Index.

EUPHRATES, a river universally allowed to take its rise in Armenia Major; but in what particular spot, or in what direction it afterwards shapes its course, there is the greatest disagreement. Strabo says, that the Euphrates rises in Mount Abos, which he joins, or one part of Mount Taurus; that its beginning is on the north side of Mount Taurus; and that running, first westward through Armenia, then striking off to the south, it forsooks its way through the mountains, and thus it rises in the south of Armenia, Mount Taurus being the boundary on that side; and runs through its south part, quito to Cappadocia, conterminal with Armenia Minor; or quits to this last, or to its south limit; to reach which, it must bend its west course a little north; because Taurus, from which it rose, lies lower, or more to the south, and almost parallel with Maliaes; and then it turns to the south, in order X x 2 to
to break through Taurus, and escape to Syria, and then take a new bend to Babylonia. To this account of Strabo, Pliny runs quite counter; adding eye-witnesses, who carry the Euphrates from north to south in a right line, till it meets Mount Taurus; placing the springs to the east, as Strabo does; whence, he says, it runs in a long course westward, before it bends south; and that it rises not from Mount Taurus, but far to the north of it; and he makes it run straight west from its rise, then turn south spontaneously, without any interposing obstacle, in a manner quite different from Strabo, Nor, and others, who make Taurus the cause of this turn. The Euphrates naturally divides into three channels, one through Babylon, and the other through Seleucia, besides the several artificial cuts made between it and the Tigris about Babylon: and these cuts or trenches are what the Psalmist calls the rivers of Babylon, on the willows of which the captives hung their harps. It is probable, that the Euphrates naturally poured into the sea at one particular mouth, before these cuts were made. A thing appearing so evident to the ancients, that Pliny has set down the distance between the mouths of the Euphrates and the Tigris; and he says, some made it 25, and others 7, miles; but that the Euphrates being for a long time back intercepted in its course by cuts, made for watering the fields, only the branch called the Positigris fell into the sea, the rest of it into the Tigris, and both together into the Persian gulf. Overflowing the country through which it runs, at stated times of the year, like the Nile, it renders it fertile.

EUPEMIS, an Athenian comic poet, flourished about the 85th Olympiad. He took the freedom of the ancient comedy in lashing the vices of the people. He lost his life in a sea fight between the Athenians and Lacedaemonians; and his fate was so much lamented, that after his death it was enacted that no poet should serve in the wars. Some say Alcibiades put him to death for his satirical freedom.

EUREMONT, Charles de St Denis, a polite scholar and soldier, was born at St Denis le Goast in Lower Normandy in 1613. He was intended for the profession of the law, and entered on the study; but he soon quitted it, and was made an ensign before he was 16. A military life did not hinder him from cultivating polite literature; and he signalized himself by his politeness and wit as much as by his bravery. The king made him a mariscal de camp, and gave him a pension of 3000 livres per annum. He served under the duke of Candale in the war of Guienne; and in Flanders, till the suspension of arms was agreed on between France and Spain: he afterwards accompanied Cardinal Mazarin when he went to conclude the peace with Don Lewis de Haro, the king of Spain's first minister. He wrote, as he had promised, a long letter to the marquis de Croqui, of this negotiation; in which he showed, that the cardinal had sacrificed the honour of France to his own private interest, and rallied him in a very satirical manner. This letter falling into the hands of the cardinal's creatures some time after his death, was represented as a state crime, and he was obliged to fly to Holland. He had too many friends in England (whither he had taken a tour the year before with the count de Soissons, sent to compliment Charles II. upon his restoration) to make any long stay in Holland; and therefore passed over into England, where he was received with great respect, and admitted into intimate friendship with several persons of distinction. The king gave him a pension of 300l. a-year. He had a great desire to return to his native country; and, after the peace of Nimeguen, wrote a letter in verse to the king of France to ask leave, but in vain. Upon the death of King Charles, he lost his pension. He did not rely much on King James, though that prince had shown himself extremely kind to him. The Revolution was advantageous to him. King William, who had known him in Holland, gave him substantial marks of his favour. He died of a strangury in 1702, aged 90; and was interred in Westminister abbey, where a monument is erected to his memory. His behaviour was engaging, his humour cheerful, and he had a strong disposition to satire: he professed the Roman religion, in which he was born; but at the bottom was certainly a freethinker. He always spoke of his disgrace with the resolution of a gentleman: and whatever strong desire he had to return to his country, he never solicited the favour with meanness; therefore, when this leave was signed to him unexpectedly in the decline of his life, he replied, that the infirmities of age did not permit him to leave a country where he lived agreeably. There have been many editions of his works: but the best is that of Amsterdam in 1726, in 5 vols. 12mo, to which is prefixed his life by Doctor Des Maizeux; who has also given an accurate English translation of them in 3 vols. 8vo.

EURIPIDES, one of the Greek poets who excelled in tragedy, was born about 486 B.C. in the isle of Salamis, whither his father and mother had retired a little before Xerxes entered Attica. He learned rhetoric under Prodicus, morality under Socrates, and natural philosophy under Anaxagoras; but at 18 years of age abandoned philosophy, in order to apply himself to dramatic poetry. He used to shut himself up in a cave to compose his tragedies, which were extremely applauded by the Greeks. The Athenian army, commanded by Nicias, being defeated in Sicily, the soldiers purchased their lives and liberties by reciting the verses of Euripides; such esteem and veneration had the Sicilians for the pieces wrote by this excellent poet. Socrates, the wisest of the philosophers, set such a value upon them, that they were the only tragedies he went to see acted; and yet his performances seldom gained the prize. Euripides frequently intersperses them through moral sentences, and severe reflections on the fair sex; whence he was called the Woman-hater. He was, nevertheless, married; but the scandalous lives of his two wives drew upon him the malice of Aristophanes, and other comic poets; which occasioned his retiring to the court of Archelaus, king of Macedon, where he was well received. That prince was fond of learned men, and drew them to him by his liberality. If we may believe Solinus, he made Euripides his minister of state, and gave him other extraordinary proofs of his esteem. He had, however, passed a few years there, when an unhappy accident put an end to his life. He was walking in a wood, and, according to his usual manner, in deep meditation; when, unfortunately happening upon Archelaus's hounds, he was by them torn in pieces. It is not certain whether
Euripides
 
EUR.

[349]

EUR.

Euripides, a daughter of Agenor of Phoenicia and Telephassa. She was so beautiful that Jupiter became enamoured of her; and to induce her to abandon her home, he assumed the shape of a bull and mingled with the herd of Agenor. With Europa, with her female attendants, were gathering flowers in the meadows. Europa caressed the beautiful animal; and at last had the courage to sit upon its back. The god took advantage of her situation; and with precipitate steps retired towards the shore, crossed the sea with Europa on his back, and arrived safe in Crete. Here he assumed his original shape, and declared his love. The nymph consented, though she had once made vows of perpetual celibacy; and she became mother of Minos, Sarpedon, and Rhadamantus. After this distinguished amour with Jupiter, she married Asterius, king of Crete. This monarch seeing himself without children by Europa, adopted the fruit of her amours with Jupiter, and always esteemed Minos, Sarpedon, and Rhadamantus, as his own children. Some suppose, that Europa lived about 1552 years before the Christian era.

EUROPA, one of the four quarters of the world. It is considerably smaller than the four grand divisions of the terraqueous globe. Its length, from east to west, according to the most authentic accounts, measures about 3300 miles British measure, and its breadth 2350. The continental part of it is bounded on the south by the Mediterranean sea, on the west by the Atlantic ocean, comprehending the most distant isle of Europe, viz. that of Iceland, for Greenland is now considered as constituting a part of North America. Many geographers of eminence have given the Azores to Europe, from their greater proximity to Portugal than to any other continental country, and have considered the Madeiras as a constituent part of Africa for a similar reason. Europe is bounded on the north by the Arctic ocean and the new land; while its eastern limits appear to be more uncertain in the estimation of geographers. It appears evident, however, that a very natural limit might be ascertained by the river Oufa, the Kama, and the Volga, which would make its division extremely natural to the town of Sarpepta; it requiring only an imaginary line of very small extent from that place to the river Don. The superficies of Europe, including the Azores, Iceland, &c. is about 3,432,000 miles.

The western and southern parts of Europe anciently consisted of the people called Celta; the Fins occupied the north-east; and the Laplanders, a people equally diminutive with the Samoeds of Asia, possessed its remotest parts toward the north, who rendered their own language less uncouth and barbarous by assimilating it to that of the Fins. The Goths from Asia seem to have driven those ancient inhabitants towards the east and north, whose descendants occupy the greater part of Europe. From the Scabonic tribes, who also came from Asia, the Poles, Russians, &c. were descended. These were accompanied by the Heruli, who made use of what is now denominated the Lette speech, to be met with in Courland, Livonia, Lithuania, Prussia, and Samogitia.
that division of the globe has hence become a kind of republic in respect of literature, every scientific invention and discovery being transmitted from one portion of it to another with the utmost dispatch. For this reason Europe has been sometimes compared to ancient Greece, and it is to be hoped that Russia will never prove another Macedon.

The greater part of this quarter of the globe lies within the northern temperate zone, a distinction which is now nearly annihilated by the interesting discoveries of modern geography. Climate is found to depend very frequently on causes which are purely local, since the Alps, in a southern latitude, exhibit mountains of ice which are not known even in Lapland, while the torrid zone is plentifully supplied with water and habitations, and for any thing which can be determined to the contrary, it may contain mountains which are covered with snow. As it is happily delivered from those intense heats which are peculiar to Asia and Africa, the inhabitants are in general blessed with greater bodily vigour and intellectual strength.

One of the most striking features of Europe in a general point of view is its inland seas, which give it a decided superiority over the other more extensive divisions of the earth, and contribute powerfully to the extension of its industry, commerce, and civilization. If such blessings had been enjoyed by Africa, it is more than probable that the consequences of her industry would have been diffused far and wide. Of these inland seas, the Mediterranean holds the most distinguished place, as the centre of civilization both to the ancient and modern inhabitants of Europe. It is about 2000 miles in length to its farthest extremities in Syria, but the maps of antiquity make it 500 more. The gulfs of Venice and the Archipelago open on its northern side, formerly denominated the Adriatic and Egean seas, from the last of which there is a communication with the sea of Marmora, or the Propontis, by means of the Hellespont; and the strait of Constantinople leads into the Black sea, to the north of which is the sea of Azof, (Palus Moesitis), or utmost maritime boundary of Europe in that direction. This vast expanse of water is beautifully ornamented with numerous islands and an opulent sea coast, exhibiting delightful specimens of almost every thing in nature which is sublime and beautiful. Tides cannot be perceived except in straits of very small dimensions, although naturalists have observed, that a current sets along the shores of Italy from west to east, while its direction is from east to west towards the coast of Africa. In the gulf of Venice the current runs along Dalmatia in a north-west direction, and returns by the opposite shore of Italy. There is abundance of fish to be met with in the Mediterranean, some of which are but rarely to be found in more northern latitudes. This sea in particular abounds with coral, now certainly known to be the production of marine insects. This imaginary plant is tri-colored, composed of red, vermilion and white, and does not exceed eleven inches in height. It is hard in the sea, and in this respect undergoes not the smallest change by exposure to the air; and the nets made use of for procuring it, measure from 50 to 125 feet. From the colour of its rocks or perilous navigation, the Black sea is said to have derived its name. As the sea of Azof almost always exhibits a muddy appearance, it
was for that reason denominated Pales by the ancients, and it is united to the Euxine or Black sea by the strait of Caffa.

The next inland sea of Europe is the Baltic, to which the Germans have given the name of the Eastern sea, which accounts for the people denominated Easterlings in the history of England, who undoubtedly came from the north of the Baltic. It opens from the German sea by a gulf trending north-east, known by the name of the Skager Rack, from whence it passes southward in the Cattegat, to the south-east of which we meet with the sound of Elsinore, where vessels become in some degree tributary to the king of Denmark. It is afterwards divided into two branches of great extent, called the gulfs of Bothnia and Finland, both of which are covered with ice for five months in the year. The greatest depth of the Baltic is said not to exceed 50 fathoms, and according to the opinion of naturalists it suffers a diminution of four feet every century. It has been affirmed that its waters do not contain above one-thirtieth of salt, while other sea-waters frequently contain one-tenth, which has been ascribed to the vast quantity of ice; and when the north wind blows, these waters, it is also said, may be employed for the purposes of domestic economy. There are no tides in the Baltic, and but very few fish.

The White sea, in the northern parts of Russia, is the last inland sea of Europe, which was well known to the English in particular, before the commerce of Archangel was transferred to Peterburgh. It went by the name of Queen sea in the reign of Alfred the Great; and the writers of Iceland called it the sea of Novogrodek, on the shores of which stood their Biarmia. There are a number of islands in the White sea, but the accounts which geographers have hitherto given us, are neither circumstantial nor satisfactory.

The German sea deserves to be mentioned among the other maritime divisions of Europe, which has received the appellation because it waters the western shores of ancient Germany, from the Rhine to the farthest boundary of Jutland. It may properly be regarded as constituting a part of the Atlantic ocean, ending at the straits of Dover, from whence the British channel extends to the west. Another extensive inlet of the Atlantic is the bay of Biscay; for the British channel is rather to be considered as the wide frith of the Severn. St George's channel lies on the south between Great Britain and Ireland, and the Irish sea leading to the North channel, is situated in the centre. What the ancients called the Decanedonian sea lies to the north of Scotland, which was likewise denominated the Sarmatian, as extending throughout the Baltic.

The Arctic ocean lies to the north of Europe, the dismal receptacle of countless miles of ice, piled up in mountains, the hoary majesty of which, while it captivates the eye, can scarcely fail to strike terror into the heart of the mariner. Yet from those dreary regions, which at first appear only as a prodigious waste in the works of creation, the benevolent Parent of the universe diffuses innumerable millions of herrings for the use of man. This is worthy of the divine being whose goodness is whispered to us in every breeze, which glows in the starry firmament of heaven, and is diffused through the whole creation.

The Goodwin sands in the vicinity of the Kentish coast, are as dangerous to the mariner as uninviting to the fisher; but excellent fish are to be found on many banks on the coast of Holland, among which may be ranked the cod, the sole, and the plaice. What are called the Silverpits of the mariners, lying between the Dogger and Well bank, supply the London market with cod, which discovers a predilection for the deep waters in the vicinity of the banks. The Horns, a narrow strip extending to Jutland, is situated towards the north-east of the Dogger bank. The Jutshirf extends from the mouth of the Baltic to the German sea, in the form of a crescent.

The Mor head takes its rise opposite to Berwick, which is little more than 15 miles in length. To the eastward of this lies the Long Firths, extending from Buchansness to Newcastle, and from between 40 and 100 miles from the shore; and a bank reaches across the German sea towards Jutshirf, from the coast of Buchan. It was thought necessary, in this concise account of Europe, to mention some of the most considerable banks or comparative shoals, which have often been regarded as the summits of lofty mountains beneath the surface of the deep; and which, as the haunts of fishes of different species, have arrested the attention of national industry.

A description of the principal rivers of Europe will be given in our account of the countries through which they respectively flow. The greater part of the Wolfa is considered as belonging to Europe; the next highly celebrated river is the Danube, after which we may rank the Nepean, the Rhine, and the Elbe. The Alps are the loftiest mountains; next the Pyrenees; and that vast ridge by which Norway is divided from Sweden. The Carpathian mountains, the chain called Emetine, and the Apennines, are of inferior magnitude.

The European states and kingdoms may properly be divided into three classes. 1. Despotic monarchies, of which Russia and Turkey may serve as specimens. 2. Absolute monarchies, such as Spain and Denmark. And 3. Those of a limited nature, as the Germanic empire, and the kingdom of Great Britain. Since the peace in 1815, constitutions formed on the model of that of England have been adopted by Bavaria, Wirttemberg, Baden, Hesse Darmstadt, and some of the smaller states. Spain and Portugal have established governments on a more democratic plan. The two old commercial aristocracies of Venice and Genoa have been suppressed.

It is customary with some geographers to divide the constituent parts of Europe into first, second, and third orders, according to their political importance; the first order including the united kingdoms of Great Britain and Ireland, France, Russia, the Austrian dominions, Prussia, Spain, Turkey. In the second order stand the United Provinces, Denmark, Sweden, Portugal, and Switzerland; and the chief states of Germany and Italy constitute the third, a detailed account of which our readers will find in this work under their proper names. For a detailed account of the recent changes in this quarter of the globe, see the article Europe in the Supplement.

EURYALE, in Mythology, one of the Gorgons, daughters of Phorcys, and sister of Medusa; she was subject neither to old age nor death.

EURYANDRA,
EUROPESE, the wife of Orpheus, who flying from Aristaeus that endeavoured to ravish her, was slain by a serpent. Her husband went down to the shades, and by the force of his music persuaded Pluto and Proserpine to give him leave to carry back his wife; which they granted, provided he did not look on her till he came to the light: but he breaking the condition, was forced to leave her behind him. See ORPHEUS.

EUYMEDON, in Ancient Geography, a noble river running through the middle of Pamphylia; famous for a sea and land fight on the same day, in which the Athenians under Cimon the son of Miltiades, defeated the Persians. The sea fight happened first in the sea of Pamphylia, towards Cyprus; the land engagement, the following night on the Eumedon. Cimon, after defeating the Persian fleet, armed his men with the armour of the captives, and set sail for the enemy, who lay on the banks of the Eumedon, in the ships taken from the Persians; who on seeing their own ships and their own people in appearance, were off their guard, and thus became an easy conquest.

EURYTHEUS, a king of Argos and Mycenae, son of Sthenelus and Nicippe the daughter of Pelope. Juno hastened his birth by two months, that he might come into the world before Hercules the son of Alcmena, as the younger of the two was doomed by order of Jupiter to be subservient to the will of the other. (See ALCMENA.) This natural right was cruelly exercised by Eurytheus, who was jealous of the fame of Hercules; and who, to destroy so powerful a relation, imposed upon him the most dangerous and uncommon enterprises, well known by the name of the twelve labours of Hercules. The success of Hercules in achieving those perilous labours alarmed Eurytheus in a greater degree, and he furnished himself with a brazen vessel, where he might secure himself a safe retreat in case of danger. After the death of Hercules, Eurytheus renewed his cruelties against his children, and made war against Ceys king of Trachinias, because he had given them support, and treated them with hospitality. He was killed in the prosecution of this war by Hyllus the son of Hercules. His head was sent to Alcmena the mother of Hercules; who, mindful of the cruelties which her son had suffered, insulted it, and tore out the eyes with the most inveterate fury. Eurytheus was succeeded on the throne of Argos by Atreus his nephew. The death of Eurytheus happened about 30 years before the Trojan war.

EUSTAETCHUS, BARTHOLOMEE, a physician and anatomist at Rome, flourished about the year 1550. His anatomical plates were discovered there in 1712, and published in 1714.

EUSTATHIAN, a name given to the Catholics of Antioch in the 4th century, on occasion of their refusal to acknowledge any other bishop beside St Eustathius, deposed by the Arians.

The denomination was given them during the episcopate of Paulinus, whom the Arians substituted to St Eustathius, about the year 330, when they began to hold their assemblies apart. About the year 350, Leontius of Phrygia, called the eunuch, who was an Arian, and was put in the see of Antioch, desired the Eustathians to perform their service in his church; which they accepting, the church of Antioch served indifferently both the Arians and Catholics.

This, we are told, gave occasion to two institutions, which have subsisted in the church ever since. The first was psalmody in two choirs; though M. Baillet thinks, that if they instituted an alternate psalmody between two choirs, it was between two Catholic choirs, and not by way of response to an Arian choir. The second was the doxology, Glory be to the Father, and the Son, and the Holy Ghost. See DOXOLOGY.

This conduct, which seemed to imply a kind of communion with the Arians, gave great offence to abundance
a garrison in the island till the treaty of Breda, when it was restored to the Dutch. Soon after the revolution, the French drove out the Dutch, and were in their turn driven out by the English under Sir Timothy Thornhill, with the loss of no more than eight men killed and wounded, though the fort they took mounted 16 guns, and was in every other respect very strong. Sir Timothy found it necessary for the protection of the Dutch, to leave a small English garrison in the fort; but he granted the French no terms of capitulation, except for their lives and baggage. By the peace of Ryswick, the entire property of this island was restored to the Dutch.

This island was reduced by the British in the year 1781. Though not 20 miles in circumference, it abounded at that time with riches, by reason of the vast conflux of trade from every other island in these seas. Being a free port, it was open to all the subjects of the belligerent powers; and thus a communication was established among them, through which they were enabled to carry on a commercial correspondence, which greatly mitigated the inconveniences of war. The greatest benefit, however, was reaped by the Dutch; who, by transacting all trading business for other nations, were thus intrusted with numerous commissions, and likewise enjoyed very profits from the sale of the merchandise to which they were entitled. At the time the attack was made upon them, they were so little under the apprehensions of such an event, that their warehouses were not sufficient to contain the quantity of commercial articles imported for sale, and the beach and streets were covered with hogheads of tobacco and sugar. In this situation, Admiral Rodney having received orders to commence hostilities against the Dutch, suddenly appeared before the island with such an armament of sea and land forces, as in its defenceless situation was not only useless but ridiculous. The governor could scarcely credit the officer who summoned him to surrender; but being convinced how matters stood, the only possible step was taken, namely, to surrender the whole island and every thing in it, at discretion. Along with the island there fell into the hands of the captors a ship of 60 guns, with 250 sail of merchantmen, while the value of property on the island was estimated at no less than four millions sterling. This capture became afterwards a subject of discussion in parliament, where the conduct of the British commanders was severely scrutinized by Mr. Burke. The admiral and general made their defence in person: but the minority at that time were far from being satisfied; and it was supposed that on the change of ministry a rigid inquiry would have been set on foot, had not the splendour of Admiral Rodney’s victory over de Grasse put an end to all thoughts of that nature.

The island of St. Eustatius is naturally of such difficult access, as already observed, that it is almost impossible for an enemy to effect a landing if proper care is taken by those who are in possession of it. This very circumstance proved the ruin of the new possessors. The British, secure in their inaccessible situation, conducted themselves in such a manner as induced the Marquis de Bouillé to make an attempt to regain it. Having sailed from Martinique at the head of 2000 men, he arrived on the 26th of November 1781, off one of the landing places.
EUTYCHIANS, ancient heretics, who denied the duplicity of natures in Christ; thus distinguished from Eutyches, the archimandrite, or abbot of a monastery at Constantinople, who began to propagate his opinion A. D. 448. He did not, however, seem quite steady and consistent in his sentiments: for he seemed to allow of two natures, even before the union; which was apparently a consequence he drew from the principles of the Platonic philosophy, which supposes a pre-existence of souls: accordingly, he believed that the soul of Jesus Christ had been united to the divinity before the incarnation; but then he allowed no distinction of natures in Jesus Christ since his incarnation. This heresy was first condemned in a synod held at Constantinople by Flavien, in 448, approved by the council of Ephe- sus, called conventus Iatromani, in 449, and re-examined, and condemned in the general council of Chalcedon in 451. The legates of Pope Leo, who assisted at it, maintained that it was not enough to define, that there were two natures in Jesus Christ; but insisted strenuously, that to remove all equivocations, they must add these terms, without being changed, or confused, or divided.

The heresy of the Eutychians, which made a very great progress throughout the east, at length became divided into several branches. Nicetas makes mention of no fewer than twelve: some called Schismatics, or Apparentes, as only attributing to Jesus Christ a phantom or appearance of flesh, and no real flesh: others, Theodossians, from Theodosius bishop of Alexandria: others, Jacobites, from one James (Jacobus), of Syria; which branch established itself principally in Armenia, where it still subsists. Others were called Acphilai, or without head; and Severians, from a monk called Severus, who wrote on the see of Antioch in 513. These last were subdivided into five factions, viz. Apollinaris, who attributed some ignorance to Jesus Christ; the followers of Paul; Manichaeus, that is, the black Angeliotes, thus called from the place where they were assembled; and lastly, Adorites and Convocites.

EUTYCHIANS was also the name of another sect, half Arian half Monomaniacs; which arose at Constantinople in the fourth century.

It being then a matter of mighty controversy among the Eunomians at Constantinople, whether or not the Son of God knew the last day and hour of the world, particularly with regard to that passage in the gospel of St Matthew, chap. xxii. ver. 56, or rather that in St Mark, xiii. 32, where it is expressed, that the Son did not know it, but the Father only; Eutychius made no scruple to maintain, even in writing, that the Son did not know it; which sentiment displeasing the leaders of the Eunomian party, he separated from them, and made a journey to Eunomus, who was then in exile. That heretic acquired safety in Eutychius's doctrine, and admitted him to his communion. Eunomius dying soon after, the chief of the Eunomians at Constantinople refused to admit Eutychius; who, upon this, formed a particular sect of such as adhered to him, called Eutychians.
This same Euthychus, with one Theophorius, as was said in Sosonius's time, were the occasions of all the changes made by the Eunomians in the administration of baptism, which consisted, according to Nicephorus, in only using one immersion, and not doing it in the name of the Trinity, but in memory of the death of Jesus Christ. Nicephorus calls the chief of that sect, not Euthychus, but Euphychus, and his fellows Eunomius, Nicepheniensis.

EUTYCHUS, patriarch of Alexandria, lived about the ninth age, and wrote annals in the Arabic language, printed at Oxford in 1698, with a Latin version by Mr. Poockes. Selden had printed something of his before.

EUXINE, or Black Sea, forms part of the boundary between Europe and Asia. It receives the Nister, the Dacube, and other large rivers; and extends from 28 to 41 degrees of E. Long. and from 41 to 47 of N. Lat. The ancients imagined this sea to have been originally only a lake or standing pool which broke first into the Propontis, and then into the Egean, washing away by degrees the earth which first kept it within bounds, and formed the two channels of the Bosphorus Thracius and Halicarnass, now the Dardanelles. It was anciently called the Aeseus, supposed to be from Asklepios, the son of Aesculapius, who was said to have settled near it. This original being lost in length of time, the Greeks explained it by inacceptable, which the word Aesculapius literally signifies; and therefore, when they came to consider the inhabitants of these coasts as more civilized and hospitable, they changed the name into Euxine. See Black Sea, Supplement.

EWE, the English name of a female sheep. See Ovis, Mammalia Index.

EWERY, in the British customs, an office in the king's household, to which belonged the care of the table-lines, of laying the cloth, and serving up wine in silver ewers after dinner.

EX, a river that rises in a barren tract of land, called Exmere, in Somersettshire; and after being joined by several little streams, runs by Tiverton, where there is a stone bridge over the river. About nine miles below Tiverton, it is joined by a pretty large stream called the Colomendens; and about two miles lower, by another stream formed by the junction of the Horton and Creedy. With these additions, it washes the walls of Exeter. At Topsham, above four miles below Exeter, it receives another considerable addition to its stream; two miles farther, it is joined by the Ken; and falls into the ocean at Exmouth, after a course of about 40 miles. Ships of great burden go up to Topsham, from whence vessels of 150 tons are conveyed to the quay at Exeter, by means of an artificial canal. The Ex is navigable for vessels of considerable burden to Topsham. The passage, however, at the mouth of the river, is but narrow, having rocks on the east side and broad sand on the west; nor is the water on the bar more than six or seven feet deep at low water, but the tide rises 4 or 5 feet, so that it is deep enough at high water. When ships are within the bar, they are led off at a place called Sturbrooke, about a mile and a half from the river's mouth; but those that go to Topsham lie agreed on the same at low water.

EX ANIMA, among lawyers, signifies the power a person has, by virtue of his office, to do certain acts without being applied to. Thus a justice of peace may, in his discretion, take surety of the person, without complaint made by any person whatever.

There was formerly an oath in office, whereby a supposed offender was compelled in the ecclesiastical court to confess, accuse, or clear himself of a crime; but this law is repealed.

Ex Post Facto, in Law, something done after another; thus an estate granted may be good by matter in ex post facto, that was not so at first, as in case of election.

EXACERBATION. See Paroxtism.

EXACTION, in Law, a wrong done by an officer, or a person in pretended authority, in taking a reward or fee that is not allowed by all.

A person guilty of exaction may be fined and imprisoned. It is often confounded with Extortion.

EXACUM, a genus of plants belonging to the straminia class; and in the natural method ranking under the 20th order, Rosaceae. See Botany Index.

EXERESIS, in Surgery, the operation of extracting or taking away something that is hurtful to the human body.

EXAGGERATION, in Rhetoric, a kind of hyperbole, whereby things are augmented or amplified by saying more than the truth, either as to good or bad.

EXAGGERATION, in Painting, a method by which the artist, in representing things, changes them too much, or makes them too strong, either in respect of the design or colouring. It differs from caricaturing, in that the latter perverts or gives a turn to the features of a face, etc. which they had not, whereas exaggeration only heightens or improves what they had.

EXALTATION, or Elevation, is chiefly used in a figurative sense, for the raising or advancing a person to some ecclesiastical dignity; and particularly to the papacy.

EXALTATION of the Cross is a feast of the Bohemian church, held on the 14th of September; in memory, as is generally supposed, of this, that the emperor Heraclius brought back the true cross of Jesus Christ on his shoulders, to the place on Mount Calvary from which it had been carried away 14 years before by Constans king of Persia, at his taking of Jerusalem, under the reign of the emperor Phocas. The cross was delivered up by a treaty of peace made with Sire, Constans's son. The institution of this treaty is commonly said to have been signalized by a miracle; in that Heraclius could not stir out of Jerusalem with the cross while he bad the imperial vestments on enriched with gold and precious stones, but bore it with ease in a common dress.

But long before the reign of Heraclius there had been a feast of the same denomination observed both in the Greek and Latin churches, on occasions of what our Saviour said in St. John xii. 32. And I, if I be lifted up, will draw all men unto me. And again, in chap. viii. ver. 24. When ye have seen me, ye shall know that I am. The feast of the dedication of the temple built by Constantine was held, says Nicodemos, on the 14th of September,
EXAMINATION, an exact and careful search or inquiry, in order to discover the truth or falsehood of a thing.

Self-EXAMINATION, is a point much insisted on by divines, and particularly the ancient fathers, by way of preparation to repentance. St. Ignatius reduces it to five points; viz. 1. A returning thanks to God for his benefits. 2. A begging of grace and light, to know and distinguish our sins. 3. A running over all our actions, occupations, thoughts, and words, in order to learn what has been offensive to God. 4: A begging of pardon, and conceiving a sincere sorrow for having displeased him. And, 5. Making a firm resolution not to offend him any more; and taking the necessary precautions to preserve ourselves from it.

EXAMINERS, in chancery, two officers of that court, who examine, upon oath, witnesses produced in causes depending there, by either the complainant or defendant, where the witnesses live in London or near it. Sometimes parties themselves, by particular order, are examined. In the country, above 20 miles from London, on the parties joining in commission, witnesses are examined by commissioners, being usually counselors or attorneys not concerned in the cause.

EXAMPLE, in a general sense, denotes a copy or pattern. Example, in a moral sense, is either taken for a type, instance, or precedent, for our admonition, that we may be cautioned against the faults or crimes which others have committed, by the bad consequences which have ensued from them; or example is taken for a pattern for our imitation, or a model for us to copy after.

That examples have a peculiar power above the naked precept, to dispose us to the practice of virtue and holiness, may appear by considering. 1. That they most clearly express to us the nature of our duties in their subjects and sensible effects. General precepts form abstract ideas of virtue; but in examples, virtues are most visible in all their circumstances. 2. Precepts instruct us in what things are our duty; but examples assure us that they are possible. When we see men like ourselves, who are united to frail flesh, and in the same condition with us, to command their passions, to overcome the most glorious and glittering temptations, we are encouraged in our spiritual warfare. 3. Examples, by secret and lively incentive, urge us to imitation. We are touched in another manner by the practice of good men, who reproaches our defects, and obliges us to the same zeal which laws, though wise and good, will not effect.

The example of our Saviour is most proper to form us to holiness; it being absolutely perfect, and accommodated to our present state. There is no example of a mere man that is to be followed without limitation: But the example of Christ is absolutely perfect; his conversation was a living law: "He was holy, harmless, undefiled, and separate from sinners."

EXAMPLE, in Rhetoric, denotes an imperfect kind of induction or argumentation; whereby it is proved, that a thing which happened on some other occasion will happen again on the present one, from the similitude of the cases. As, "The war of the Thebans, against their neighbours the Phocians, was ruinous; consequently, that of the Athenians against their neighbours, will likewise be fatal."

EXANTHEMA, among Physicians, denotes any kind of efflorescence or eruption, as the measles, purple spots in the plague, or malignant fevers, &c.

EXARCH, in antiquity, an appellation given, by the emperors of the east, to certain officers sent into Italy, in quality of vicars, or rather prefects, to defend that part of Italy which was yet under their obedience, particularly the city of Ravenna, against the Lombards, who had made themselves masters of the greatest part of the rest.

The residence of the exarch was at Ravenna; which city, with that of Rome, was all that was left the emperors. The first exarch was the patrician Boetius, famous for his treatise, De Consolatione Philosophiae; appointed in 568 by the younger Justin. The exarchs subsisted about 185 years, and ended in Eutychius; under whose exarch the city of Ravenna was taken by the Lombard king Atalphilus, or Astolphus.

The emperor Frederic created Heraclius, archbishop of Lyons, a descendant of the illustrious house of Montboissier, exarch of the whole kingdom of Burgundy; a dignity till that time unknown anywhere but in Italy, particularly in the city of Ravenna.

Homer, Philo, and other ancient authors, give likewise the name exarchus to the choragus or master of the singers in the ancient choruses, or him who sung first; the word αρχευς or αρχαυς, signifying equally to begin, and to command.

EXARCH of a Diocese was, anciently, the same with primate. This dignity was inferior to the patriarchal, yet greater than the metropolitan.

EXARCH also denotes an officer, still subsisting in the Greek church; being a kind of deputy or legate a latere of the patriarch, whose office it is to visit the provinces allotted him, in order to inform himself of the
EXC " the lives and manners of the clergy; take cognizance of ecclesiastical causes; the manner of celebrating divine service; the administration of the sacraments; particularly confession; the observance of the canons; monastic discipline; affairs of marriages, divorces, &c. But above all, to take an account of the several revenues which the patriarch receives from several churches; and, particularly, as to what regards the collecting the same.

The exarch, after having greatly enriched himself in his post, frequently rises to the patriarchate itself.

Exarch is also used, in the eastern church antiquity, for a general or superior over several monasteries; the same that we otherwise call archimandrite; being exempted, by the patriarch of Constantinople, from the jurisdiction of the bishops; as are now the generals of the Roman monastic orders.

EXAUCTORATIO, in the Roman military discipline, differed from the missio, which was a full discharge, and took place after they had served in the army 20 years; whereas the exauctoratio was only a partial discharge: they lost their pay indeed, but still kept under their colours or ensigns, though not under the eagle, which was the standard of the legion; whence, instead of Legionarii, they were called Subsignani, and were retained till they had either served their full term or had lands assigned them. The exauctoratio took place after they had served 17 years.

EXCALCATION, among the Hebrews, was a particular law, whereby a widow, whom her husband’s brother refused to marry, had a right to summon him to a court of justice; and, upon his refusal, might excalate him, that is, pull off one of his shoes, and spit in his face; both of them actions of great ignominy.

EXCELLENCY, a title anciently given to kings and emperors, but now to ambassadors, generals, and other persons who are not qualified for that of highness, and yet are to be elevated above the other inferior dignities.

EXCENTRIC, in Geometry, a term applied to circles and spheres which have not the same centre, and consequently are not parallel; in opposition to concentric, where they are parallel, having one common centre.

EXCENTRICITY, in Astronomy, is the distance of the centre of the orbit of a planet from the centre of the sun; that is, the distance between the centre of the ellipse and the focus thereof.

EXCEPTION, something reserved, or set aside, and not included in a rule.

It is become proverbial, that there is no rule without an exception; intimating that it is impossible to comprehend all the particular cases, under one and the same maxim. But it is dangerous following the exception preferably to the rule.

Exception, in Law, denotes a stop or stay to an action; and is either dilatory or peremptory, in proceedings at common law; but in chancery it is what the plaintiff alleges against the sufficiency of an answer, &c.

An exception is no more than the denial of what is taken to be good by the other party, either in point of law or pleading. The counsel in a cause are to take all their exceptions to the record at one time, and be excepted from the court has delivered any opinion of it.

EXCEPT, in matters of literature. See Exchange.

EXCESS, in Arithmetic and Geometry, is the difference between any two unequal numbers or quantities, or that which is left after the lesser is taken from or out of the greater.

EXCHANGE, in a general sense, a contract or agreement, whereby one thing is given or exchanged for another.

Exchange, in commerce, is the receiving or paying of money in one country for the like sum in another, by means of bills of exchange.

The security which merchants commonly take from one another when they circulate their business, is a bill of exchange, or a note of hand; these are looked upon as payment. See Bill, and Mercantile Laws.

The punctuality of acquitting these obligations is essential to commerce; and no sooner is a merchant’s accepted bill protested, than he is considered as a bankrupt. For this reason, the laws of most nations have given very extraordinary privileges to bills of exchange.

The security of trade is essential to every society; and were the claims of merchants to hang under the formalities of courts of law when liquidated by bills of exchange, faith, confidence, and punctuality would quickly disappear, and the great engine of commerce would be totally destroyed.

A regular bill of exchange is a mercantile contract, in which four persons are concerned, viz. 1. The drawer, who receives the value; 2. His debtor, in a distant place, upon whom the bill is drawn, and who must accept and pay it; 3. The person who gives value for the bill, to whose order it is to be paid: and, 4. The person to whom it is ordered to be paid, creditor to the third.

By this operation, reciprocal debts, due in two distant parts, are paid by a sort of transfer, or permutation of debtors and creditors.

(A) in London is creditor to (B) in Paris, value 100l. (C) again in London is debtor to (D) in Paris for a like sum. By the operation of the bill of exchange, the London creditor is paid by the London debtor; and the Paris creditor is paid by the Paris debtor; consequently the two debts are paid, and no money is sent from London to Paris nor from Paris to London.

In this example, (A) is the drawer, (B) is the acceptor, (C) is the purchaser of the bill, and (D) receives the money. Two persons here receive the money, (A) and (D); and two pay the money, (B) and (C); which is just what must be done when two debtors and two creditors clear accounts.

This is the plain principle of a bill of exchange. From which it appears that reciprocal and equal debts only can be acquited by them.

When it therefore happens, that the reciprocal debts of London and Paris (to use the same example) are not equal, there arises a balance on one side. Suppose London to owe Paris a balance, value 100l. How can this be paid? Answer, it may either be done with or without the intervention of a bill.

With a bill, if an exchanger, finding a demand for a bill upon Paris for the value of 100l. when Paris owes
Exchange owes no more to London, sends 100l. to his correspond-
ent at Paris in coin, at the expense (suppose) of 1l.
and then, having become creditor on Paris, he can
give a bill for the value of 100l. upon his being repaid
his expense, and paid for his risk and trouble.

Or it may be paid without a bill, if the London
debtor sends the coin himself to his Paris creditor,
without employing an exchanger.

This last example shows of what little use bills are in
the payment of balances. As far as the debts are equal,
nothing can be more useful than bills of exchange; but
the more they are useful in this easy way of business,
the loss profit there is to any person to make a trade of
exchange, when he is not himself concerned either as
debtor or creditor.

When merchants have occasion to draw and remit
bills for the liquidation of their own debts, active and
passive, in distant parts, they are upon 'Change, where,
to pursue the former examples, the creditors upon Paris,
when they want money for bills, look out for those who
are debtors to it. The debtors to Paris again, when
they want bills for money, seek for those who are
creditors upon it.

This market is constantly attended by brokers, who
relieve the merchant of the trouble of searching for
these he wants. To the broker every one communicates
his wants, so far as he finds it prudent; and by
going about among all the merchants, the broker discov-
ers the side upon which the greater demand lies,
for money or for bills.

He who is the demandeer in any bargain, has con-
nstantly the disadvantage in dealing with him of whom
he demands. This is nowhere so much the case as in
exchange, and renders secrecy very essential to individu-
als among the merchants. If the London merchants
want to pay their debts to Paris, when there is a bal-
ance against London, it is their interest to conceal
their debts, and especially the necessity they may be
under to pay them; from the fear that those who are
creditors upon Paris would demand too high a price
for the exchange over and above par.

On the other hand, those who are creditors upon
Paris, when Paris owes a balance to London, are so
careful in concealing what is owing to them by Paris,
from the fear that those who are debtors to Paris would
avail themselves of the competition among the Paris cre-
ditors, in order to obtain bills for their money, below
the value of them, when at par. A creditor upon Par-
ris, who is greatly pressed for money at London, will
willingly abate something of his debt, in order to get
one who will give him money for it.

From the operation carried on among merchants upon
'Change, we may discover the consequence of their
separate and jarring interests. They are constantly in-
terested in the state of the balances. Those who are
creditors on Paris, fear the balance due to London; those
who are debtors to Paris, dread a balance due to
Paris. The interest of the first is to dissemble what
they fear; that of the last, to exaggerate what they
wish. The brokers are those who determine the
course of the day; and the most intelligent merchants
are those who despatch their business before the fact is
known.

Now, how is trade in general interested in the que-
ation, Who shall extricate, and who shall be extritted, Exchange
in this complicated operation of exchange among mer-
chants?

The interest of trade and of the nation is principal-
ly concerned in the proper method of paying and re-
ceiving the balances. It is also concerned in preserv-
ing a just equality of profit and loss among all the
merchants, relative to the real state of the balance.
Unequal competition among men engaged in the same
pursuit, constantly draws along with it bad consequen-
ces to the general undertaking; and secrecy in trade
will be found, upon examination, to be much more use-
ful to merchants in their private capacity, than to the
trade they are carrying on.

Merchants endeavor to simplify their business as
much as possible; and commit to brokers many opera-
tions which require no peculiar talents to execute. This
of exchange is of such a nature, that it is hardly pos-
sible for a merchant to carry on the business of his bills
without their assistance, upon many occasions. When
merchants come upon 'Change, they are always af-
fraid of fear and jealousies, that they will not open themselves to
one another, lest they should discover what they want to
conceal. The broker is a confidential man, in some de-
gree, between parties, and brings them together.

Besides the merchants who circulate among them-
several their reciprocal debts and credits arising from
their importation and exportation of goods, there is
another set of merchants who deal in exchange,
which is the importation and exportation of money and
bills.

Were there never any balance on the trade of na-
tions, exchangers and brokers would find little employ-
ment; reciprocal and equal debts would easily be tran-
acted openly between the parties themselves. No man
feigns and dissembles, except when he thinks he has an
interest in so doing.

But when balances come to be paid, exchange be-
comes intricate; and merchants are so much engaged
in particular branches of business, that they are obliged
to leave the liquidation of their debts to a particular
set of men, who make it turn out to the best advantage
to themselves.

Whenever a balance is to be paid, that payment
costs, as we have seen, an additional expense to those
of the place who owe it, over and above the value of
the debt.

If, therefore, this expense be a loss to the trading
man, he must either be repaid this loss by those whom
he serves, that is, by the nation; or the trade he car-
ries on will become less profitable.

Every one will agree, that the expense of high ex-
change upon paying a balance is a loss to a people,
no way to be compensated by the advantages they reap
from enriching the few individuals among them who
gain by contriving methods to pay it off; and if an ar-
gument is necessary to prove this proposition, it may
be drawn from this principle, viz. whatever renders
the profit upon trade precarious or uncertain, is a
loss to trade in general; this loss is the consequence
of high exchange; and although a profit does re-
sult from it upon one branch of trade, the exchange
business, yet that cannot compensate the loss upon
every other.

We
EXCHANGE.

We may, therefore, here repeat what we have said above, that the more difficulty is found in paying a balance, the greater is the loss to a nation.

The Course of Exchange.

The course of exchange is the current price between two places, which is always fluctuating and unsettled, being sometimes above, and sometimes below par, according to the circumstances of trade.

When the course of exchange rises above par, the country where it rises may conclude for certain that the balance of trade runs against them. The truth of this will appear, if we suppose Britain to import from any foreign place goods to the value of 100,000l. at Exchange par, and export only to the value of 80,000l. In this case, bills on the said foreign place will be scarce in Britain, and consequently will rise in value; and after the 80,000l. is paid, bills must be procured from other places at a high rate to pay the remainder, so that perhaps 120,000l. may be paid for bills to discharge a debt of 100,000l.

Though the course of exchange be in a perpetual flux, and rises or falls according to the circumstances of trade; yet the exchanges of London, Holland, Hamburg, and Venice, in a great measure regulate those of all other places in Europe.

EXCH.

I. Exchange with Holland.

MONEY TABLE.

<table>
<thead>
<tr>
<th>Per in Sterling.</th>
<th>s.</th>
<th>d.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 great or penny</td>
<td>0</td>
<td>54</td>
</tr>
<tr>
<td>1 stiver</td>
<td>0</td>
<td>99</td>
</tr>
<tr>
<td>1 schilling</td>
<td>0</td>
<td>36</td>
</tr>
<tr>
<td>1 pound Flemish</td>
<td>10</td>
<td>11.18</td>
</tr>
<tr>
<td>1 guider or florin</td>
<td>1</td>
<td>88</td>
</tr>
<tr>
<td>1 rix dollar</td>
<td>4</td>
<td>66</td>
</tr>
</tbody>
</table>

Or, by practice.

50 2210
44.3 = 2 per cent.
22.1 = 1 per cent.
2.7625 = 1/6 per cent.

2279.0625

If the agio only be required, make the agio the middle term, thus:

Guil. st. pen.

As 100 : 3½ :: 2210 : 69. 1 4 agio. Or work by practice as above.

PROB. II. To reduce current money to bank money.

RULE. As 100+agio to 100, so the given guilders to the answer.

EXAMPLE. What will 2279 guilders in bank money amount to in Holland currency, the agio being 3½ per cent?

<table>
<thead>
<tr>
<th></th>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>As 100 : 103½ :: 2279 : 1 4 cur.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>800 825</td>
<td>21050</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4420 17080</td>
<td></td>
<td></td>
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<tr>
<td>Guild. st. pen.</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>8(00)1823250(2279) 1 4 cur.</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>16...20</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>22 1000</td>
<td></td>
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<tr>
<td>16 8</td>
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<td></td>
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<td>63 2</td>
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<td>56 16</td>
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<tr>
<td>73 32</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>72 32</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

At
Exchange.

At Amsterdam, Rotterdam, Middleburgh, &c. books and accounts are kept by some in guilders, stivers, and pennings, and by others in pounds, shillings, and pence Flemish.

Britain gives 1l. sterling for an uncertain number of shillings and pence Flemish. The par 1l. sterling for 36.59s. Flemish; that is, 1l. 16s. 7d. 8d. Flemish.

When the Flemish rate rises above par, Britain gains and Holland loses by the exchange, and vice versa.

Sterling money is changed into Flemish, by saying, As 1l. sterling to the given rate, So is the given sterling to the Flemish sought.

Or, the Flemish money may be cast up by practice. Dutch money, whether pounds, shillings, pence Flemish, or guilders, stivers, penniaig, may be changed into sterling, by saying, As the given rate to 1l. sterling, So the given Dutch to the sterling sought.

Example I. A merchant in Britain draws on Amsterdam for 78l. sterling: How many pounds Flemish, and how many guilders, will that amount to, exchange at 54s. 8d. per pound sterling?

Decimally.

<table>
<thead>
<tr>
<th>L. s. d.</th>
<th>L.</th>
</tr>
</thead>
<tbody>
<tr>
<td>If 1:34 8::782</td>
<td>782</td>
</tr>
<tr>
<td>12</td>
<td></td>
</tr>
<tr>
<td>416</td>
<td></td>
</tr>
<tr>
<td>782</td>
<td>693</td>
</tr>
<tr>
<td>27733</td>
<td>245906</td>
</tr>
<tr>
<td>277109-3</td>
<td></td>
</tr>
<tr>
<td>133594Flem</td>
<td></td>
</tr>
</tbody>
</table>

By practice.

<table>
<thead>
<tr>
<th>L. s. d.</th>
<th>L. s. d.</th>
</tr>
</thead>
<tbody>
<tr>
<td>782</td>
<td>5478</td>
</tr>
<tr>
<td>391</td>
<td>2614</td>
</tr>
<tr>
<td>1568</td>
<td></td>
</tr>
<tr>
<td>2614</td>
<td></td>
</tr>
<tr>
<td>13594Flem</td>
<td></td>
</tr>
</tbody>
</table>

Multiply the Flemish pounds and shillings by 6, and the product will be guilders and stivers; and if there be any pence, multiply them by 8 for pennings; or, divide the Flemish pence by 40, and the quot will be guilders, and the half of the remainder, if there be any, will be stivers, and one penny odd will be half a stiver, or 8 pennings, as follows:

<table>
<thead>
<tr>
<th>L. s. d.</th>
<th>Flemish.</th>
</tr>
</thead>
<tbody>
<tr>
<td>135594</td>
<td>1661</td>
</tr>
</tbody>
</table>

Holland exchanges with other nations as follows, viz. with

Flem. d.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Hamburg, on the dollar, = 664/6</td>
<td></td>
</tr>
<tr>
<td>France, on the crown, = 54</td>
<td></td>
</tr>
<tr>
<td>Spain, on the ducat, = 1094/6</td>
<td></td>
</tr>
<tr>
<td>Portugal, on the crusade, = 50</td>
<td></td>
</tr>
<tr>
<td>Venice, on the ducat, = 93</td>
<td></td>
</tr>
<tr>
<td>Genoa, on the pezzo, = 100</td>
<td></td>
</tr>
<tr>
<td>Leghorn, on the piastre, = 120</td>
<td></td>
</tr>
<tr>
<td>Florence, on the crown, = 136</td>
<td></td>
</tr>
<tr>
<td>Naples, on the ducat, = 124</td>
<td></td>
</tr>
<tr>
<td>Rome, on the crown, = 102</td>
<td></td>
</tr>
<tr>
<td>Milan, on the ducat, = 94</td>
<td></td>
</tr>
<tr>
<td>Bologna, on the ducat, = 94</td>
<td></td>
</tr>
</tbody>
</table>

Exchange between Britain and Antwerp, as also the Austrian Netherlands, is negotiated the same way as with Holland; only the par is somewhat different, as will be described in article 2d following.

II. Exchange with Hamburg.

Money Table.

<table>
<thead>
<tr>
<th>Par in Sterling. s d.</th>
</tr>
</thead>
<tbody>
<tr>
<td>2a Phennig</td>
</tr>
<tr>
<td>16 Schilling-lubs</td>
</tr>
<tr>
<td>2 Marks</td>
</tr>
<tr>
<td>3 Marks</td>
</tr>
<tr>
<td>6½ Marks</td>
</tr>
</tbody>
</table>

Books
EXC

Exchange. Books and accounts are kept at the bank, and by most people in the city, in marks, schilling-lubes, and phennings; but some keep them in pounds, schillings, and groats Flemish.

The agio at Hamburg runs between 20 and 40 per cent. All bills are paid in bank money.

Hamburg exchanges with Britain by giving an uncertain number of schillings and groats Flemish for the pound sterling. The groat or penny Flemish here, as also at Antwerp, is worth 4½ of a penny sterling; and is something better than in Holland, where it is only 4d. sterling.

6 Phennings = 1 groat or penny
6 Schilling-lubes = 1 schilling
1 Schilling-lube = 2 pence or groats
1 Mark = 32 pence or groats
7½ Marks = 1 pound.

The par with Hamburg, and also with Antwerp, is 35s. 6½d. Flemish for 1l. sterling.

EXAMPLES. 1. How many marks must be received at Hamburg for 300l. sterling, exchange at 35s. 3d. Flemish per l. sterling?

<table>
<thead>
<tr>
<th>L. s. d.</th>
<th>L.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 2 3 4 5 6 7 8 9 0</td>
<td>1 2 3 4 5 6 7 8 9 0</td>
</tr>
<tr>
<td>423</td>
<td>300</td>
</tr>
</tbody>
</table>

2. How much sterling money will a bill of 3965 marks 10 schilling-lubes amount to, exchange at 35s. 3d. per pound sterling?

<table>
<thead>
<tr>
<th>Fl. s. d.</th>
<th>L. St. Mks. sch.</th>
</tr>
</thead>
<tbody>
<tr>
<td>35 3 1 0</td>
<td>3965</td>
</tr>
<tr>
<td>1 2 3 4 5 6 7 8 9 0</td>
<td>1 2 3 4 5 6 7 8 9 0</td>
</tr>
<tr>
<td>423</td>
<td>7930</td>
</tr>
</tbody>
</table>

423x13690=3965(300l. ster.)

1369

Decimally.

17625

2225

4528751321875

1321875396562500(300l. ster.)

3965625

III. Exchange with France.

Money Table.

<table>
<thead>
<tr>
<th>Par in Ster. s. d.</th>
</tr>
</thead>
<tbody>
<tr>
<td>12 Deniers</td>
</tr>
<tr>
<td>x sol</td>
</tr>
<tr>
<td>5</td>
</tr>
</tbody>
</table>

At Paris, Rouen, Lyons, &c. books and accounts are kept in livres, sols, and deniers; and the exchange with Britain is on the crown, or ecu, of 5 livres, or 60 sols Tournois. Britain gives for the crown an uncertain number of pence, commonly between 30 and 34, the par, as mentioned above, being 20½d.

EXAMPLE I. What sterling money must be paid in London to receive in Paris 1978 crowns 25 sols, exchange at 31½d. per crown?

<table>
<thead>
<tr>
<th>Sols. d.</th>
<th>Cr. sols.</th>
</tr>
</thead>
<tbody>
<tr>
<td>60</td>
<td>31½</td>
</tr>
<tr>
<td>253</td>
<td>60</td>
</tr>
<tr>
<td>1118105</td>
<td>3</td>
</tr>
<tr>
<td>253</td>
<td></td>
</tr>
<tr>
<td>356115</td>
<td></td>
</tr>
<tr>
<td>592525</td>
<td></td>
</tr>
<tr>
<td>237410</td>
<td></td>
</tr>
</tbody>
</table>

1321875300

Marks in 1l. sterling

Marks in 300l. sterling

Schilling-lubes

Vol. VIII. Part I.
Exchange

By Practice.

<table>
<thead>
<tr>
<th>Cr.</th>
<th>Sols.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1978</td>
<td>23, at 314d.</td>
</tr>
</tbody>
</table>

30 = 1
12 = 7
12 = 7
0 = 0
0 = 0
0 = 0
260 = 13
11.8

If you work decimally, say,

As 1 = 31.625 :: 1978.416 :: 62367.427083.

2. How many French livres will 121 : 18 : 6 sterling amount to, exchange at 324d. per crown?

<table>
<thead>
<tr>
<th>d. Liv.</th>
<th>L.</th>
<th>s. d.</th>
</tr>
</thead>
<tbody>
<tr>
<td>324 : 3</td>
<td>121</td>
<td>18</td>
</tr>
</tbody>
</table>

865 = 20
2438 = 12
2362 = 24
11948 = 5924

Liv. sols. den.
263)702288(2670 5 11 Ans.
Rem. (78 = 5 sols 11 deniers.

IV. Exchange with Portugal.

Money Table.

<table>
<thead>
<tr>
<th>Par in Ster.</th>
<th>s.</th>
<th>d.</th>
</tr>
</thead>
<tbody>
<tr>
<td>400 rees 1 ree = 0 0 0.27</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1000 rees 1 crusade = 2 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>375 rees 1 millere = 5 7 1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

In Lisbon, Oporto, &c. books and accounts are generally kept in rees and milleres; and the milleres are distinguished from the rees by a mark set between them, thus, 485 = 372; that is, 485 milleres and 372 rees.

Britain, as well as other nations, exchanges with Portugal on the millere; the par, as in the table, being 67½d. sterling per millere.

Example 1. How much sterling money will pay a bill of 827 + 160 rees, exchange at 634d. sterling per millere?

<table>
<thead>
<tr>
<th>Rees.</th>
<th>d.</th>
<th>Rees.</th>
</tr>
</thead>
<tbody>
<tr>
<td>If 1000 : 634 :: 827.160</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

8 597
8000 597 379012
4133580

Rem.
8000)419370120 2
1212241 = 5d.
203468 = 8s.
L. 218 8 5½ Ans.

The rees being thousandth-parts of the milleres, are annexed to the integer, and the operation proceeds exactly as in decimals.

2. How many rees of Portugal will 500L. sterling amount to, exchange at 5s. 4½d. per millere?

<table>
<thead>
<tr>
<th>d.</th>
<th>Rees.</th>
</tr>
</thead>
<tbody>
<tr>
<td>8 20</td>
<td></td>
</tr>
</tbody>
</table>

517 = 8000
10000 12
120000 8000

Rees.
51796000000)1856.866 Ans.

V. Exchange with Spain.

Money Table.

<table>
<thead>
<tr>
<th>Par in Ster.</th>
<th>s.</th>
<th>d.</th>
</tr>
</thead>
<tbody>
<tr>
<td>35 meravides 1 rial = 0 5 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8 rials 1 piastre = 3 7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>375 meravides 1 ducat = 4 11 2</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

In Madrid, Bilboa, Cadiz, Malaga, Seville, and most of the principal places, books and accounts are kept in piastres, called also dollars, rials, and meravides; and they exchange with Britain generally on the piastre, and sometimes on the ducat. The course runs from 35½d. to 45d. for a piastre or dollar of 8 rials.

Example 1. London imports from Cadiz goods to the value of 2163 piastres and 4 rials: How much sterling will this amount to, exchange at 38½ sterling per piastre?

<table>
<thead>
<tr>
<th>Piast.</th>
<th>Rials.</th>
</tr>
</thead>
<tbody>
<tr>
<td>2163</td>
<td>4 at 38½d.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>d.</th>
<th>Rials.</th>
</tr>
</thead>
<tbody>
<tr>
<td>24 = 75</td>
<td></td>
</tr>
<tr>
<td>12 = 4</td>
<td></td>
</tr>
<tr>
<td>2 = 4</td>
<td></td>
</tr>
<tr>
<td>1 = 1</td>
<td></td>
</tr>
</tbody>
</table>

345 = 17 1 1/2
L. 345 18 8½ Ans.

2. London remits to Cadiz 345L. 18s. 8½d. How much Spanish money will this amount to, exchange at 38½d. sterling per piastre?
### Exchange with Venice

#### Money Table

<table>
<thead>
<tr>
<th>Deniers d'or</th>
<th>1 sol d'or</th>
<th>1 ducat = 50½d. sterling</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>1</td>
<td>4½</td>
</tr>
</tbody>
</table>

The money of Venice is of three sorts, viz. two of bank money and the picoli money. One of the banks deals in banco money, and the other in banco current. The bank money is 20½ per cent. better than the banco current, and the banco current 20 per cent. better than the picoli money. Exchanges are always negotiated by the ducat banco, the par being 42 ½d. sterling, as in the table.

Though the ducat be commonly divided into 24 gros, yet bankers and negotiators, for facility of computation, usually divide it as follows, and keep their books and accounts accordingly.

12 Deniers d'or = 1 sol d'or = 1 ducat = 50½d. sterling.

Bank money is reduced to current money, by allowing for the agio, as was done in exchange with Holland; viz. say, As 100 to 120, or as 10 to 12, or as 3 to 6, so the given bank money to the current sought. And current money is reduced to bank money by reversing the operation. And in like manner may picoli money be reduced to current or to bank money, and the contrary.

In Leghorn = 73 pezzos | In London = 77 crowns |
In Rome = 68½ crowns | In Frankfort = 139½ florins |

### Exchange with Genoa

#### Money Table

<table>
<thead>
<tr>
<th>Denari</th>
<th>1 soldi</th>
<th>1 pezzo = 4 ½ sterl.</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>1</td>
<td>4½</td>
</tr>
</tbody>
</table>

Books and accounts are generally kept in pezzos, soldi, and denari; but some keep them in livres, soldi, and denari; and 12 such denari make 1 soldi, and 20 soldi make 1 livre.

The pezzo of exchange is equal to 5½ lires; and, consequently exchange money is 5½ times better than the lire money. The course of exchange runs from 47½ to 58½ sterl. per pezzo.

**Examp.** How much sterling money is equivalent to 3390 pezzos 16 soldi of Genoa, exchange at 51½d. sterl. per pezzo?

<table>
<thead>
<tr>
<th>Soldi</th>
<th>Pes. soldi.</th>
</tr>
</thead>
<tbody>
<tr>
<td>16</td>
<td></td>
</tr>
</tbody>
</table>

If 20: 51½ :: 3390 16

8 20

415

63816

415

39080

67816

241264

L. 320 17 6 sterl. Ans.

L. 28143 6 40 (175897) = 732 18 ½
Exchange. If sterling money be given, it may be reduced or changed into pezzos of Genoa, by reversing the former operation.

Exchange money is reduced to lire money, by being multiplied by $\frac{364}{5}$, as follows:

<table>
<thead>
<tr>
<th>Denari</th>
<th>soldi</th>
<th>Ducati</th>
<th>Florin</th>
<th>Dukat</th>
<th>Dollar</th>
<th>Florin</th>
</tr>
</thead>
<tbody>
<tr>
<td>3390</td>
<td>16</td>
<td>3390.8</td>
<td>5.75</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\frac{1}{2}$</td>
<td>1605.4</td>
<td>1605.40</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\frac{1}{4}$</td>
<td>847.14</td>
<td>847.14</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Lire of 1,000 = Lire of 1,049.72

And lire money is reduced to exchange money by dividing it by $\frac{364}{5}$:

1. In Milan, 1 crown = 80
2. In Naples, 1 ducat = 86
3. In Leghorn, 1 piastre = 20
4. In Sicily, 1 crown = 127.0

VIII. Exchange with Leghorn.

<table>
<thead>
<tr>
<th>Denari</th>
<th>Soldi</th>
<th>Piastre</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>1</td>
<td>1.6</td>
</tr>
</tbody>
</table>

Books and accounts are kept in piastres, soldi, and denari. The piastre here consists of 6 lire, and the lire contains 20 soldi, and the soldi 12 denari; and consequently exchange money is 6 times better than lire money. The course of exchange is from 48d. to 58d. sterling per piastre.

Example. What is the sterling value of 732 piastres at 55.8d. each?

<table>
<thead>
<tr>
<th>Sterling</th>
<th>Piastres</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>180</td>
<td>10</td>
<td>94229</td>
</tr>
</tbody>
</table>

Exchange money is reduced to money of Leghorn, by reversing the former operation; and exchange money is reduced to lire money by multiplying by 6, and lire money to exchange money by dividing by $\frac{364}{5}$.

100 piastres of Leghorn are equal to 134 ducats in Naples and 18.58 crowns in Geneva.

Soldi of Leghorn:

<table>
<thead>
<tr>
<th>Crown</th>
<th>Dollar</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>9.5</td>
</tr>
</tbody>
</table>

The above are the chief places in Europe with which Britain exchanges directly; the exchanges with other places are generally made by bills on Hamburg, Holland, or Venice. We shall here, however, subjoin the par of exchange betwixt Britain and most of the other places in Europe with which she has any commercial intercourse.
If 140 : 100
14 : 10 L.
7 : 5 :: 1780
5

7)8900  8.
1371  8 6 1/2 Ster. Ans.

Bills of exchange from America, the rate being high, is an expensive way of remitting money to Britain; and therefore merchants in Britain generally choose to have the debts due to them remitted home in sugar, rum, or other produce.

X. Exchange with Ireland.

At Dublin, and all over Ireland, books and accounts, are kept in pounds, shillings, and pence, as in Britain, and they exchange on the 100l. sterling.

The par of one shilling sterling is one shilling and one penny Irish; and so the par of 100l. sterling is 108l. 6s. 8d. Irish. The course of exchange runs from 6 to 15 per cent.

Examp. 1. London remits to Dublin 586l. 10s. sterling; how much Irish money will that amount to, exchange at 9 1/2 per cent.

L.  
If 100 : 109 1/2 :: 586.5
8
800 : 877 41055
41055
46920
800)514360.5

642.950625.

Ans. 642l. 19s. Irish.

By practice.

p. cent.  586.5
10 = 7 8 58.65
2 = 11 7.5 sub.
8 = 46.92
1 = 5 365
1 = 2 232 5
9 1/2 = -733 725
9 1/2 = 56.450625 add.
642.950625

2. How much sterling will 625l. Irish amount to, exchange at 10 1/2 per cent?

If 110 1/2 : 100 :: 625
8
800

L. s. d.
883
800 883 500000 566 5 0 1/2 Ster. Ans.

XI. Exchange between London and other places in Britain.

The several towns in Britain exchange with London for a small premium in favour of London; such as Exchange, 1, 1 1/2, &c. per cent. The premium is more or less, according to the demand for bills.

Examp. Edinburgh draws on London for 86l. exchange at 1 1/4 per cent.: How much money must be paid at Edinburgh for the bill?

L.
860
1
2
3
4
5

11 16 6 premium.

87 16 6 paid for the bill.

To avoid paying the premium, it is an usual practice to take the bill payable at London a certain number of days after date: and in this way of doing, 73 days is equivalent to 1 per cent.

XII. Arbitration of Exchanges.

The course of exchange betwixt nation and nation naturally rises or falls according as the circumstances and balance of trade happen to vary. Now, to draw upon and remit to foreign places, in this fluctuating state of exchange, in the way that will turn out most profitable, is the design of arbitration. Which is either simple or compound.

I. Simple Arbitration.

In simple arbitration the rates or prices of exchange from one place to other two are given; whereby is found the correspondent price between the said two places, called the arbitrated price, or par of arbitration; and hence is derived a method of drawing and remitting to the best advantage.

Examp. 1. If exchange from London to Amsterdam be 33s. 9d. per pound sterling; and if exchange from London to Paris be 32d. per crown; what must be the rate of exchange from Amsterdam to Paris, in order to be put on a par with the other two?

5 4 5 2 33
12 12
230 405
810 33
1215

240)12960(54d. Flem. per crown. Ans.

2. If exchange from Paris to London be 32d. sterling per crown; and if exchange from Paris to Amsterdam be 54d. Flemish per crown; what must be the rate of exchange between London and Amsterdam, in order to be on a par with the other two?

If.
Exchange

d. d. d.
32 : 54 : 240
240

216
108
12 s. d.
32 12950 (405 33 9 Flem. per l. Ster. Ans.

From these operations it appears, that if any sum of money be remitted, at the rates of exchange mentioned, from any one of the three places to the second, and from the second to the third, and again from the third to the first, the sum so remitted will come home entire, without increase or diminution.

From the par of arbitration thus found, and the course of exchange given, in deduced a method of drawing and remitting to advantage, as in the following example.

3. If exchange from London to Paris be 32d. sterling per crown, and to Amsterdam 405d. Flemish per pound sterling: and if, by advice from Holland to France, the course of exchange between Paris and Amsterdam is fallen to 52d. Flemish per crown; what may be gained per cent. by drawing on Paris, and remitting to Amsterdam?

The par of arbitration between Paris and Amsterdam in this case by Ex. 1. is 54d. Flemish per crown. Work as under.

d. St. Cr. L. St. Cr.

If 32 :: 100 :: 750 debit at Paris.
Cr. d.Fl. C. d.Fl.

If 1 :: 52 :: 750 :: 39000 credit at Amsterdam.

If 405 :: 1 :: 39000 :: 56 5 11½ to be remitted.

3 14 0½

But if the course of exchange between Paris and Amsterdam, instead of falling below, rise above the par of arbitration, suppose to 56d. Flemish per crown; in this case if you propose to gain by the negotiation, you must draw on Amsterdam, and remit to Paris. The computation follows:

L. St. d.Fl. L. St. d.Fl.

If 405 :: 100 :: 40500 debit at Amsterdam.
d.Fl. Cr. d.Fl. Cr.

If 56 :: 1 :: 40500 :: 723½ credit at Paris.

If 1 :: 32 :: 723½ :: 96 8 64 to be remitted.

3 11 5½ gained per cent.

In negotiations of this sort, a sum for remittance is afforded out of the sum you receive for the draught; and your credit at the one foreign place pays your debt at the other.

II. Compound Arbitration.

In compound arbitration the rate or price of exchange between three, four, or more places, is given,
Exchange, the rules direct, save so many
stating the rule of three, and greatly shorten the
operation. The proportions at large for the above
question would be stated as under.

<table>
<thead>
<tr>
<th>L. St.</th>
<th>d. Fl.</th>
<th>L. St.</th>
<th>d. Fl.</th>
</tr>
</thead>
<tbody>
<tr>
<td>If 1 : 420 : 1000 : 420000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>d. Fl.</td>
<td>Cr.</td>
<td>d. F.</td>
<td>Cr.</td>
</tr>
<tr>
<td>If 28 : 1 : 420000 : 7241 1/3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cr.</td>
<td>Duc.</td>
<td>Cr.</td>
<td>Duc.</td>
</tr>
<tr>
<td>If 100 : 60 : 724 1/3 : 4344 1/3</td>
<td></td>
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<tr>
<td>If 1 : 360 : 4344 1/3 : 156437 1/2</td>
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<tr>
<td>If 272 : 1 : 156437 1/2 : 5750 5/8</td>
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</tbody>
</table>

If we suppose the course of direct exchange in Spain
to be 492 d. sterling per piastres, the 1000 d. remitted
would only amount to 5647 piastres; and, consequently,
103 piastres are gained by the negotiation; that is,
about 2 per cent.

1. A banker in Amsterdam remits to London 400d.
Flemish; first to France at 50d. Flemish per crown;
from France to Venice, at 100 crowns per 60 ducats;
from Venice to Hamburg, at 100d. Flemish per ducat;
from Hamburg to Lisbon, at 50d. Flemish per
amount of 400 rees; and, lastly, from Lisbon to Lon-
don at 63d. sterling per miller. How much sterling
money will the remittance amount to; and how much
will be gained or saved, supposing the direct exchange
from Holland to London at 36s. 10d. Flemish per
pound sterling?

<table>
<thead>
<tr>
<th>Antecedents</th>
<th>Consequents</th>
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<tbody>
<tr>
<td>36d. Flem.</td>
<td>= 1 crown</td>
</tr>
<tr>
<td>100 crowns</td>
<td>= 60 ducats</td>
</tr>
<tr>
<td>1 ducat</td>
<td>= 100d. Flem.</td>
</tr>
<tr>
<td>50d. Flem.</td>
<td>= 400 rees</td>
</tr>
<tr>
<td>1000 rees</td>
<td>= 64d. sterling</td>
</tr>
</tbody>
</table>

How many d. ster. = 400d. or 96000d. Flemish?

This in the fractional form, will stand as follows.

\[
60 \times 100 \times 400 \times 64 \times 9600 = 368640, \quad \text{and} \\
65 \times 100 \times 50 \times 1000 = 32665 \times 7
\]

To find how much the exchange from Amsterdam
directly to London, at 36s. 10d. Flemish per l.
stereing, will amount to, say,

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<tbody>
<tr>
<td>36</td>
<td>10</td>
<td>If 442 : 1 : 96000 : 217 3 10\frac{1}{2}</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td></td>
<td>219 8 6\frac{1}{2}</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

442

Gained or saved, 2 4 8\frac{1}{2}

In the above example, the par of arbitration, or the
arbitrated price, between London and Amsterdam,
viz. the number of Flemish pence given for 1l.
stereing, may be found thus:

Make 64d. sterling, the price of the millree, the
first antecedent; then all the former consequents will
become antecedents, and all the antecedents will be-
come consequents. Place 240, the pence in 1l.
stereing, as the last consequent, and then proceed as taught
above, viz.

2
Exchange, founded on the authority of Livy, whose words are as follows: *Cartumen consulibus mediatum uter dedicaret Mercurii adem. Senatus 2 se rem ad populum referit: utriusque dedicator jussu populi datu esset, cum processa annonis, mercatorum collegium instituere jussit.* Liv. lib. ii. But it must be here remarked, that collegium never signified a building for a society in the proper ages of the Latin tongue; so that collegium mercatorum instituire must not be rendered to build an exchange for the merchants, but to incorporate the merchants into a company. As Mercury was the god of traffic, this aes Mercurii seems to have been chiefly designed for the devotions of this company or corporation.

**Exchange, Bills of.** The following information concerning the origin of bills of exchange is extracted from Beckmann's History of Inventions.

"I shall not here repeat (says he) what has been collected by many learned men respecting the important history of this noble invention, but only lay before my readers an ordinance of the year 1394, concerning the acceptance of bills of exchange, and also two bills of the year 1404, as they may serve to illustrate farther what has been before said on the subject by others. These documents are, indeed, more modern than those found by Raphael de Turre in the writings of the jurist Baldus, which are dated March the 5th 1328; but they are attended with such circumstances as sufficiently prove that the method of transacting business by bills of exchange was fully established so early as the fourteenth century; and that the present form and terms were then even used. For this important information, I am indebted to Mr. Von Martens, who found it in a book which, as far as I know, has never been noticed in any literary journal, though it is much more deserving of attention than many others better known. It is a history, written in Spanish, of the maritime trade and other branches of commerce at Barcelona, taken entirely from the archives of that city, and accompanied with documents from the same source, which abound with matter highly interesting (A).

"Among these is an ordinance issued by the city of Barcelona in the year 1394, that bills of exchange should be accepted within twenty-four hours after they were presented; and that the acceptance should be written on the back of the bill.

"In the year 1404, the magistrates of Bruges, in Flanders, requested the magistrates of Barcelona to inform them what was the common practice, in regard to bills of exchange, when the person who presented a bill raised money on it in an unusual manner, in the case of its not being paid, and by these means increased the expenses so much that the drawer would not consent to sustain the loss. The bill which gave occasion to this question is inserted in the memorial. It is written in the short form still used; which certainly seems to imply great antiquity. It speaks of usance; and it appears that first and second bills were at that time drawn, and that when bills were not accepted, it was customary to protest them.

"As this article is of great importance I shall here transcribe it, from vol. ii. p. 203: "Cum de measibus Aprilis et Maii ultimo elapsis Antonius Quarti, mercator Lucanus residen is in villa Brugensi, a Joanne Colom, mercatore civitatis Barchinone, etiam residente in predicta villa Brugensi, duo millia scutorum Philippii, quolibet scuto pro xxii grossis computato, solvendi per Franciscum de Prato mercatorum Florentiae, more solito, in Barchinone, mediatim Petro Gilberto et Petro Olivo, et mediatim Petro Scorp, et supradicto Petro Gilberto, mercatoribus Cardonese: prout de dictis cambiis apparebat quatuor litterae papireis, quarum tenores subsequenter.


Bills of exchange are justly considered as of the greatest importance to the interest of commerce; but several queries have been proposed respecting them, which do not as yet appear to have received a satisfactory solution. It still seems to be a disputed point, whether the law ought to consider them as nothing more than a deposit belonging to the drawer, and successively confided to the remittents; or as property capable of being transferred, and entirely vested in the holder at all times, who should be alone responsible for neglecting it, when its value is vitiated.

Professor Busch of Hamburgh thought that bills of exchange should always be viewed as the exclusive property of the person holding them, which, in a work published..."
Officers of the receipt may take one penny in the Exchequer pound, as their fee, for sums issued out; and they are obliged, without delay, to receive the money brought thereto; and the money received is to be put into chests under three different locks and keys, kept by three several officers. All sheriffs, bailiffs, &c. are to account in the exchequer; and in the lower part, termed the receipt, the debtors of the king, and persons in debt to them, the king's tenants, and the officers and ministers of the court, are privileged to sue one another, or any stranger, and to be sued in the like actions as are brought in the court of king's bench and common pleas.

The judicial part of the exchequer is a court both of law and equity. The court of law is held in the office of pleas, according to the course of common law, before the barons: in this court, the plaintiff ought to be a debtor or accountant to the king; and the leading process is either a writ of subpoena, or quo warranto, which last goes into Wales, where no process out of courts of law ought to run, except a capias uti possidetis.

The court of equity is held in the exchequer chamber, before the treasurer, chancellor, and barons; but generally, before the barons only: the lord chief baron being the chief judge to hear and determine all causes. The proceedings of this part of the exchequer are by English bill and answer, according to the practice of the court of chancery; with this difference, that the plaintiff here must set forth, that he is a debtor to the king, whether he be so or not. It is in this court of equity that the clergy exhibit bills for the recovery of their tithes, &c. Here too the attorney-general exhibits bills for any matters concerning the crown; and a bill may be exhibited against the king's attorney by any person aggrieved in any cause prosecuted against him on behalf of the king, to be relieved therein; in which case the plaintiff is to attend on the attorney general, with a copy of the bill, and procure him to give an answer thereto; in the making of which he may call in any person interested in the cause, or any officer, or others, to instruct him, that the king be not prejudiced thereby; and his answer is to be put in without oath.

But, besides the business relating to debtors, farmers, receivers, accountants, &c. all penal punishments, intrusions, and forfeitures upon popular actions, are matters

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(b) In Vol. III. p. 613. under the article Bill, the old duty on stamps is mentioned, and the new entirely omitted.

The following are the duties on such stamps for the year 1820. The duty on promissory notes for the payment of money to the bearer on demand, for a sum not exceeding 11. 12s. 4d. For a sum exceeding 11. 12s. and not 21. 12s.; 10s. For a sum exceeding 21. 12s. and not 51. 5s.; 1s. 3d. For a sum exceeding 51. 5s. and not 10l.; 1s. 6d. Which notes may be redeemed after payment as often as shall be thought fit.

Bill of exchange, draft, or promissory or other note, payable to the bearer on demand or otherwise, not exceeding 2 months after date, or 60 days after sight, 40s. and not exceeding 51. 5s.; 1s.

Bill of exchange, draft, order, or promissory note for the payment of money, where the sum shall exceed 51. 5s. and not 20l.; 1s. 6d. Exceeding 20l. and not 30l.; 2s. Above 30l. and not 50l.; 2s. 6d. Above 50l. and not 100l.; 3s. 6d. Above 100l. and not 200l.; 4s. 6d. Above 200l. and not 500l.; 5s. Above 500l. and not 1000l.; 6s. 6d. Above 1000l. and not 2000l.; 8s. 6d.

Foreign bills of exchange drawn in sets, where the sum shall not exceed 100l.; for each bill in each set, 1s. 6d. Exceeding 100l. and not 200l.; 3s. Exceeding 200l. and not 500l.; 4s. Exceeding 500l. and not 1000l.; 5s.
Excise, terms likewise cognizable by this court; where there
also sits a puisne-baron, who administers the oaths to
high sheriffs, bailiffs, auditors, receivers, collectors,
comptrollers, surveyors, and searchers of all the cus-
toms, &c.

The exchequer in Scotland has the same privileges
and jurisdiction as that of England; and all matters
competent to the one are likewise competent to the
other.

Black Book of the Exchequer, is a book under the
keeping of the two chamberlains of the exchequer;
said to have been composed in 1261 by Gerard of
Tilbury, nephew of King Henry II, and divided into
seven chapters. Herein is contained a description of
the court of England, as it then stood, its officers, their-
ranks, privileges, wages, perquisites, power, and juris-
diction; and the revenues of the crown, both in money,
grain, and cattle. Here we find, that for one shilling,
as much bread might be bought as would serve 100
men a whole day; that the price of a fat bullock was
only 12 shillings, and a sheep seven.

Chancellor of the Exchequer. See Chancellor.

Exchequer Bills. By statute 5 Ann. c. 13, the lord
treasurers may cause exchequer bills to be made of any
sums not exceeding 1,000,000l. for the use of the war;
and the duties upon houses were made chargeable with
4l. 10s. per cent. per annum to the bank for circulating
them. The bank not paying the bills, actions to be
brought against the Company, and the money and da-
 mage recovered; and if any exchequer bills be lost,
upon affidavit of the bill before a baron of the exchequer,
and certificate from such baron, and security to pay the
same if found, duplicates are to be made out; also when bills
are defaced, new ones shall be delivered. The king,
or his officers in the exchequer, by former statutes,
might borrow money upon the credit of bills, payable
on demand, with interest at the rate of 3d per diem
for every 100l. bill. And by 8 and 9 W. III. c. 20,
an interest of 3d. a day was allowed for every 100l.
But 12 W. III. c. 1, reduced the interest on these bills
to 4d. a-day per cent. And by 12 Ann. c. 11, it is
sunk to 2d. a-day. Forging excise bills, or the
endorsements thereof, is felony.

Excise, (from the Belgic accisae, tributum, "tribute," an
inland duty or imposition, paid sometimes
upon the consumption of the commodity, or frequently
upon the wholesale, which is the last stage before the
consumption. This is doubtless, impartially speaking,
the most economical way of taxing the subject; the
charges of levying, collecting, and managing the excise
duties, being considerably less in proportion than in
other branches of the revenue. It also renders the
commodity cheaper to the consumer, than charging it
with customs to the same amount would do; for the
reason now given, because generally paid is a much
later stage of it. But at the same time, the rigour
and arbitrary proceedings of excise laws seem hardly
compatible with the temper of a free nation. For the
frauds that might be committed in this branch of the
revenue, unless a strict watch is kept, make it necessary,
wherever it is established, to give the officers a power
of entering and searching the houses of such as deal
in excisable commodities, at any hour of the day,
and, in many cases, of the night likewise. And the
proceedings, in case of transgressions, are so summary
and sudden, that a man may be convicted in two days'time in the penalty of many thousand pounds, by two
commissioners or justices of the peace; to the total ex-
clusion of the trial by jury, and disregard of the com-
mon law. For which reason, though Lord Clarendon
tells us, that to his knowledge the earl of Bedford
(who was made lord treasurer by King Charles I, to
oblige his parliament) intended to have set up the ex-
cise in England, yet it never made a part of that un-
fortunate prince's revenue; being first introduced, on
the model of the Dutch prototype, by the parliament
after its rupture with the crown. Yet even the
opinion of its general unpopularity, that when in
1642 "aspersions were cast by malignant persons upon
the house of commons, that they intended to introduce
excises, the house for its vindication therein did de-
clare, that these rumours were false and scandalous,
and that their authors should be apprehended and
brought to condign punishment." Its original esta-
lishment was in 1633, and its progress was gradual;
being at first laid upon those persons and commodities
where it was supposed the hardship would be least per-
ceivable, viz. the makers and venders of beer, ale,
cyder, and perry; and the royalists at Oxford soon
followed the example of their brethren at Westminster,
by imposing a similar duty: both sides protesting that
it should be continued no longer than to the end of the
war, and then be utterly abolished. But the parlia-
ment at Westminster soon after imposed it on flesh,
wine, tobacco, sugar, and such a multitude of other
commodities, that it might be fairly denominated gen-
eral: in pursuance of the plan laid down by Mr Pymne
(who seems to have been the father of the excise), in
his letter to Sir John Hotham, signifying, "that they
had proceeded in the excise to many particulars,
and intended to go on farther; but that it would be ne-
necessary to use the people to it by little and little."—
And afterwards, when the nation had been accustomed
to it for a series of years, the succeeding champions of
liberty boldly and openly declared "the impost of ex-
cise to be the most easy and indifferent levy that could
be laid upon the people;" and accordingly continued it
during the whole usurpation. Upon King Charles's
return, it having then been long established, and its
produce well known, some part of it was given to the
crown, in 12 Car. II. by way of purchase for the feudal
tenures and other oppressive parts of the hereditary
revenue. But, from its first original to the present time,
its very name has been odious to the people. It has,
nevertheless, been imposed on abundance of other com-
modities in the reigns of King William III, and every
succeeding prince, to support the enormous expenses
occasioned by our wars on the continent. These bran-
tles and other spirits are now excised at the distillery;
printed silks and linens, at the printer's; starch and
hair powder, at the make's; gold and silver wire, at
the wirecutter's; all plate whatsoever, first in the hands
of the vender, who pays yearly for a license to sell it,
and afterwards in the hands of the occupier, who also
pays an annual duty for having it in his custody; and
coaches and other wheel carriages, for which the occu-
piers is excised; though not with the same circumstances
of arbitrary strictness with regard to plate and coaches
as in the other instances. To these we may add coffee
and tea, chocolate and cocoa-paste, for which the do-

EXCOMMUNICATION

Excise

Excise is paid by the retailer; all artificial wines, commonly called "sweet"; paper and pasteboard, first when made, and again, if stained or printed; malt, as before mentioned; vinegars; and the manufacture of glass; all for which the duty is paid by the manufacturer; hops, for which the person that gathers them is answerable; candles and soap, which are paid for at the makers; malt liquors brewed for sale, which are excised at the brewery; cider and Perry at the vender's; leather and skins, at the tanner's; and, lately, tobacco, at the manufacturer's: A list, which no friend to his country would wish to see farther increased.

The excise was formerly farmed out; but is now managed for the king by commissioners in both kingdoms, who receive the whole product of the excise, and pay it into the exchequer. These commissioners are nine in number in England, and five in Scotland. The former have a salary of 1000l. a-year, the latter 600l. They are obliged by oath to take no fee or reward but from the king himself; and from them there lies an appeal to five other commissioners called commissioners of appeals.

EXCISION, in Surgery, the cutting out, or cutting off, any part of the body.

Exclusion, in a scripture sense, means the cutting off of a person from his people, by way of punishment for some sin by him committed. The Jews, Selden informs us, reckon 36 crimes, to which they pretend this punishment is due. The Rabbins reckon three kinds of exclusion; one, which destroys only the body; another, which destroys the soul only; and a third, which destroys both body and soul. The first kind of exclusion they pretend is an untimely death; the second is an utter extinction of the soul; and the third, a compound of the two former: thus, making the soul mortal or immortal, says Selden, according to the degrees of misbehaviour and wickedness of the people.

EXCLAMATION. See Oratory, No. 85.

EXCLUSION, or Bill of Exclusion, a bill proposed about the close of the reign of Charles II., for excluding the duke of York, the king's brother, from the throne, on account of his being a Papist.

EXCLUSIVE, is sometimes used adjectively, thus: A potent carrier with an exclusive privilege. Sometimes adverbially: as, He sent him all the numbers from No. 145 to No. 247 exclusive; that is, all between these two numbers, which themselves were excepted.

EXCOEGARIA, a genus of plants belonging to the Dioscia class, and in the natural method ranking under the 38th order, Triœcœ. See Botany Index.

EXCOMMUNICATION, an ecclesiastical penalty or censorry, whereby such persons as are guilty of any notorious crime or offence, are separated from the communion of the church, and deprived of all spiritual advantages.

Excommunication is founded on a natural right, which all societies have, of excluding out of their body such as violate the laws thereof; and it was originally instituted for preserving the purity of the church; but ambitious ecclesiastics converted it by degrees into an engine for promoting their own power, and inflicted it on the most frivolous occasions.

The power of excommunication, as well as other acts of ecclesiastical discipline, was lodged in the hands of the clergy, who distinguished it into the greater and lesser. The lesser excommunication, simply called apotrosis, "separation or suspension," consisted in excluding men from the participation of the eucharist, and the prayers of the faithful. But they were not expelled the church; for they had the privilege of being present at the reading of the Scriptures, the sermons, and the prayers of the catechumens and penitents. This excommunication was inflicted for lesser crimes; such as neglecting to attend the service of the church, misbehaviour in it, and the like.

The greater excommunication, called pantaleon apotrosis, "total separation and anathema," consisted in an absolute and entire exclusion from the church and the participation of all its rites. When anyone was thus excommunicated, notice of it was given by circular letters to the most eminent churches over all the world, that they might all confine this act of discipline, by refusing to admit the delinquent to communion. The consequences of this latter excommunication were very terrible. The excommunicated person was avoided in civil commerce and outward conversation. No one was to receive him into his house, nor eat at the same table with him; and when dead, he was denied the solemn rites of burial.

The Remish pontifical takes notice of three kinds of excommunication. 1. The minor, incurred by those who have any correspondence with an excommunicated person. 2. The major, which falls upon those who disobey the commands of the holy see, or refuse to submit to certain points of discipline; in consequence of which they are excluded from the church militant and triumphant, and delivered over to the devil and his angels. 3. Anathema, which is properly that pronounced by the pope against heretical princes and countries.

In former ages, these papal fulminations were most terrible things; but at present, they are formidable to none but a few petty states of Italy.

Excommunication, in the Greek church, cuts off the offender from all communion with the 318 fathers of the first council of Nice, and with the saints; consigns him over to the devil and the traitor Judas; and condemns his body to remain after death as hard as a flint or piece of steel, unless he humbles himself and makes atonement for his sins by a sincere repentance. The form abounds with dreadful imprecations; and the Greeks assert, that if a person dies excommunicated, the devil enter into the lifeless corpse; and therefore, in order to prevent it, the relations of the deceased cut his body in pieces, and boil them in wine. It is a custom for the patriarch of Jerusalem annually to excommunicate the pope and the church of Rome; on which occasion, together with a great deal of idle ceremony, he drives a nail into the ground with a hammer, as a mark of malediction.

The form of excommunication in the church of England anciently ran thus: "By the authority of God the Father Almighty, the Son and Holy Ghost, and of Mary the blessed mother of God, we excommunicate, anathematize, and seek these from the pale of the holy mother church," &c. The causes of excommunication in England are, contempt of the bishop's court, heresy, neglect of public worship and the sacraments, incontinency, adultery, simony, &c. It is described to be twofold. The less is an ecclesiastical cen-
EXCOMMUNICATION, excluding the party from the participation of the sacraments: the greater proceeds farther, and excludes him not only from these, but from the company of all Christians. But if the judge of any spiritual court communicates a man for a cause of which he be not the legal cognizant, the party may have an action against him at common law, and he is also liable to be indicted at the suit of the king.

Heavy as the penalty of excommunication is, considered in a serious light, there are, notwithstanding, many obstinate or profligate men, who would despise the brutum fulmen of mere ecclesiastical censures, especially when pronounced by a petty surrogate in the country, for railing or contumelious words, for non-payment of fees or costs, or other trivial cause. The common law, therefore, compassionately steps in to their aid, and kindly lends a supporting hand to an otherwise tottering authority. Imitating herein the policy of the ancient Britons, among whom, according to Caesar, whoever were interdicted by the druids from their sacrifices, "In numero impiorum ac sceleratorum habentur: ab illis omnes decredat, ut longum aeternum sermonemque defugiant, no quid ex contagione incarnandi accipiant: neque eis potestibus jus redditur, neque habet ullam communicatur." And so with us, by the common law, an excommunicated person is disabled to do any act that is required to be done by one that is probus et legalis homo. He cannot serve upon juries; cannot be a witness in any court; and, which is the worst of all, cannot bring an action, either real or personal, to recover lands or money due to him. Nor is this the whole: for if, within 40 days after the sentence has been published in the church, the offender does not submit and abide by the sentence of the spiritual court, the bishop may certify such contempt to the king in chancery. Upon which there issues out a writ to the sheriff of the county, called from the bishop's certificate a significavit; or from its effect, a writ de excommunicato capiendo: and the sheriff shall thereupon take the offender and imprison him in the county jail, till he is reconciled to the church, and such reconciliation certified by the bishop; upon which another writ de excommunicato delibrando, issues out of chancery to deliver and release him.

EXCOMMUNICATION was also practised among the Jews, who used to expel from their synagogues such as had committed any grievous crime. See the Gospel according to St. John, ix. 22. xii. 43. xvi. 2. And Joseph. Antiq. Jud. lib. iv. cap. 22. and lib. xvi. cap. 2.

Godwin, in his Moses and Aaron, distinguishes three degrees, or kinds, of excommunication among the Jews. The first he finds intimated in John ix. 22. The second in 1 Cor. v. 5. And the third in 1 Cor. xvi. 22. See NIDDUK.

The rule of the Benedictines gives the name of excommunication to the being excluded from the oratory, and the common table of the house; in our inns of court called discomming. This was the punishment of such monks as came too late.

EXCOMMUNICATION, or a being secluded from a participation in the mysteries of religion, was also in use under paganism.

Such as were thus excommunicated were forbidden to assist or attend at the sacrifices, or enter within the temples; and were afterwards delivered over to the demons and furies of hell, with certain imprecations; Excommunication which was called among the Romans divus descensus. See EXCOMMUNICATION.

The Druids among the ancient Britons and Gauls, likewise, made use of excommunication against rebels; and interdicted the communion of their mysteries to such as refused to acquiesce in their decisions. See DRUIDS.

EXCORIATION, in Medicine and Surgery, the galling or rubbing off the cuticle, especially of the parts between the thighs and about the anus. In adults, it is occasioned by riding, much walking, or other vehemence exercise, and may be cured by vulnery applications. In children there is often an excoriation, not only of the parts near the pudenda, chiefly of the groin and scrotum, but likewise in the wrinkles of the neck, under the arms, and in other places; proceeding from the acrimony of urine and sweat; and occasioning itching pains, crying, watching, restlessness, &c. To remedy this, the parts affected may be often washed with warm water, and sprinkled with drying powders, as chalk, hartshorn, but especially taty, lapis calambris, and cerus, which may be tied loosely in a rag, and the powder shook out on the parts.

EXCREMENT, whatever is discharged out of the body of animals after digestion; or the fibrous part of the aliment, mixed with the bile, saliva, and other fluids. Urine and the feces are the gross excrements that are discharged out of the bladder or belly. Other excrements are the various humours that are secreted from the blood through the different strainers in the body, and which serve for several uses; such as the saliva, sweat, bile, the pancreatic juice, lymph, the semen, nails, the hair, the horns and hoofs of animals.

Alchemists, who have sought everywhere for their great work, as they called it, have particularly operated much on the excrements of men and other animals; but philosophical chemistry has acquired no knowledge from all these alchemical labours, from the obscurity with which their authors have described them. The philosophic chemists have not much examined animal excrements. Of these Homberg is the only one who has particularly analyzed and examined human ordure; and this was done to satisfy an alchemical project of one of his friends, who pretended that from this matter a white oil could be obtained, without smell, and capable of fixing mercury into silver. The oil was found by Homberg, but mercury was not fixed by it.

The labours of this able chemist were not, however, useless, like those of the alchemists; because he has clearly related the experiments he made on this matter, in the memoirs of the Academy of Sciences. These experiments are curious, and teach several essential things concerning the nature of excrements. The result of these experiments is as follows: Fresh human feces, being distilled to dryness in a water bath, furnish a clear, watery, insipid liquor, of a disagreeable smell, but which contains no volatile alkali; which is a proof that this matter, although nearly in a potate state, is not however putrefied; for all substances really putrid furnish with this degree of heat a manifest volatile alkali. The dry residuum of the foregoing experiment, being distilled in a retort with a superheated air, furnishes a volatile alkaline spirit and salt,
Human feces, diluted and lixiviated in water, furnish by filtration and evaporation of the water an oily salt of a nitrous nature, which degenerates like nitre upon ardent coals, and which inflames in close vessels when heated to a certain degree. The same matter yielded to Homberg, who treated it by a complete fermentation or putrefaction, excited by a digestion during 40 days in a gentle water-bath heat, and who afterwards distilled it, an oil without colour, and without bad smell, and such as he endeavoured to find; but which did not, as we said before, fix mercury into silver.

EXCRESCE, in Surgery, denotes every preternatural tumour which arises upon the skin, either in the form of a wart or tubercle. If they are born with a person, as they frequently are, they are called mavi materni, or marks from the mother; but if the tumour is large, so as to depend from the skin, like a fleshy mass, it is then called sarcoma. See Surgery.

EXCRETION, or Secretion, in Medicine, a separation of some fluid, mixed with the blood, by means of the glands. Excretions, by which we mean those that evacuate superfluous and heterogeneous humours, purify the mass of blood; the humours which are generated in the blood are excreted by the glands, and are replaced by a sufficient quantity of aliment.

EXCRETORY, in Anatomy, a term applied to certain little ducts or vessels, destined for the reception of a fluid, secreted in certain glands, and other viscera, for the excretion of it in the appropriated places.

EXCULUBLE, in antiquity, the watches and guards kept in the day by the Roman soldiers. They are contradistinguished from the vigiles which were kept in the night. The excubie were placed either at the gates and intrenchments or in the camp; for the latter there was allowed a whole manipulus to attend before the praetorium, and four soldiers to the tent of every tribune. The excubie at the gates of the camp, and at the entrenchments, were properly called staciones. One company of foot and one troop of horse were assigned to each of the four gates every day. To desert their post, or abandon their corps of guards, was an unpardonable crime.

The triarii, as the most honourable order of soldiers, were excused from the ordinary watches; yet being placed opposite to the equites, they were obliged to have an eye over them.

LETTERS OF EXCULPATION, in Scots Law, a writ or summons issued by authority of the court of justiciary, at the instance of a panel, for citing witnesses to prove his defence, or his objections to any of the jury or witnesses cited against him.

EXCUSATI, in church history, a term used to denote slaves, who flying to any church for sanctuary, were excused and pardoned by their masters; but these were obliged to take an oath to the purpose before they could have them again; and, if they broke the oath, they were punished and fined as persons guilty of perjury.

EXEAT, in church discipline, a Latin term used for a permission which a bishop grants a priest to go out of his diocese; or an abbot to a religious to go out of his monastery.

EXECRATION, in antiquity, a kind of punishment, consisting of direful curses and marks of infamy: such was that used against Philip king of Macedon by the Athenians. A general assembly of the people being called, they made a decree, that all the statues and images of that king, and of all his ancestors, should be demolished, and their very name razed; that all the festivals, sacred rites, priests, and whatever else had been instituted in honour of him, should be profaned; that the very places where there had been any monument or inscription to his honour, should be defaced; that nothing should be set up, or dedicated in them, which could be done in clean places; and, lastly, that the priests, as often as they prayed for the Athenian people, allies, armies, and fleets, should as many times detest and execrate Philip, his children, kingdom, land and sea forces, and the whole race and name of the Macedonians.

At the taking and demolishing of cities, it was usual among the Jews, Greeks, and Romans, to pronounce curses upon, and load with direful excommunications, the rebuilders of them.

EXECUTION, in a general sense, the act of accomplishing, finishing, or achieving anything.

EXECUTION, in Law, the completing or finishing some act, as of judgment, deed, &c. and it usually signifies the obtaining possession of any thing recovered by judgment of law.

Sir Edward Coke observes, that there are two sorts of executions: the one final; and the other a quaesumus, that tends to an end. An execution final, which is that which makes money of the defendant's goods, or extends to his land and delivers them to the plaintiff, who accepts the same in satisfaction; and this is the end of the suit, and the whole that the king's writ requires to be done. The writ of execution with a quaesumus, though it tends to an end, yet is not final, as in the case capias ad satisfacere, where the defendant's body is to be taken, in order that the plaintiff may be satisfied for his debt. See Capias.

Executions are either in personal, real, or mixed actions. In a personal action, the execution may be made three ways, viz. by the writs of capias ad satisfacere, against the body of the defendant; fieri facias, against his goods; or elegit, against his lands. See Fieri Facias and Elegit.

In a real and mixed action, the execution is by writ of haberes facias suasiones, and haberes possessionsum. Writs of execution bind the property of goods only from the time of delivery of the writ to the sheriff; but the land is bound from the day of the judgment obtained, and here the sale of any goods for valuable consideration, after a judgment, and before the execution awarded, will be good. It is otherwise as to lands, of which execution may be made, even on a purchase after the judgment, though the defendant sell such land before execution. Likewise, sheriffs may deliver in all the lands whereof others shall be seized in trust for him against whom execution is had on a judgment, &c.

When any judgment is signed, the execution may be taken out immediately thereon; but if it be not issued within a year and a day after, where there is no fault
Execution, fault in the defendant, as in the case of an injunction, writ of error, &c. there must be a scire facias, to revive the judgment; though, if the plaintiff sues out any writ of execution within the year, he may continue it after the year is expired. After judgment against the defendant, in an action wherein special bail is given, the plaintiff is at liberty to have execution against such defendant, or against his bail: but this is understood where the defendant does not render himself, according to law, in safeguard of the bail; and execution may not regularly be sued forth against a bail, till a default is returned against the principal: also if the plaintiff takes the bail, he shall never take the principal. It is held that an execution may be executed after the death of the defendant: for his executor, being privy thereto, is liable, as well as the testator. The execution is an entire thing, so that he who begins must end it; therefore, a new sheriff may distrain an old one, to sell the goods seized on a distressing, and to bring the money into court.

Execution, in criminal cases, the completion of punishment. This follows judgment; and must in all cases, capital as well as otherwise, be performed by the legal officer, the sheriff or his deputy; whose warrant for so doing was anciently by precept under the hand and seal of the judges, as it is still practiced in the court of the lord high steward, upon the execution of a peer: though, in the court of the peers in parliament, it is done by writ from the king. Afterwards it was established, that in case of life, the judge may command execution to be done without any writ. And now the usage is, for the judge to sign the calendar or list of all the prisoners names, with their separate judgments in the margin, which is left with the sheriff. As for a capital felony, it is written opposite to the prisoner's name, "let him be hanged by the neck:" formerly in the days of Latin and abbreviation, "susc per col," for "suspensur per collum." And this is the only warrant: that the sheriff has for so material an act as the taking away the life of another. It may certainly afford matter of speculation, that in civil causes there should be such a variety of writs of execution to recover a debt, issued in the king's name, and under the seal of the court, without which the sheriff cannot legally stir one step; and yet that the execution of a man, the most important and terrible task of any, should depend upon a marginal note.

The sheriff, upon receipt of his warrant, is to do execution within a convenient time: which in the country is also left at large. In London, indeed, a more solemn and becoming exactness is used, both as to the warrant of execution and the time of executing thereof: for the recorder, after reporting to the king in person the case of the several prisoners, and receiving his royal pleasure, that the law must take its course, issues his warrant to the sheriffs, directing them to do execution on the day and at the place assigned. And in the court of king's bench, if the prisoner be tried at the bar, or brought there by habeus corpus, a rule is made for his execution; either specifying the time and place, or leaving it to the discretion of the sheriff. And, throughout the kingdom, by statute 25 Geo. II. c. 23, it is enacted that, in case of murder, the judge shall in his sentence direct execution to be performed on the next day but one after sentence passed. But, otherwise, the time and place of execution are by law.

The sheriff cannot alter the manner of the execution, by substituting one death for another, without being guilty of felony himself. It is held also by Sir Edward Coke and Sir Matthew Hale, that even the king cannot change the punishment of the law, by altering the hanging or burning into beheading; though, when beheading is part of the sentence, the king may remit the rest. And, notwithstanding some examples to the contrary, Sir Edward Coke strongly maintaineth, that judicandum est legibus, non exemplis. But others have no part of the judgment. It has been well observed, that it is of great importance that the punishment should follow the crime as early as possible; that the prospect of gratification or advantage, which tempts a man to commit the crime, should instantly awake the attendant idea of punishment. Delay of execution serves only to separate these ideas; and then the execution itself affects the minds of the spectators rather as a terrible sight, than as the necessary consequence of transgression.

To conclude: It is clear, that if, upon judgment to be hanged by the neck till he is dead, the criminal be not thoroughly killed, but revives, the sheriff must hang him again. For the former hanging was no execution of the sentence; and, if a false tenderness were to be indulged in such cases, a multitude of collusions might ensue. Nay, even while abjurations were in force, such
EXECUTION, in the law of Scotland. See Law Index.

Execution, in the French music, is used to denote the manner of singing, or the performance of a song. "As to the manner of singing, called in France execution, no nation may, with any probability, dispute it with the French. If the French, by their commerce with the Italians, have gained a bolder composition, the Italians have made their advantage of the French, in learning of them a more polite, moving, and exquisite execution." St Evremond.

EXECUTIVE POWER. The supreme executive power of these kingdoms is vested by our laws in a single person, the king or queen for the time being. See the article KING.

The executive power, in this state, hath a right to a negative in parliament, i.e. to refuse assent to any acts offered; otherwise the two other branches of legislative power would, or might, become despotic.

EXECUTOR, a person nominated by a testator, to take care to see his will and testament executed or performed, and his effects disposed of according to the tenor of the will. See Law.

EXECUTOR, in Scots Law, signifies either the person entitled to succeed to the moveable estate of one deceased, or who by law or special appointment is intrusted with the administration of it.

EXECUTORY, in Law, is where an estate in fee, that is, made by deed or fine, is to be executed afterwards by entry, livery, or writ. Lease for years, annuities, conditions, &c. are termed inheritances executory.

EXECUTRY, in Scots Law, is the moveable estate falling to the executor. Under executry, or moveables, is comprehended every thing that moves itself, or can be moved; such as corns, cattle, furniture, ready money, &c.

EXEDRÆ, in antiquity, denoted balls with many seats, where the philosophers, rhetoricians, and men of learning, met for discourse and disputation. The word occurs in ecclesiastical writers as a general name for such buildings as were distinct from the main body of the churches, and yet within the limits of the church taken in its largest sense. Among the exedra the chief was the BAPTISTRY.

EXEGESIS, a discourse by way of explanation or comment upon any subject. In the Scotch universities, there is an exercise among the students in divinity, called an exegesis, in which a question is stated by the respondent, who is then opposed by two or three other students in their turns; during which time the professor moderates, and solves the difficulties which the respondent cannot overcome.

EXEGETES, (formed of ἐξεγετεῖν, "I explain," among the Athenians, persons learned in the laws, whom the judges used to consult in capital causes.

EXEGETICA, in Algebra, the art of finding, either in numbers or lines, the roots of the equation of a problem, according as the problem is either numerical or geometrical.

EXEMPLAR, a model, or original, to be imitated or copied. See Model.

EXEMPLAR also denotes the idea, or image, conceived or formed in the mind of the artist, whereby he conducts his work. Such is the idea of Caesar, which a painter has in his mind when he goes to make a picture of Caesar.

EXEMPLIFICATION of Letters Patent, denotes an exemplar, or copy of letters patent, made from the enrolment thereof, and sealed with the great seal of England. Such exemplifications are as effectual to be showed or pleaded, as the letters patent themselves.

EXEMPTION, in Law, a privilege to be free from some service of appearance: thus, barons and peers of the realm are, on account of their dignity, exempted from being sworn upon inquests; and knights, clergy men, and others, from appearing at the sheriff's turn. Persons of 70 years of age, apothecaries, &c. are also by law exempted from serving on juries; and justices of the peace, attorneys, &c. from parish offices.

EXERCISE, among physicians, such an agitation of the body as produces salutary effects in the animal economy.

Exercise may be said to be either active or passive. The active is walking, hunting, dancing, playing at bowls, and the like; as also speaking and other labour of the body and mind. The passive is riding in a coach, on horseback, or in any other manner. Exercise may be continued to a beginning of weariness, and ought to be used before dinner in a pure light air; for which reason, journeys, and going into the country, contribute greatly to preserve and re-establish health.

Exercise increases the circulation of the blood, attenuates and divides the fluids, and promotes a regular perspiration, as well as a due secretion of all the humours; for it accelerates the animal spirits, and facilitates their distribution into all the fibres of the body, strengthens the parts, creates an appetite, and helps digestion. Whence it arises, that those who accustom themselves to exercise are generally very robust, and seldom subject to diseases.

Boerhaave recommends bodily exercise in diseases of a weak and lax fibre. By riding on horseback, says his commentator, the pendulous viscera of the abdomen are shaken every moment, and gently rubbed as it were one against another, while in the meantime the pure air acts on the lungs with greater force. But it is to be observed that a weak man should not ride with a full stomach, but either before dinner, or after the digestion is nearly finished; for when the stomach is distended, weak people do not bear these concussions of the horse without difficulty; but when the prime vitæ are nearly empty, the remaining feces are discharged by this concussion. Sailing in a ship is also an exercise of great use to weak people. If the vessel moves with an even motion, by increasing perspiration it usually excites a wonderful alacrity, creates an appetite, and promotes digestion. These exercises are more especially serviceable to weak people; but, in order to strengthen the body by muscular motion, running and bodily exercises are to be used. In these we should begin with the most gentle, such as walking, and increase it by degrees till we come to running. Those exercises of the body are more especially serviceable which give delight to the mind at the same time, as tennis, fencing, &c.; for which reason, the wisdom of antiquity appointed rewards for those who excelled in these gymnastic exercises.
As nothing is more conducive to health than moderate exercise, so violent exercise dissipates the spirits, weakens the body, destroys the elasticity of the fibres, and exhausts the fluid parts of the blood. No wonder, then, that acute and mortal fevers often arise from too violent exercise of the body; for the motion of the venous blood towards the heart being quickened by the contraction of the muscles, and the veins being thus depleted, the arteries more easily propel their contained humours through the smallest extremities into the now less resisting veins; and therefore the velocity of the circulation will be increased through all the vessels. But this cannot be performed without applying the humours oftener, or in a greater quantity, to the secretory organs in the same time, whence the more fluid parts of the blood will be dissipated, and what remains will be insipid; and by the greater action of the vessels upon their contained fluids, and of the reacting fluids upon the vessels, the blood acquires an inflammatory density. Add to this, that by the violent attrition of the solids and fluids, together with the beat thence arising, all the humours will incline to a greater acrimony, and the salts and oils of the blood will become more acrid and volatile. Hence, says Hoerbaaw, these fevers which arise from too much exercise or motion, are cured by rest of body and mind, with such alicia and medicines as moisten, dilute, and soften or allay acrimony.

The exercise of a soldier in camp, considered as conducive to health, Dr Pringle distinguishes into three heads; the first relating to his duty, the second to his living more commodiously, and the third to his diversion. The first, consisting chiefly in the exercising of his arms, will be no less the means of preserving health than of making him expert in his duty: and frequent returns of this, early, and before the sun grows hot, will be made more advantageous than repeating it seldom, and staying out long at a time; for a camp affording little convenience for refreshment, all unnecessary fatigue is to be avoided. As to the second article, cutting boughs for shading the tents, making trenches round them for carrying off the water, airing the straw, cleaning their clothes and accoutrements, and assisting in the business of the mess, ought to be no disagreeable exercise to the men for some part of the day. Lastly, as to diversions, the men must be encouraged to them either by the example of their officers, or by small premiums to those who shall excel in any kind of sports as shall be judged most conducive to health: but herein great caution is necessary, not to allow them to fatigue themselves too much, especially in hot weather or sickly times; but, above all, that their clothes be kept dry, wet clothes being the most frequent causes of camp diseases.

Exercise, in military affairs, is the ranging a body of soldiers in form of battle, and making them perform the several motions and military evolutions with different management of their arms, in order to make them expert therein. See also Words of Command.

Exercise, in the royal navy, is the preparatory practice of managing the artillery and small arms, in order to make the ship's crew perfectly skilled therein, so as to direct its execution successfully in the time of battle.

The exercise of the great guns was formerly very complicated, and abounding with superfluities, in our navy, as well as all others. The following method was, it is said, successfully introduced by an officer of distinguished abilities.

1st, Silence.
2d, Cast loose your guns.
3d, Level your guns.
4th, Take out your tourniques.
5th, Run out your guns.
6th, Prime.
7th, Point your guns.
8th, Fire.
9th, Sponge your guns.
10th, Load with cartridge.
11th, Shot your guns.
12th, Put in your tourniques.
13th, House your guns.
14th, Secure your guns.

Upon beat to arms (every body having immediately repaired to their quarters) the midshipman commanding a number of guns, is to see that they are not without every necessary article, as (at every gun) a sponge, powder horn, with its priming wires, and a sufficient quantity of powder, crow, handspike, bod, quoin, train tackle, &c: sending without delay for a supply of any thing that may be wanting; and for the greater certainty of not overlooking any deficiency, he is to give strict orders to each captain under him, to make the like examination at his respective gun, and to take care that every requisite is in a serviceable condition, which he is to report accordingly. And (besides the other advantages of this regulation) for the still more certain and speedy account being taken upon these occasions, the midshipman is to give each man his charge at quarters (as expressed in the form of the monthly report), who is to search for his particular implements, and, not finding them, is immediately to acquaint his captain, that, upon his report to the midshipman, they may be replaced.

The man who takes care of the powder is to place himself on the opposite side of the deck from that where we engage, except when fighting both sides at once, when he is to be amid ships. He is not to suffer any other man to take a cartridge from him but he who is appointed to serve the gun with that article, either in time of a real engagement or at exercise.

1. "Silence." At this word every one is to observe a silent attention to the officers of the quarter deck.

2. "Cast loose your guns." The muzzle lashing is to be taken off from the guns, and (being coiled up in a small compass) is to be made fast to the eye-bolt above the port. The lashing tackles at the same time to be cast loose, and middle of the breeching seized to the thimbles of the pomilion. The sponge to be taken down, and, with the crow, handspike, &c. laid upon the deck by the gun. N.B. When prepared for en-
charging, the vent is to be closed, in order to another
any spark of fire that may remain in the chamber of the
gun; and the man who sponges is immediately to place
himself by the muzzle of the gun in readiness; when,
at the next word,
9. "Sponge your guns," The sponge is to be ram-
ded down to the bottom of the chamber, and then
twisted round, to extinguish effectually any remains of
fire; and, when drawn out, to be struck against the
outside of the muzzle, to shake off any sparks or scrapes
of the cartridge that may have come out with it; and
next, its end is to be shifted ready for loading; and
while this is doing, the man appointed to provide a
cartridge is to go to the box, and by the time the
sponge is out of the gun, he is to have it ready; and at
the word,
10. "Load with cartridge." The cartridge (with
the bottom-end first, seam downwards, and wad after
it) is to be put into the gun, and thrust a little way
within the mouth, when the rammer is to be entered:
and the cartridge is then to be forcibly rammed down;
and the captain at the same time is to keep his priming-
wire in the vent, and feeling the cartridge, is to give
the word Home, when the rammer is to be drawn, and
not before. While this is doing, the man appointed
to provide a shot is to provide one or two, according
to the order at that time) ready at the muzzle, with a
wad likewise; and when the rammer is drawn, at the
word,
11. "Shot your guns." The shot and wad are to
be put into the gun, and thrust a little way down,
when the rammer is to be entered as before. The shot
and wad are to be rammed down to the cartridge, and
there have a couple of forcible strokes; when the ram-
ner is to be drawn, and laid out of the way of the guns
and tackles, if the exercise or action is continued; but
if it is over, the sponge is to be secured in the place it
is at all times kept in.
12. "Put in your tomponis." The tomponis are
to be put into the muzzle of the cannon.
13. "House your guns." The seizing is to be
put on again upon the clinched end of the breeching,
leaving it no slacken then to admit of the guns being
housed with ease. The quoin is to be taken from un-
der the breech of the gun, and the bed, still resting
upon the bolt within the carriage, thrust under, till
the foot of it falls off the axletree, leaving it to rest
upon the end which projects out from the foot. The
metal is to be let down upon this. The gun is to be
placed exactly square; and the muzzle is to be close to
the wood, in its proper place for passing the muzzle-
lashings.
must first be made secure, and then with one tackle
(having all its parts equally taught with the breech-
ing) the gun is to be lashed. The other tackle is to
be bowled taught, and by itself made fast, that it may
be ready to cast off for lashing a second breeching.
N. B. Care must be taken to hook the first tackle to
the upper bolt of the carriage, that it may not other-
wise obstruct the reving of the second breeching, and
to give the greater length to the end part of the fall.
No pains must be spared in bowing the lashings very
taught, that the gun may have the least play that is
possible, as their being loose may be productive of very
dangerous
EXERCITOR, in Scots Law, he who employs a Exercise a ship in trade, whether he be owner, or only freight her from the owner.

EXERGESIA. See Oratory, No. 90.

EXERGUM, among antiquarians, a little space around or without the figures of a medal, left for the inscription, cipher, device, date, &c.

EXETER, the capital city of Devonshire, situated on the river Ex, ten miles north of the British channel. W. Long. 3° 40'. N. Lat. 50° 44'. Anciently the name of this city was Iex, and see Dumnorium. The present name is a contraction of Exceter, that is, a city upon the Ex. It is large, populous, and wealthy, with gates, walls, and suburbs: the circumference of the whole is about three miles. It is the see of a bishop, transferred hither from Crediton, by Edward the Confessor; and is one of the principal cities in the kingdom, for its buildings, wealth, and number of its inhabitants. It had six gates, besides many turrets, several of which are now pulled down. It had formerly so many convents, that it was called Monk-town, till King Athelstan changed its name to Exeter, about the year 945; at which time he also fortified the city (which had before been only enclosed with a ditch and a fence of timber) with circular walls, embattlements, towers, and turrets of squared stone, en- circling the whole, except the western side, with a deep moat. Besides chapels and five large meeting-houses, there are now 17 churches within the wall, and four without. St. Peter's, the cathedral, is a magnificent pile; though little now remains of the ancient fabric of the church, except that part which is called Our Lady's Chapel. It has a ring of 22 bells, reckoned the largest ring of the largest bells in England; as is also its organ, whose largest pipes are 15 inches in diameter. In 1763 the cathedral was repaired, beauti- fied, and new paved; when, in removing the old pavement, was found the leaden coffin of Bishop Bitton, who died in 1327; the top of which, being decayed, afforded an opportunity of viewing the skeleton lying in its proper form: near the bones of the finger was found a sapphire ring set in gold; the stone considerably large, but of no great value, on account of several flaws in it. Near this stood a small neat chalice and pattern of silver gilt, but the damp had de-stroyed the greatest part of the gilding. In the centre of the pattern was engraved a hand, with the two fore- fingers extended in the attitude of benediction. The top of the crozier was also found, but totally decayed.

A most beautiful modern painted glass window has been lately erected at the western end of the cathedral, the eastern end having before a remarkable fine antique one. In the other windows there is much fine ancient paint- ed glass. The altar is remarkable for its beautiful de- sign and execution. On the left hand side of it there yet exists the seat where Edward the Confessor and his queen sat and installed Leofricus, his chamberlain, the first bishop of Exeter; and in the fourth cross aisle in the monument of the noble Leofricus, who died 1073, who at the time of his interment was a part of the churchyard, but by the enlarging of the church by his successors, became nearly the middle of the build- ing. The grand western end of the church is most magnificently adorned with the statues of the pa- triarchs, &c. The chapter house was built in 1430.
The beautiful throne for the bishop was constructed about 1466, and is said to be the grandest of the kind in Britain. The great north tower was completed in 1485, which contains a bell, that weighs 12,500 pounds; and exceeds the great Tom of Lincoln by 2500 pounds. This city has had divers charters granted, or confirmed by most of our kings; but it was made a mayor town in the reign of King John, and a county of itself by King Henry VIII. It is governed by a mayor, 24 aldermen, four bailiffs, a recorder, chamberlain, sheriff, town-clerk, &c. They have a sword-bearer, and four stewards, four sergeants at mace wearing gowns, and staff-bearers in liveries with silver badges. It had anciently a mint; and in the reigns of King William III and Queen Anne, many pieces of silver money were coined here, which bore the letter E under the bust. Here are 12 or 14 incorporate city companies. All pleas and civil causes are tried by the mayor, recorder, aldermen, and common council; but criminal causes, and those relating to the peace, are determined by eight aldermen, who are justices of the peace. Here are four principal streets, all entering in the middle of the city, which is therefore called Crosscom, from the old Norman word Quatre coins, i.e. the four ways. Near it is a conduit, lately removed from the centre to the side of the principal street, which was first erected by William Duke, mayor of the city, in the reign of Edward IV, and there are others well supplied with water brought in pipes from the neighbourhood. There is an old castle in the north-east part of the city, called Roanmont, from the red soil it stands on; from thence there is a pleasant prospect from the walls. It is supposed to have been built by the West Saxon kings, and that they resided here, as did afterwards the earls and dukes of Cornwall. This castle was remarkably strong both by nature and art. The gate which originally led into it, was walled up by order of William the Conqueror, in token of his having reduced it to his obedience after a very obstinate resistance; and close by it an inferior gate was made in the wall in which state they both remain. The outward stone facing is kept in tolerable repair; but the inside being but earth, is gradually crumbling down. Here yet remains the ancient chapel, built in 1260, and kept in good repair, where prayers are read, and a sermon preached in sessions weeks. The city itself is healthy, and pleasantly situated on the sides of a hill, having other hills to its N.W. and S. by which it is sheltered from the force of storms. The bank which sustained the ditch that in a great part surrounded the castle, is planted and gravelled, and accommodated with seats, being the place of resort for walking for the inhabitants; and the ditch between it and the castle being filled up, is now thickly planted with elms, which form a delightful grove. The old palace is now entirely demolished, and new house erected there the amities, quarter-sessions, and county courts are held. In the city and suburbs are prisons both for debtors and misdeemers; a workhouse, almshouses, and charity schools; an hospital for the sick and lame poor of the city and county, upon the model of the infirmaries of London and Westminster; and two free grammar-schools. It has markets on Wednesdays and Fridays; and four fairs in the year. Great trade is carried on here in serges, perpetuans, long eells, and other woollen goods, in which it is computed that at least 600,000l. a year is traded for: yet no markets were erected here for wool, yarn, and kerseys, till the 30th of Henry VIII. Before that time the merchants drove a considerable trade to Spain and France: they were incorporated in the reign of Queen Mary I. by the name of "The Governor, Consuls, and Society of Merchant adventurers, trading to France." Here is also a weekly serge market, the greatest in England, next to the Brigg market at Leeds in Yorkshire. It is said that some weeks as many serges have been sold here as amount to 80,000l. or 100,000l.; for besides the vast quantities of their woollen goods shipped for Portugal, Spain, and Italy, the Dutch give large commissions for buying up serges, perpetuans, &c. for Holland and Germany. It is particularly remarked of this city, that it is almost as full of gentry as of tradesmen; and that more of its mayors, and bailiffs have descended from, or given rise to good families, than in any other city of its bigness in the kingdom: for the great trade and flourishing state of this city tempted gentlemen to settle their sons in it, contrary to the practice of many of the inland as well as northern counties, where, according to the vain and ruinous notion of the Normans, trade was despised by the gentry as fit for only mechanics and the vulgar. This city was under the jurisdiction of the Romans, whose coins have been frequently dug up and in about it. After they left England, the Saxons drove the Britons out of it into Cornwall, and encompassed it with a ditch, besides bulwarks. The Danes attacked and spoiled it in 875; and afterwards in revenge of the general massacre of the Danes by the English, Sweyn one of their kings, came hither with a great force, put the men to the sword, ravished the women, massacred the children, burnt the city, and defaced the walls. A long time after this, just as it was reviving, William the Conqueror besieged and took it; and it was again besieged in the reign of King Stephen and Edward IV. In the reign of Henry VII, it was again besieged by Perkin Warbeck, and battered furiously; but the citizens forced him to raise the siege; which so pleased the king that he came hither, and presented a cap of maintenance to the city, and gave the very sword from his side to be borne always before the mayor. In the reign of Edward VI., in July 1544, it was smartly cannoned by the rebels of Cornwall and Devon, who almost starved it by breaking down its bridges, cutting off its water, and stopping up all passages; but it held out till the lord John Russell came with a force and raised the siege on the 6th of August, which was then appointed as an anniversary day of thanksgiving by the city, and is still observed as such. King Charles I.'s queen, to whom this city gave shelter in the civil wars, was here delivered of Henrietta, afterwards duchess of Orleans; whose picture is in its guildhall, as are also General Monk's and George I.'s, &c. In the south-east quarter of the city was a house called Bedford house, where the above queen was delivered of the princess. This having lately been taken down, an elegant circus is built on the spot, with a theatre adjoining it; and for the convenience of the inhabitants, a passage has been made through the town wall to Southern Hay, on which green stands the county hospital, already spoken of, besides a considerable number of new buildings.
are remains of several ancient structures, which are daily giving way to modern erections; among the rest, an old building, said to have been a palace of King Athelstan. The guildhall is a spacious and convenient building, whose front or portico projects a great way into the street, and was first erected in 1330, to which its present front was rebuilt in 1593, and repaired in 1720. An arm of the sea formerly flowed nearly up to the city's wall, till 1276, when Hugh Courtenay earl of Devon, in revenge for an affront, ruined the navigation, by constructing weirs and dams in the river; but to remedy it, in 1539, an act of parliament was passed for making a navigable canal, for the better conveyance of goods in barges to and from the city to Topsham. This was carried into execution in 1581, but not completed till 1675; nor was it after all found sufficient, till the present haven was constructed in 1697, when it was rendered capable of bringing ships of 150 tons quite to the quay, constructed near the walls of the city. In short, Exeter, by a constant adherence to its motto, Semper fidelis, has been applauded by all historians for its inviolable fidelity to its sovereigns, whether they held their crown by hereditary or parliamentary right. The city sends two members to parliament; and gives title of earl to the Cecils. The number of houses in Exeter, according to the return ordered by act of parliament in 1811, was 2071, and the number of inhabitants amounted to 18,896. The see of Exeter was once one of the most wealthy in the kingdom; but its revenues were most shamefully wasted by Bishop Voysey, who alienated its lands. What little he left was so much enclosed, that the same has never been able to recover its former grandeur; and so small are its present revenues, that it has been found necessary for the bishop to hold some other preten- dents for the better support of his dignity and rank. The diocese contains the entire counties of Devonshire and Cornwall, wherein are 604 parishes, whereof 230 are inappropriate. It hath four archdeacones, viz. of Cornwall, Exeter, Barnstable, and Totness. The dioce was formerly valued in the king's books at 1356. 14s. 6d. but, since Bishop Voysey's time, it is lowered to 100l. and is computed to be worth annually 2700l. The clergy's tenths is 1200l. 15s. 24d. To the cathedral belong a bishop, a dean, four archdeacones, a chancellor, a treasurer, a chancellor, 24 prebendaries, and other inferior officers and servants.

EXFOLIATION, a term used by surgeons for the scaling of a bone, or the separation of the dead part of a bone from the living part.

EXHALATION, a general term for all effusio or steam raised from the surface of the earth in form of vapour.

EXHAUSTIONS, in Mathematics. Method of exhaustions, is a way of proving the equality of two magnitudes, by a reductio ad absurdum; showing, that if one be supposed either greater or less than the other, there will arise a contradiction.

The method of exhaustions was of frequent use among the ancient mathematicians; as Euclid, Archimedes, &c. It is founded on what Euclid says in his tenth book; viz. that those quantities whose difference is less than any assignable quantity, are equal; for if they were unequal, be the difference never so small, yet it may be so multiplied, as to become greater than either of them; if not so, then it is really nothing. This he assumes in the proof of Prob. 1. book x. which imports, that if, from the greater of two quantities, you take more than its half, and from the remainder more than its half, and so continually, there will, at length, remain a quantity less than either of those proposed. On this foundation it is demonstrated, that if a regular polygon of infinite sides be inscribed in, or circumscribed about a circle; the space, which is the difference between the circle and the polygon, will, by degrees, be quite exsustated, and the circle become equal to the polygon.

EXHEREDATION, in the civil law, with us ordinarily called :the, is the father's excluding his sons from inheriting his estate.

There are 14 causes of exheredation, expressed in Justinius's Novellae; without some one of which causes, he decrees the exheredation null, and the testament invalid, as the civilians call it. Indeed, by the ancient Roman law, the father might pronounce exheredation without any cause; but the rigour of this law was restrained and moderated by Justinian.

EXHIBIT, in Law, is where a deed, or other writing, being produced in a chancery suit, to be proved by witnesses, the examiner, or commissioner appointed for the examination of any such, certifies on the back of the deed or writing, that the same was sworn to the witness at the time of his examination, and by him sworn to.

EXHIBITION, in Law, a producing, or shewing, of titles, authorities, and other proofs, of a matter in question.

Anciently they used the phrase, exhibition of a tragedy, comedy, or the like; but now we say representation in lieu thereof.

EXHIBITION, in our old writers, is used for an allowance of meat and drink, such as was customary among the religious appropriators of churches, who usually made it to the depending vicar. The benefactions settled for the maintaining of scholars in the universities not depending on the foundation, are also called exhibitions.

EXHORATION, in Rhetorics, differs only from suasion, in that the latter principally endeavours to convince the understanding, and the former to work on the affections.

EXHUMATION, (of ex, "out of," and humus, "ground"); the act of digging up a body interred in holy ground, by the authority of the judge. In France, the exhumation of a dead body is ordered, upon proof that he was killed in a duel. By the French laws, a parson has a right to demand the exhumation of the body of one of his parishioners, when interred out of the parish without his consent.

EXIGENCE, or EXIGENCY, that which a thing requires, or which is expedient or suitable thereto.

EXIGENT, in Law, a writ which lies where the defendant in a personal action cannot be found, nor any effects of his within the county, by which he might be attached or restrained.

EXIGENTS, four officers in the court of common pleas, who make all exigents and proclamations, in all actions where process of outlawry lies. Writs of supersedes, as well as the prohonotaries, upon exigents, are likewise drawn up in their office.
EXILE. See Banishment.

Among the Romans, the word exilium properly signified an interdict or exclusion from water and fire; the necessary consequence of which was, that the interdicted person must betake himself into some other country, since there was no living without fire and water.——Thus Cicero, ad Horat. observes, that the form of the sentence did not express exilium, but only of igne interdicto. The same author remarks, that exilium was not properly a punishment, but a voluntarily flying or avoiding the punishment decreed: Exilium non esse supplicium, sed perfgugium, partisque supplicii. He adds, that there was no crime among the Romans, as among other nations, punished with exile; but exile was a resource to which people flew voluntarily, in order to avoid chains, ignominy, starving, &c.

The Athenians frequently sent their generals and great men into exile, out of envy of their merits, or distrust of their too great authority. See Ostracism.

EXISTENCE, that whereby any thing has an actual essence, or is said to be. See the article Metaphysics.

EXIT, properly expresses the departure of a player from off the stage, when he has acted his part. The word is also used in a figurative sense, to express any kind of departure, even death.

EXITERIA, in antiquity, oblations or prayers to any of the gods for a prosperous expedition or journey. There were also feasts under this denomination, which were celebrated by the Greeks with sacrifices and prayers, when their generals undertook expeditions against an enemy.

EXOCETUS, the flying fish, a genus of fishes belonging to the order of abalone. See Ichthyology Index.

EXODIARY, in the ancient Roman tragedy, was the person who, after the drama or play was ended, sung the Exodium.

EXODIUM, in the ancient Greek drama, one of the four parts or divisions of a tragedy, being so much of the piece as included the catastrophe and unraveling of the plot, and answering nearly to our fourth and fifth acts.

EXODIUM, among the Romans, consisted of certain humorous verses rehearsed by the exodiary at the end of the Fabule Attelane.

EXODIUM, in the Septagint, signifies the end or conclusion of a feast. Particularly, it is used for the eighth day of the feast of tabernacles, which, it is said, had a special view to the commemoration of the Exodus or departure out of Egypt.

EXODUS, a canonical book of the Old Testament; being the second of the Pentateuch, or five books of Moses.

It is so called from the Greek ἐξοδος, the going out or departure of the children of Israel from the land of Egypt; the history of which is delivered in this book, together with the many miracles wrought on that occasion.

EXOMPHALUS, in Surgery, called also omphalolexis and hernia umbilicalis, is a preternatural tumor of the abdomen, at the navel, from a rupture or distension of the parts which invest that cavity.

EXORCISM, the expelling of devils from persons possessed, by means of conjurations and prayers. The Jews made great pretences to this power. Josephus tells several wonderful tales of the great success of several exorcists. One Eleazer, a Jew, cured many demons, he says, by means of a root set in a ring. This root, with the ring, was held under the patient's nose, and the devil was forthwith evacuated. The most part ofconjurers of this class were impostors, each pretending to a secret nostrum or charm which was an overmatch for the devil. Our Saviour was sometimes to his disciples a real power over demons, or perhaps over the diseases said to be occasioned by demons. See De Montac.

Exorcism makes a considerable part of the superstition of the church of Rome, the rituals of which forbid the exorcising any person without the bishop's leave. The ceremony is performed at the lower end of the church, towards the door. The exorcist first signs the possessed person with the sign of the cross, makes him kneel, and sprinkles him with holy water. Then follow the litanies, psalms, and prayer; after which the exorcist asks the devil his name, and adjures him by the mysteries of the Christian religion not to afflict the person any more; then, laying his right hand on the demoniac's head, he repeats the form of exorcism, which is this: “I exorcise thee, unclean spirit, in the name of Jesus Christ: tremble, O Satan! thou enemy of the faith, thou foe of mankind, who hast brought death into the world, who hast deprived men of life, and hast rebelled against justice; thou seducer of mankind, thou root of evil, thou source of avarice, discord, and envy.” The Romanists likewise exorcise houses and other places, supposed to be haunted by unclean spirits; and the ceremony is much the same with that for persons possessed.

EXORCISTS, in church history, an order of men, in the ancient church, whose employment it was to exorcise or cast out devils. See the preceding article.

EXORDIUM, in Oratory, is the preamble or beginning, serving to prepare the audience for the rest of the discourse.

Exordiums are of two kinds; either just and formal, or vehement and abrupt. The last are more suitable on occasions of extraordinary joy, indignation, or the like. See Oratory, No. 26.

EXOSTOSIS (from α, out, and στειφω, a bone), in Anatomy, an acute eminence or excrescence, pushing preternaturally above the bone.

EXOTERIC and ESOTERIC, are terms denoting exterior and interior, and applied to the double doctrine of the ancient philosophers: the one was public or exoteric; the other secret, or esoteric. The first was that which they openly professed and taught to the world; the latter was confined to a small number of chosen disciples. This method was derived originally from the Egyptians; who, according to the united testimony of Herodotus, Diodorus Siculus, Strabo, Plutarch, &c. had a twofold philosophy, one secret and sacred, another public and common. The same practice also obtained among the Persian Magi, the Druids of the Gauls, and the Brahmanas of India. The Egyptian priests, with whom it originated, sustained the character of judges and magistrates, and probably introduced this distinction with a view to the public welfare, and to serve the purpose of legislation and government. Clement of Alexandria informs us,
that they communicated their mysteries principally to those who were concerned in the administration of the state; and Plutarch confirms the same declaration. However, others have supposed that they invented the fables of their gods and heroes, and the other external ceremonies of their religion, to disguise and conceal natural and moral truths; but whatever was the motive of their practice, it was certainly applied to political purposes.

EXOTIC, a term properly signifying foreign or extraneous, i.e. brought from a remote or strange country. In which sense we sometimes say exotic or barbarous terms or words, &c. The word is derived from the Greek ἔξω, ἐξώ, ἔξτρω, "without, on the outside."

EXOTIC, is chiefly applied to plants which are natives of foreign countries, particularly those brought from the East or West Indies, and which do not naturally grow in Europe.

The generality of exotics, or exotic plants, do not thrive in England without some peculiar care or culture: they require the warmth of their own climates; whence the use of hot beds, glass frames, green houses, &c. See Gardening Index. EXPANSION, among metaphysicians, denotes the idea which we have of lasting distance, all whose parts exist together.

EXPANSION, in Physics, the enlargement or increase of bulk in bodies, chiefly by means of heat. This is one of the most general effects of that subtle principle, being common to all bodies whatever, whether solid or fluid. In some few cases, indeed, bodies seem to expand as they grow cold, as water in the act of freezing; but this is found to be owing to a new arrangement of the particles, or to crystallization; and is not at all a regular and gradual expansion like that of metals, or any other solid or fluid substance by means of heat. In certain metals also, an expansion takes place when they pass from a fluid to a solid state: but this too is not to be accounted any proper effect of cold, but of the arrangement of the parts of a metal in a peculiar manner; and is, therefore, to be ascribed to a kind of crystallization.

The expansion of bodies by heat is very various, and in solids does not seem to be guided by any certain rule. In the 4th volume of the Phil. Trans. Mr Smeeaton has given a table of the expansions of many different substances. See Chemistry Index.

EXPECTANCY, ESTATES IN, are of two sorts; one created by act of the parties, called a remainder; the other, by act of law, called reversion.

EXPECTATION, in the doctrine of chances, is applied to any contingent event, and is capable of being reduced to the rules of computation. Thus a sum of money in expectation when a particular event happens, has a determinate value before that event happens; so that if a person is to receive any sum, e.g. 10l. when an event takes place which has an equal probability of happening and failing, the value of the expectation is half that sum or 5l.; and in all cases the expectation of obtaining any sum is estimated by multiplying the value of the sum expected by the fraction which represents the probability of obtaining it. The expectation of a person who has three chances in five of obtaining 100l. is equal to \(\frac{3}{5} \times 100\) or 60l. and the probability of obtaining 10ol. in this case is equal to \(\frac{2}{5}\).

EXPECTATION of Life, signifies, in the doctrine of life annuities, that share or number of the years of human life, which a person of any given age may expect to enjoy on an equality of chance.

According to Mr. Simpson, by the expectation of life we are not to understand that period which a person may have an equal chance of surviving, which is a different and more simple consideration; but the number of years at which the present of an annuity ought to be valued, granted on it without discount of money. There will be a greater or less difference in this number of years, in proportion to the various degrees of mortality to which the different stages of human life are exposed. Thus, it is more than an equal chance that an infant just come into the world, will not reach the age of 10 years; yet the expectation of life, or share of existence due to it, is almost 20 years upon an average. The reason of this vast difference is the excess of the probability of death in the first tender years of existence, above that which respects the more advanced stages. If the numbers of those who die at every assignable period were always found to be on an equality, the two quantities already mentioned would be the same; but when these numbers constantly become less and less, the expectation must of consequence become the greater of the two.

EXPECTORANTS, in Pharmacy, medicines which promote EXPECTORATION. See Materia Medica Index.

EXPECTORATION, the act of evacuating or bringing up phlegm or other matters out of the trachea, lungs, &c. by coughing, hacking, spitting, &c.

EXPEDITION, in the forest laws, signifies a cutting out the paths in a dog's fore feet for the preservation of the king's game.

Every one that keeps any great dog not expedited forfeits three shillings and four pence to the king. In mastiffs, not the ball of the feet, but the three claws, are to be cut to the skin. Instruct. Part VI. p. 308.

This expedition was to be performed once in every three years, and was done to every man's dog who lived near the forest, and even the dogs of the foresters themselves.

EXPEDITION, the march of an army to some distant place, with a view of hostilities. Such were the expeditions of Cyrus against Artaxerxes, and of Bacchus and Alexander into the Indies.

Expeditions for the recovery of the Holy Land were called crusades.

EXPERIENCE, a kind of knowledge acquired by long use without any teacher. It consists in the ideas of things we have seen or read, which the judgment has reflected on, to form for itself a rule or method.

Authors make three kinds of experience: the first is the simple uses of the external senses, whereby we perceive the phenomena of natural things without any direct attention thereto, or making any application thereof. The second is, when we premeditatively and designedly make trials of various things, or observe those done by others, attending closely to all effects and circumstances. The third is that preceded by a foreknowledge, or at least an apprehension of the event, and
EXPERIMENTAL PHILOSOPHY

It is that which has its foundation in experience, wherein nothing is assumed as a truth but what is founded upon ocular demonstration, or which cannot be denied without violating the common sense and perceptions of all mankind.

In former times philosophers, when reasoning about natural things, instead of following this method, assumed such principles as they imagined sufficient for explaining the phenomena, without considering whether these principles were just or not. Hence for a great number of ages no progress was made in science; but systems were heaped upon systems, having neither consistency with one another nor with themselves. No proper explanations indeed were given of anything; for all these systems, when narrowly examined, were found to consist merely in changes of words, which were often vary absurd and barbarous. The first who deviated from this method of philosophizing, if we may call it by that name, was Friar Bacon, who lived in the 13th century, and who spelt 2000l. (an immense sum in those days) in making experiments. The Admireable Crichton, who flourished about the year 1580, not only disputed against the philosophy of Aristotle, which had for so long been in vogue, but wrote a book against it. Cotemporary with this celebrated personage was Francis Bacon lord chancellor of England, who is looked upon to be the founder of the present mode of philosophy or experimentals. But though he might lay the foundation, Sir Isaac Newton is justly allowed to have brought this kind of philosophy to perfection; and to him we are certainly indebted for the greatest part of it. Unfortunately, however, neither Lord Bacon nor Sir Isaac Newton had an opportunity of knowing many important facts relating to the principles of fire and electricity, which have since been brought to light. Hence all their philosophy was merely mechanical, or derived from the visible operations of solid bodies, or of the grosser fluids, upon one another. In such cases, therefore, where the more subtle and active fluids were concerned, they fell into mistakes, or were obliged to deny the existence of the principles altogether, and to make use of terms which were equally unintelligible and incapable of conveying any information with those of their predecessors. A remarkable instance of the errors into which they were thus betrayed, we have in the doctrine of projectiles, where the most enormous deviations from truth were sanctioned by the greatest names of the last century, merely by reasoning from the resistance of the air to bodies moving slowly and visibly, to its resistance to the same bodies when moved with high degree of velocity. In other cases they were reduced to make use of words to express inmechanical powers, as attraction, repulsion, rarefaction, &c. which have since tended in no small degree to embarrass and confound science by the disputes that have taken place concerning them. The foundations of the present system of experimental philosophy are as follows:

I. All the material substances of which the universe is composed are called natural bodies. What we perceive is neither uniform nor invariable in these substances we call their properties. Some of these are general and common to all matter, as extension; others are proper to particular substances, for instance fluidity; while some appear to be compounded of general and particular properties, and thus belong to a still smaller number; as the properties of air, which are derived from the general property of extension combined with those of fluidity, elasticity, &c.

II. In taking a particular review of the properties of bodies we naturally begin with that of extension. This manifests itself by the three dimensions of length, breadth, and thickness. Hence proceeds the divisibility of matter; which the present system supposes to reach even to infinity: but though this proposition be supported by mathematical demonstrations, it is impossible we can either have any distinct idea of it, or of the opposite doctrine, which teaches that matter is composed of excessively minute particles called atoms, which cannot be divided into smaller ones. The subtlety indeed to which solid bodies may be reduced by mechanical means is very surprising; and in space is so great, that we might be tempted to suppose that a further division is impossible. Thus, in grinding a speculum, the inequalities of its surface are so effectually worn off, that the whole becomes in a certain degree invisible, showing not itself by the light which falls upon it, but the image of other bodies; but the smallest scratch which disturbs the equality of the surface is at once distinctly visible.

III. From the arrangement of these ultimate particles of matter, whatever we suppose them to be, arise the various figures of bodies: and hence figure is a property of all bodies no less universal than extension, unless we choose to speak of the ultimate particles of matter, which, as they are supposed to be destitute of parts, must consequently be equally destitute of figure, and the same consequence will follow whether we adopt this supposition or the other. The figures of bodies are so extremely various and dissimilar, that it is impossible to find any two perfectly alike. It is indeed the next thing to impossible to find two in which the dissimilarity may not be perceived by the naked eye; but if any such should be found, the microscope will quickly discover the imbecility of our senses in this respect. Solidity is another property essential to all matter. By this we mean that property which one quantity of matter has of excluding any other from the space which itself occupies.
EXPERIMENTAL PHILOSOPHY.

occupies at that time. Hence arises what we call resistance, which is always an indication of solidity; and no less so in those bodies which we call fluid than in those which are the most solid. This may at first seem to be a contradiction; but fluids yield only when they can get away from the pressure; in all other cases they resist as violently as the most solid bodies. Thus water confined in a tube will as effectually resist the impression of a piston thrust down upon it as though it were the most solid substance. Air indeed will yield for a certain time; but this is as appears from several experiments, entirely owing to a more subtle-fluid, viz. that of elementary fire, being pressed out from among its particles. As long as this fluid can be forced out, either from among the particles of air, water, or any other more gross fluid substance, the latter will be found compressible, as a heap of wet sand would be by squeezing the water out from it; but when we come to the most subtle of all elements, such as we suppose that of fire to be, there cannot be any possibility of compressing it, even though we had a vessel so close as to prevent it from escaping through its sides; because its parts are already as near each other as they can be.

IV. The distance of the parts of bodies from each other is what we call their porosity, and was formerly supposed to be owing to a vacuum interspersed between them; but now it is generally allowed that the pores of solid bodies as well as of fluids are filled with an extremely subtle matter which pervades all nature. The porosity of bodies with regard to one another may be thus explained. Wood or a sponge is porous with regard to water; but water itself is porous with regard to air, which it absorbs in considerable quantity. But air and water are porous with regard to the element of fire, which produces very considerable changes upon them, according to the quantity of it they contain, or the manner it acts in their pores. The element itself, however, is not porous with regard to any other substance. Its pores, therefore, if it has any, must be absolute vacuities, destitute of any matter whatever. Vacuities of this kind indeed are supposed to be absolutely necessary to motion: for though we may say, matter being divisible almost ad infinitum, that a body or substance more solid may move in another substance that is more subtle, and that will give way to its motion, we must nevertheless have recourse to a last resort, and admit of an ultimate vacuum, which will give room sufficient to the least corpuscle, that its part may take the place of its part without the least resistance: besides, it is not to be imagined, that nature, in fact, admits of that infinite divisibility which our imagination can conceive, and that every thing which is possible in idea is at all times practicable. All that exists is possible, but all that is possible does not however exist. By density, is understood the proportion between the extension and solidity of a body; one body therefore is more dense than another, when, under the same degree of extension, it contains more solid matter: and this quality arises from condensation and compression. Elasticity is nothing more than that effort by which certain bodies, when compressed, endeavour to restore themselves to their former state; and this property supposes them compressible. As all these natural properties of bodies are of great utility in explaining the principles of physics, and in applying them to all the arts, experimental philosophy proves their reality by a thousand examples.

V. We discover still other properties in bodies; such as mobility, which we must not here confound with motion. This mobility arises from certain dispositions which are not in an equal degree in all bodies: from whence it comes that some are more easily moved than others: and this proceeds from the resistance to motion which is perceived in all bodies: having regard merely to their mass; and this resistance is called the inert, or inert force. A body is said to have motion when it is actually moving from one place to another; or, whenever a body changes its situation with regard to the objects that surround it, either nearly or remotely, it is said to be in motion. There are three principal matters to be considered in a moving body; its direction, its velocity, and the quantity of its motion: and here physics explains the force or moving power; it likewise distinguishes between simple and compound motion. Simple motion is that which arises from only one force, or which tends to one point only. It describes the laws, and explains the resistance, of mediums; the resistance of friction; the difficulties of a perpetual motion; the alteration of direction occasioned by the opposition of a fluid matter; reflected or reverberated motion; the communication of motion by the shock of bodies, &c. Compound motion is that of a body impelled to move by several causes or powers which act according to their different directions. Physics here likewise investigates the laws of motion; and is particularly applied to the explaining, under this head, what are called the central forces, which produce a motion that is either circular or in a curve line, and which incessantly urge the moving body either to approach or recede from the centre. To distinguish these from each other, the former is called the centripetal force, and the latter the centrifugal force. See DYNAMICS.

VI. By gravity, or ponderosity, is to be understood that force which occasions bodies to pass from a higher to a lower place, when nothing opposes their course, or when the obstacles are not sufficient to stop them. Speculative philosophy investigates its cause, and perhaps in vain. Experimental philosophy contents itself with describing the phenomena, and teaching the laws of gravity, which are thoroughly established by a thousand reiterated experiments. In order properly to understand this subject, we must take care not to confound the term gravity with that of weight. By the former, we understand that force which urges bodies to descend through a certain space in a given time. By the latter, is meant the quantity of a heavy body that is contained under the same bulk. The phenomena are explained by the experiments themselves, and by inferences deduced from them.

VII. Hydrostatics is a science of which the object is the gravity and equilibrium of fluids in particular. Though the gravity of these bodies is the same with that of others, and is subject to the same laws, yet their state of fluidity gives rise to particular phenomena, which it is of consequence to know. But as hydrostatics cannot be successfully treated without the assistance of calculation, it has been ranked among the mathematical sciences.

VIII. We say the same with regard to mechanics; which is the art of employing, by the aid of machines,
the motion of bodies, in conformity to its properties and laws, as well with regard to solids as fluids, either more commodiously or more advantageously.

IX. After it has made the most accurate experiments, and the most judicious observations, on all these different subjects, and the properties of bodies in particular, Experimental Philosophy passes to the examination of the air, the water, fire, the wind, colours, &c. The air is a fluid with which we are surrounded from the instant of our birth, and without which we cannot exist. It is by the properties and the influences of the air, that nature gives increase and perfection to all that it produces for our wants and conveniences: it is the spirit of navigation: sound, voice, speech itself, are nothing more than percussions of the air: this globe that we inhabit is completely surrounded by air: and this kind of coverture, which is commonly called the atmosphere, has such remarkable functions, that it evidently appears to concur to the mechanism of nature. Experimental physics, therefore, considers the air, 1. Of itself, independent of its bulk, and the figure of its whole body: it examines its essential properties: as its gravity, density, spring, &c. The air-pump is here of indispensable use; and by this machine physics examines in what manner space, or a vacuum, is made. It likewise shows the necessity of air to the preservation of animal life: the effect it has on sound, fire, and gunpowder, in smoke; and a hundred other experiments of various degrees of curiosity. 2. It considers the air as the terrestrial atmosphere, sometimes as a fluid at rest, and sometimes in motion. And by these means it accounts for the variation of the mercury in the barometer, and why it sinks in proportion as the height of the atmosphere diminishes; as also for the figure, the extent, and weight of the atmosphere: it shows the method of determining the height of mountains, the nature of sound in general, of its propagation, and of concordant sounds. The late discoveries have added greatly to experimental philosophy, of which an account is given under the article Chemistry, &c.

X. It is here also, that experimental philosophy considers the nature of the wind: which is nothing more than agitated air, a portion of the atmosphere that moves like a current, with a certain velocity and determinate direction. This fluid, with regard to its direction, takes different names according to the different points of the horizon from whence it comes, as east, west, north, and south. Winds are likewise distinguished into three sorts; one of which is called general or constant, as the trade winds which continually blow between the tropics: another is the periodical, which always begins and ends within a certain time of the year, or a certain hour of the day, as the monsoons, the land breezes and sea breezes, which arise constantly in the morning and evening; and lastly, such as are variable, as well with regard to their direction as their velocity and duration.

M. Mariotte computes the velocity of the most impetuous wind to be at the rate of 32 feet in a second, and Mr. Derham makes it 66 feet in the same time. The first, doubtless, meant the wind of the greatest velocity that had then come to his knowledge. The invention of aerostatic machines has tended more to show the real velocity of the wind than any other invention as yet made public; but all of them more slower than the aerial current; so that the real velocity of the wind remains yet undetermined.

XI. The force of the wind, like that of other bodies, depends on its velocity and mass: that is, the quantity of air which is in motion; so the same wind has more or less force on any obstacle that opposes it, in proportion as that obstacle presents a greater or a less surface: for which reason it is that they spread the sails of ships more or less, and propel the wings of a windmill in different directions. The machine by which the winds are measured, are called anemometers. They show the direction, the velocity, and the duration of the winds. It is by the agitations of the winds that the air is purified; that the seeds of trees and herbs are conveyed through the forests and fields; that ships are driven from one pole to the other; that our mills turn upon their axles, &c.: and art, by imitating nature, sometimes procures us artificial winds, by which we refresh our bodies, invigorate our fires, purify our corn, &c.

XII. Water is an universal agent, which nature employs in all her productions. It may be considered as in three states: 1. As a liquid; 2. As a vapour; 3. As ice. These three different states do not in any manner change its essence, but make it proper to answer different ends. The natural state of water would be that of a solid body, as fat, wax, and all those other bodies which are only fluid when heated to a certain degree; for water would be constantly ice, if the particles of fire, by which it is penetrated in the temperate climates, did not render it fluid, by producing a reciprocal motion among its parts; and, in a country where the cold is continually strong enough to maintain the congelation, the assistance of art is necessary to make it fluid in the same manner as we do lead, &c. Water, when not in ice, is a fluid that is insipid, transparent, without colour and without smell, and that easily adheres to the surface of some bodies, that penetrates many, and extinguishes fire. Experimental philosophy investigates the origin of fountains; the cause of the saltiness of the sea; the means of purifying water; what is its weight, and what are its effects when heated, &c. It likewise examines this fluid in the state of vapour; and finds that a drop of water, when in vapour, occupies a space vastly greater than it did before. It explains the ascension and its effects; fire engines; and the force of vapour that gives motion to immense machines in mines and elsewhere, &c. And lastly, it considers water in the state of ice. Ice consequentlly is more cold than water; and its coldness increases if it continues to lose that matter, already too rare, or too little active, to render it fluid. Experimental physics endeavours to investigate the causes of the congelation of water, and why ice is lighter than water; from whence it derives that expansive force by which it breaks the containing vessel; the difference there is between the congelation of rivers and that of standing waters; why ice becomes more cold by the mixture of salts; and many other similar phenomena.

XIII. The nature of fire is yet very much unknown to the most learned philosophers. As objects when at a great distance are not perceptible to our senses, so when we examine them too nearly, we discern them but confusedly. It is still disputed whether fire be a homogene, unalterable matter, designed, by its presence, or by its
EXPERIMENTAL PHILOSOPHY.

action, to produce heat, inflammation, and dissolution, in bodies; or if its essence consists in motion only, or in the fermentation of those particles which we call inflammable, and which enter as principles, in greater or less quantities, in the composition of mixed bodies. The most learned inquirers into nature incline to the former opinion; and to have recourse to a matter which they regard as the principle of fire. They suppose that there is in nature a fluid adapted to this purpose, created such from the beginning; and that nothing more is necessary than to put it in action. The numberless experiments which are daily made in electricity seem to favour this opinion, and to prove that this matter, this fluid, this elementary fire, is diffused through all nature, and in all bodies, even ice itself. We cannot say to what important knowledge this great discovery of electricity may lead if we continue our inquiries concerning it. It appears, however, that we may believe, without any inconvenience or absurdity, that fire and light, considered in their first principle, are one and the same substance differently modified.

XIV. Be this matter however as it may, experimental philosophy is employed in making the most ingenious and most useful researches concerning the nature of fire, its propagation, and the means by which its power may be excited or augmented; concerning the phosphorus and its inflammation; fire excited by the reflection of the sun's rays from a mirror; and on the effects of fire in general; concerning lightning and its effects; the fission of metals; gunpowder and its explosion; flame and the aliments of fire; and an infinity of like objects which it explains, or concerning which it makes new discoveries, by the aid of experiments.

XV. By the word *light*, we understand that agent by which nature affects the eye with that lively and almost constantly pleasing sensation, which we call *seeing*, and by which we discern the size, figure, colour, and situation of objects, when at a convenient distance. All philosophers agree, that the light which is diffused in any place, is a real body. But what this body is, and by what means it enters that place where it is perceived, is a question about which philosophers are divided.

XVI. Experimental philosophy is applied in discovering or proving, by an infinity of experiments, what is the nature of light, in what manner it is propagated, what its velocity and progressive motion. It also investigates and explains the principle of *optics* properly so called, and shows the directions which light observes in its motions. From these it proceeds to the examen of the principles of *catoptrics*, and describes the laws and effects of reflected light. It next treats of the principles of *dioptrics*, and explains the laws of refracted light; and lastly, it teaches, from the principles of natural and artificial vision, the construction of optical instruments, as lenses, concave mirrors, prisms, telescopes, &c. &c. and the uses to which they are applied.

XVII. By resolving or separating the rays of light, philosophy has obtained true and clear discoveries of the nature of colours. We are naturally led to imagine that colours, and their different degrees, make a part of the bodies that present them to our sight; that white is inherent in snow, green in leaves and grass, and red in a stuff dyed of that colour. But this is far from being true. If an object, which presents any colour to our sight, be not illuminated, it presents no colour whatsoever. In the night all is black. Colours therefore depend on light; for without that we could form no idea of them; but they depend also on bodies; for of several objects presented to the same light, some appear white, others red, blue, &c. But all these matters being separate from our own bodies, we should never acquire any idea of them, if the light, transmitted or reflected by these objects, did not make them sensible to us, by striking upon the organs of our sight, and if these impressions did not revive in us those ideas which we have been used to express by certain terms. For these reasons philosophy considers colours from three points of view. 1. As in the light; 2. In bodies, as being coloured; and, 3. From the relation they have to our visual faculties, which they particularly affect, and by which we are enabled to distinguish them.

It is unnecessary in this place to say more, either on the nature of light in particular, or experimental philosophy in general. The different subjects of this collective article are particularly treated under their proper names, in the order of the alphabet: the reader will therefore turn, as he has occasion, to ACOUSTICS, CATOPTRICS, CHROMATICS, DIOTROPS, HYDRODYNAMICS, MECHANICS, OPTICS, PNEUMATICS, ELECTRICITY, MAGNETISM, &c. &c. &c. Also, AEROSTATION, ATMOSPHERE, BURNING GLASS, CHEMISTRY, &c. &c.

EXP.

EXPERIMENTUM CRUCIS, a capital, leading, or decisive experiment; thus termed, either on account of its being like a cross, or direction-post placed in the meeting of several roads, guiding men to the true knowledge of the nature of that thing they are inquiring after; or, on account of its being a kind of torture, whereby the nature of the thing is as it were extorted by force.

EXPHORESIS. See ORATORY, No 85.

EXPIATION, a religious act, by which satisfaction or atonement is made for the commission of some crime, the guilt done away, and the obligation to punishment cancelled.

Expiations among the Heathens, were of several kinds; as sacrifices and religious washings. They were used for effacing a crime, averting any calamity, and on numberless other occasions, as purifying towns, temples, and sacred places, and armies before and after battle. And they were performed for whole cities as well as particular persons.

The
The method of expiation among the Jews was chiefly by sacrifice, whether for sins of ignorance, or to purify themselves from certain pollutions.

Feast of Expiation, among the Jews, called by our translators the day of atonement, was held on the tenth day of Tisri, or the seventh month of the Jewish year, answering to part of our September and October. It was instituted by God himself, Levit. xxiii. 27, &c. On that day the high-priest, the figure or type of Jesus Christ, entered into the most holy place, and confessed his sins; and, after several ceremonies, made an atonement for all the people, to wash them from their sins. See Isa. v. 7; Matt. xxii. 40.

Expiation, in a figurative sense, is applied by divines to the pardon procured to the sins of the penitent by the merit of Christ's death. See the article Christianity.

Expiration, in Medicine. See Expiration.

Expiration, is also used figuratively, for the end of a term of time granted, agreed on, or adjudged.

Explicit, in the schools, something clear, distinct, formal, and unfolded.

Explosion, in Natural Philosophy, a sudden and violent expansion of an aerial or other elastic fluid, by which it instantly throws off any obstacle that happens to be in the way, sometimes with incredible force, and in such a manner as to produce the most astonishing effects upon the neighbouring objects.

Explosion differs from expansion, in that the latter is a gradual and continued power, acting uniformly for some time, whereas the former is always sudden, and only of momentary duration. The expansions of solid suns, loc. cit. chap. xxvi. See Scarc-Const.

The reason of this is, that the force of air is proportional to the quantity. Every one has heard of the prodigious effects of lightning when it happens to strike buildings, trees, or even the most solid rocks; and in some cases, where the quantity of electricity is still greater than in any flash of lightning, we hear of still more tremendous consequences ensuing. Dr Priestley gives an instance of a large fire ball (undoubtedly a quantity of electric matter) rolling on the surface of the sea, which after rising up to the top-most of a ship of war, burst with such violence that the explosion resembled the discharge of hundreds of cannon fired at once. Great damage was done by it; but there is not the least doubt that most of its force was spent on the air, or carried down to the sea by the mast and iron work of the ship. Indeed, considering that in all cases a great part of the force of electric explosions is dissipated in this manner it may justly be doubted whether they can be measured by any method applicable to the measurement of other forces. Even in artificial electricity the force is prodigiously great; insomuch that Dr Van Marum calculated that of the great battery belonging to the machine in Teyler's museum to be upwards of 900 pounds.

In those cases where the electrical matter acts like Volcanic common fire, the force of the explosions, though exceeding great, is capable of measurement by comparing the distances to which the bodies are thrown with their weight. This is most evident in volcanoes, where the projections of the burning rocks and lava manifest...
Explosion

In what manner aerial explosions take place.

The greatness of the power, at the same time that they afford a method of measuring it. These explosions, as is shown under the article Volcano, are owing to the extraction of aerial vapours, and their rarefaction by intense heat. In all of them the air is originally in a state of decomposition, viz. its invisible and solid part is joined with some terrestrial substances. Thus, when fixed air, for instance, is exposed to any pure earth which attracts it, as calcined magnesia, a decomposition instantly takes place. All these vapours are composed of elementary fire and some invisible substance capable of assuming a solid form. The decomposition just mentioned is therefore easily explained; the solid part of the air joins itself to the magnesia, while the elementary fire or latent heat is dissipated, and passes through the sides of the vessel. Were it now in our power suddenly to restore the latent heat to the whole of the fixed air, so that it would at once assume its former expansion, a violent explosion would follow. This seems to be precisely the case with the volcanic explosions. An immense quantity of the fixed part of different aerial fluids is united to the various substances found below the surface of the earth. By means of the electric fire which kindles the volcanoes, the aerial fluids are suddenly restored to their elastic state; and not only so, but their natural elasticity is greatly augmented, so that the explosions take place with great violence. The case is the same with gunpowder; only that the condensed air in this case is at first of the degphlogisticated kind, but is quickly phlogisticated by reason of the combustible matters mixed with the nitre, while the heat produced by the inflammation augments the elasticity of the generated air so four times what it usually is. The pressure of the expansion is calculated at 1000 times the pressure of the common atmosphere.

Thus the explosions of gunpowder and of volcanoes are essentially the same. The reason of the extreme quickness of those of gunpowder is, that it takes fire so readily by the intimate mixture and combustibility of all the materials. In volcanoes the explosions likewise follow one another very quickly, and are by no means inferior in strength to those of gunpowder; but here the quantity of vapour makes up for the comparative slowness with which it is affected by the heat. Thus, though we could not by any means contrive to fire cannon in quick succession by means of calcareous earth as we can do with gunpowder, yet in the huge furnace of a volcano the elastic matter is supplied in such quantities, that the explosions are in a manner unremitting; and even in ordinary experiments the confinement of aerial vapours has often occasioned violent explosions in chemical vessels. In one case too the extraction of fixed air is as easy as it was in the other, viz. in that of pulvis fulminans. This is compounded of sulphur, saltpetre, and salt of tartar. The latter we know contains much fixed air: and it is probable that the violence of the explosion is occasioned by this air; for the greater quantity of it that the alkaline salt contains, the greater force does it explode with. Fulminating gold emits a quantity of phlogisticated air, to which its explosive power is supposed to be owing, as is explained under the article Chemistry; but that of fulminating silver is so extraordinary, that scarce any force of aerial vapour that can be extricated is likely to produce it, and it seems probable that electricity itself is concerned.

Next in strength to the aerial vapours are those of aqueous and other liquids. The most remarkable effects of these are observed in steam engines; but there is one particular case from which it has been inferred that aqueous steam is vastly stronger than the flame of gunpowder. This is when water is thrown upon melted copper; for here the explosion is so strong as almost to exceed imagination; and the most terrible accidents have been known to happen from such a slight cause as one of the workmen spitting in the furnace where copper was melting. Here, however, it is most probable that a decomposition of the water takes place. That this element can be decomposed, or resolved into elastic vapours, has been completely established by the most satisfactory experiments, and is now, we believe, universally admitted by chemical philosophers. See Water, Chemistry Index. The position is indeed denied by the phlogistians; but their arguments appear not to be conclusive; nor is it a fact which militates in the least against their principles. On the supposition that the water is decomposed in the present case, however, the phenomenon in question is easily solved. The water being thrown in substance upon the melted copper, is decomposed by the violent heat, and one part of it adheres to the metal, thus converting it into a calx, or oxide, while the other is converted into inflammable air, or hydrogen gas, which expanding suddenly, throws the melted metal all about with the greatest violence by means of its reaction.

To understand the manner in which this is accomplished, we must consider some of the principles of Gunnery laid down by Mr Robins, and related under that article. One of these is, that though the air, in cases of ordinary velocity, makes no great resistance, it is far otherwise where the velocity of the moving body becomes very great. In all cases of explosion there is in the first instance a resisting vacuum made by the exploding fluid; and consequently the weight of the atmosphere is to be overcome, which amounts to about 14 pounds on every square inch of surface. Supposing the surface of the exploding fluid, then, on that of melted copper, to contain an area of 4 square inches, it meets with a resistance of 60 pounds from the atmosphere, and consequently communicates an equal pressure to the fluid metal. Even this must of consequence throw it about, unless the same pressure was exactly diffused over every part of the surface. But much more must this effect be increased by the immense velocity with which the fluid moves, and by which the resistance of the atmosphere is augmented in a prodigious degree, as is easily understood from the article Gunnery. The elastic fluid generated is then confined not only by the fluid metal and sides of the furnace, but by the air itself, which cannot get out of the way; so that the whole resembles a cannon closed at the mouth, and filled with inflamed gunpowder. Hence not only the melted metal, but the furnace itself and the adjacent walls of the building, are hurried off as they would be by the firing of a great quantity of gunpowder in a small space, and which is well known to produce analogous effects.

In explaining the phenomenon in question, Dr Black supposes that the mere heat of the metal applied to the
Explosion. aqueous steam produces the explosion; and in proof of this allegation, that copper imbibes a greater quantity of heat during fusion than any other metal. Aqueous steam, however, seems to be too slow for producing such sudden and violent effects. Explosions, it is true, will be occasioned by it, but then it must be confined for a very considerable time; whereas the effects of water thrown upon melted copper would probably be overthrown.

It may be asked, Why such explosions do not take place with any other metal, iron for instance, when water is thrown upon its surface in fusion? In answer to this we must observe, That though water is decomposed by being applied to red-hot iron in the form of steam, yet there is a possibility, that when the same element is applied in substance to the fluid metal, no decomposition may ensue. Something like this indeed happens with copper itself; for, notwithstanding the violent effects which take place on the contact of water in substance with the melted metal, no explosion happens though aqueous steam be thrown upon its surface. On the contrary, the upper part of the metal is thus cooled, and forms itself into cakes, which are afterwards taken off, and new ones formed in the same manner; neither does aqueous steam affect red-hot copper in the manner that it does iron in the same state.

A decisive proof that the explosion is not occasioned by the mere heat of the aqueous steam may be deduced from the example of melted glass, which produces no explosion though we pour water upon it in that state; and yet the best of melted glass is undoubtedly equal at least to that of melted copper. It must be observed, however, that in all cases where a very hot body is thrown upon a small quantity of water in substance, an explosion will follow; but here the water is confined and suddenly rarefied into steam, which cannot get away without throwing off the body which confines it. Examples of this kind frequently occur where masons or other mechanics are employed in fastening cramps of iron into stones, where, if there happens to be a little water in the hole into which the lead is poured, the latter will fly out in such a manner as sometimes to burn them severely. Terrible accidents of this kind have sometimes happened in founderies, when large quantities of melted metal have been poured into wet moulds. In these cases, the sudden expansion of the aqueous steam has thrown out the metal with violence; and if any decomposition has taken place at the same time, so as to convert the aqueous into an air-vapour, the explosion must be still greater.

To this last kind of explosion we must refer that which takes place on pouring cold water into boiling or burning oil or tallow. Here the case is much the same whether we pour the oil on the water, or the water on the oil. In the former case, the water which lies at the bottom is rarefied into steam, and explodes; in the latter, it sinks down through the oil by its superior specific gravity, and explodes as it passes along.

In either case, however, the quantity of aqueous fluid must be but small in proportion to that of the oil: a very great quantity would put out the flame, or destroy the heat, in whatever way we applied it.

Another kind of explosion is that which takes place in solid substances, where we can scarcely suppose either aqueous or aerial vapours to be concerned. The most remarkable of these are the volcanic bombs mentioned by Sir William Hamilton in the great eruption of Vesuvius in 1779. They were large pieces of lava which burst in pieces like bombs as they fell to the ground; but he does not inform us whether their bursting was attended with any great violence or not. Indeed, amidst such scenes of horror, and the continual tremendous explosions of the volcano, smaller phenomena of this kind would probably be overlooked.

It is most likely that article; the bursting of electrical globes, when put in motion; of other glass vessels spontaneously, and seemingly without any cause; and lastly, the bursting of large cast metal vessels in the act of cooling. These are all so similar to one another, that it is probable they depend on one general cause. All of them agree in this respect, that the extreme parts of them are considerably cooled, while the internal remain very hot. Thus, in the volcanic bombs, the current of air, formed by their swift passage through it in falling, necessarily carries off a great quantity of heat from the parts which are in contact with it, while the rest are scarce at all cooled. The glass tears are artificially cooled on the outside by dropping them upon water; and in consequence of this, their explosion is probably more violent in proportion to their bulk than that of the volcanic bombs. Glass vessels only burst spontaneously when they have not been well annealed; and we know that this bad annealing consists only in applying cold too suddenly to the outside. Something like this probably takes place when cast-iron vessels explode; and we are certain it does so with electrical globes, for these last are not apt to burst if they have been well annealed. In all cases, therefore, there is a remarkable contraction of the outward surface by the cold, while the internal parts remain as much expanded as ever. In this case there must be a continual effort of that subtile fluid called elementary fire, from the internal to the external part, as the contraction gradually proceeds the contrary way. Thus, when a volcanic bomb, for instance, is cooled on the outside, its parts are consolidated so that the internal fluid has not such an easy passage through it as is necessary. In consequence of this it makes a greater effort, which is still further augmented by the cooling and contraction of the internal parts squeezing the fluid out from among themselves, and forcing it to recoil upon that in the centre, as well as to exert itself against the external part; from which united operation the effect already mentioned at last takes place. This explanation, however, does not hold with respect to electrical globes, glass tears, or ill annealed glass; but in order to accommodate it to all these, we have only to remember that fire, and the electric fluid acting from a centre to a circumference, are not in the least different; so that from whatever cause the electric matter is disposed to act in this manner, the same effect will follow, i.e. an explosion will take place if the substance does not afford an equally easy passage through all its parts, and that whether any sensible heat is felt in it or not.

The only other kind of explosion we have to notice is that produced by inflammable and depblongisti- cated air, or oxygen and hydrogen gases, when mixed and oxygen together and set on fire. This differs from any of those hitherto considered, because in reality there is an abso-
Explosion.

Itute condensation rather than an expansion throughout the whole of the operation; and the result is the formation of water; and could the air be made to take fire throughout their whole substance absolutely at the same instant, there would be no explosion, but only a sudden production of heat. From this cause also is derived a very singular phenomenon, taken notice of by Dr Priestley in his experiments on that subject, recorded in the Phil. Trans. Having enclosed several quantities of inflammable and explosively disposed air in a copper vessel, fuming them afterwards by the electric sparks, he found that the force of the explosion was directed more towards one part of the vessel than another; least on that part where the electrical discharge was made, and most upon that which was farthest from it. This inequality was very considerable; insomuch that he could not repeat his experiments any number of times without injuring the vessel in that part which was farthest from the discharge. The reason he gives for this is, that the mixture was not fired at the same instant, but first at the place where the discharge was made. This first explosion would have acted equally upon all parts of the vessel, had it not been for the intervention of the air. By the first momentary explosion, however, the air in the farthest part of the vessel was condensed, so that the next explosion was made stronger, while the copper in the fore part of the vessel had the whole of this strong explosion to resist, the hinder part being little concerned, as the air in it was condensed and reduced almost to a vacuum.

The phenomena of explosions are sometimes very destructive, they are likewise of considerable use in life, by removing obstacles which could scarcely be got the better of by any mechanical power whatever. The principal of these are the blowing up of rocks, the separating of stones in quarries, and other purposes of that kind. The destruction occasioned by them in times of war, and the machines formed upon the principle of explosion for the destruction of the human race, are well known; and if we cannot call these useful, we must allow them at least to be necessary evils. For the production of explosions, gunpowder is the only substance that has yet been found to answer; nevertheless, as its use is attended with considerable expense, several attempts have been made to find out a cheap substitute for it. One of the most remarkable of these was by mixing small quantities of water, enclosed in little bladders or some easily destructible vehicles, along with a charge of powder. By this contrivance it was hoped that the water being converted into vapour when the powder was inflamed, would augment the force of the explosion, but instead of this, it was found greatly to diminish it. The reason was evident, viz. that the conversion of the water into steam required so much of the latent heat of the inflamed gunpowder that enough was not left to give the necessary expansion to the aerial fluid produced. A mixture of hydrogen and oxygen gases has also been tried; but the explosion here has always been found too weak. In mines, indeed, very terrible effects are produced by such a mixture, but in these the quantity is immense; so that the comparative weakness of the mixture cannot be discovered. Electricity therefore seems to be the only resource we have; except by adding ingredients to gunpowder which may increase the strength of it. There can be no doubt in deded that the electric fluid is possessed of sufficient strength to perform every thing we could desire; and electricians have supposed, perhaps justly enough, that a cannon charged with water might, by means of electricity, become more dangerous than one charged with gunpowder: but this fluid is so exceedingly capricious, so imperceptible and unmanageable, that the use of it cannot as yet be thought practicable, nor in all probability ever will be so.

The effects of explosions, when violent, are felt at a considerable distance, by reason of the concussions they give to the atmosphere; for, as has been already hinted, all of them act upon the atmospheric fluid with the very same force they exert upon terrestrial substances subjected to their action. Sir William Hamilton relates, that at the explosions of Vesuvius in 1767, the doors and windows of the houses at Naples flew open if unbolted, and one door was burst open though it had been locked. A great quantity of gunpowder being put into the ditch of a fortified city, and set on fire, destroyed part of the wall, and broke down one of the gates. The blowing up of powder magazines or powder mills will destroy buildings and kill people, though certainly without the reach of the flame, and untouched by any part of the shattered magazine or mill. But the most curious effect is, that they electrify the air, and even glass windows, at a considerable distance. This is always observable in firing the guns of the Tower at London; and some years ago, after an explosion of some powder mists in the neighbourhood of that city, a great number of people were alarmed by a rattling and breaking of their china ware; which by the vulgar was taken for a supernatural phenomenon, but undoubtedly was owing to some commotion in the electrical fluid from the violent concussion of the atmosphere. In this respect, however, the effects of electrical explosions themselves are most remarkable, though not in the uncommon way just mentioned; but it is certain that the influence of a flash of lightning is diffused for a great way round the place where the explosion happens, producing many very perceptible changes both on the animal and vegetable creation.

EXPONENT, in Algebra, the same with index. See ALGEBRA.

EXPONENT is also used in arithmetic, in the same sense as index or logarithm.

Exponential Calculus, the method of differencing, or finding the fluxions of exponential quantities, and of summing up those differences, or finding their fluents.

Exponential Curve, is that whose nature is defined or expressed by an exponential equation; as the curve denoted by \( a^x = y \), or by \( x^y = y \).

Exponential Equation, is one in which is contained an exponential quantity; as the equation \( a^x = b \), or \( x^a = b \), &c.

Exponential Quantity, is that whose power is a variable quantity; as the expression \( a^x \), or \( x^a \). Exponential quantities are of several degrees and orders, according to the number of exponents or powers, one over another.

Exportation, the shipping and carrying out of the kingdom wares and commodities for other countries. See the articles Commerce, Trade, and Shipping.
EXPOSING, the act of setting a thing to public view. In the Roman church, the sacrament is said to be exposed when it is shown in public uncovered on festival days, and during the time of plenary indulgences.

Exposing is also used with a farther latitude; thus we say, It is prohibited to expose false and clipped money. Such a house stands very high, and has a delicious prospect; but it is exposed to all the four winds, such a city being on the frontiers, and not fortified, is exposed to the insults of every party of forces.

Exposing of Children, a barbarous custom practised by most of the ancients excepting the Thespians, who had an express law to the contrary, whereby it was made capital to expose children; ordaining at the same time, that such as were not in a condition to educate them should bring them to the magistrates, in order to be brought up at the public expense. Among the other Greeks, when a child was born, it was laid on the ground; and if the father designed to educate his child, he immediately took it up; but if he forsook to do this, the child was carried away and exposed. The Lacedaemonians indeed had a different custom; for with them all new-born children were brought before certain men, who were some of the bravest men in their own tribes, by whom the infants were carefully viewed; and if they were found lusty and well favoured, they gave orders for their education, and allotted a certain proportion of land for their maintenance; but if weakly or deformed, they ordered them to be cast into a deep cavern in the earth, near the mountain Taygetus, as thinking it neither for the good of the children themselves nor for the public interest, that defective children should be brought up. Many persons exposed their children only because they were not in a condition to educate them, having no intention that they should perish. It was the unhappy fate of daughters especially to be thus treated, as requiring more charges to educate and settle them in the world than sons.

The parents frequently tied jewels and rings to the children they exposed, or any other thing whereby they might afterwards discover them, if Providence took care for their safety. Another design in adorning these infants was either to encourage such as found them to nourish and educate them, if alive, or to give them human burial if dead. The places where this was usual to expose children were such as people frequented most. This was done in order that they might be found, and taken up by compassionate persons who were in circumstances to be at the expense of their education. With this intention, the Egyptians and Romans chose the banks of rivers, and the Greeks the high-ways.

Exposition, in general, denotes the setting a thing open to public view. See Exposing.

Exposition, in a literary sense, the explaining an author, passage, writing, or the like, and setting their meaning in an obvious and clear light. Expositor, or Expository, a title which some writers have given to a lesser kind of dictionaries or vocabularies, serving to expound or explain the meaning of the obscure or difficult words of a language. It is also used in the same sense with commentary and paraphrase.

Ex-post-facto, in Law, denotes something done after another thing that was committed before. An estate granted may be made good by matter ex-post-facto, that was not so at first by election, &c.

Exposition, in Rhetoric, a warm address to a person who has done another some injury, representing the wrong in the strongest terms, and demanding redress.

Exposure, in Gardening, the situation of a garden wall, or the like, with respect to the points of the compass, as south or east. See Gardening.

Expressed Oil, such oils as are obtained from bodies only by pressing. See Chemistry and Materia Medica Index.

Expression, in Rhetoric, the elocution, diction, or choice of words in a discourse. See Language, Oratory, and Poetry.

Expression, in Music. See Composition.

Expression, in Painting, a natural and lively representation of the subject, or of several objects intended to be shown.

The expression consists chiefly in representing the human body and all its parts, in the action suitable to it, in exhibiting the faces of the several passions proper to the figures, and observing the motions they impress on the external parts. See Painting.

Expression, Theatrical. See Declamation, Article iv.

Expression, in Medicine, Chemistry, &c., the act of expressing or extracting the juices or oils of plants, fruits, or other matters, by squeezing, wringing, or pressing them in a press. After having let the herbs infuse a due time, their juice must be drawn by expression in a linen cloth or by a press.

Expulsion, in a general sense, the act of violently driving a person out of any city, society, &c.

Expulsion, in Medicine, the act whereby any thing is forcibly driven out of the place in which it is: thus we say, the expulsion of the fetuses in delivery.

Expulsion, (formed of ex and sicca, "dry," in Chemistry, &c., the act of drying up or evaporating the moisture of a thing.

Expiration, in Physics, that part of respiration by which the air is expelled or driven out of the lungs. See Anatomy Index and Respiration.

Exsudation, or Exudation, the act of sweating out. In which manner, gums, balsams, &c. are usually produced from trees.

Extant, something that still subsists, or is in being. It is but part of the history of Livy, of the writings of Cicero, Cæsar, &c. that are extant, the rest are lost. We have nothing extant of Socrates, though he wrote a great deal.

Extasy, a transport which suspends the function of the senses, by the intense contemplation of some extraordinary or supernatural object.

Extasy, in Medicine, a species of catalepsy, when a person perfectly remembers, after the paroxysm is over, the ideas he conceived during the time it lasted.

Extension, in Philosophy, one of the common and essential properties of body; or that by which it possesses or takes up some part of universal space, which is called the place of that body. See Metaphysics.

Extensor, an appellation given to several muscles,
EXTENT, in Law, is used in a double sense. Sometimes it signifies a writ or command to the sheriff for the valuing of lands or tenements; and sometimes the act of the sheriff, or other commissioner, upon this writ.

Old and New Extent, in Scots Law. See Law Index.

EXTENATION, the act of diminishing or lessening the bulk or substance of a thing, especially of the human body. Fevers, aches, long abstinence, &c. occasion great extenations or emaciations.

EXTENSION, is also a figure in rhetoric, opposite to the hyperbole. The Greeks call it αλαγενης.

EXTERIOR, or External. See External, Extermination, in general, the extirpating of persons and things.

Extermination or Exterminating, in Algebra, is used for taking away. Thus algebraists speak of the exterminating surds, fractions, and unknown quantities out of equations. See Maclauri, Algebra, Part I, Chap. 12, where we have some general theorems for the exterminating unknown quantities in given equations.

EXTERNAL, a term of relation applied to the surface or outside of a body, or that part which appears or presents itself to the eye, touch, &c. in contradistinction to internal.

EXTERNAL is also used to signify any thing that is without side a man, or that is not within himself, particularly in his mind; in which sense we say, external objects, &c.

EXTINCTION, in general, denotes the putting out or destroying something, as a fire or flame. See Extinguishing of Fire.

Extinguishment, in Law, is a consolidation or union, as when one has due to him a yearly rent out of lands, and afterwards purchases the lands out of which the rent arises; in this case, both the property and the rent being united in one possessor, the rent is said to be extinguished.

Extirpation (formed of ex and stirps, "root," etc.) the act of pulling up or destroying anything to the very roots. Among the prayers of the Roman jubilee, there is one for the extirpation of heresy.

Extirpation is also used in Surgery, for cutting off any part entirely; as a wen, &c. or eating it away, as a wart, &c. by corrosive medicines.

ExtispeX, in antiquity, the person who drew pressages from viewing the entrails of animals offered in sacrifice.

EXTORTION, in Law, is an illegal manner of wresting any thing from a man, either by force, menace, or authority. It is also the exacting of unlawful usury, winning by unlawful games, and taking more than is due under pretense of right, as excessive tolls in mills, &c.

At the common law, extortion is punishable by fine and imprisonment; and the statute of 3 Eliz. 1 c. 30. has enacted, that officers of justice guilty of extortion for the expedition of business, &c. shall render to the party treble value. There are likewise divers other statutes for punishing extortions of sheriffs, bailiffs, gaolers, clerks of the assize and of the peace, attorneys, solicitors, &c.

EXTRACT, in Pharmacy, is a solution of the purer parts of a mixed body insipissated by distillation or evaporation, nearly to the consistence of honey.

Extract, in matters of literature, is something copied or collected from a book or paper.

EXTRACTION, in Chemistry and Pharmacy, the operation by which essences, tinctures, &c. are drawn from natural bodies.

Extraction, in Surgery, is the drawing any foreign matter out of the body by the hand, or by the help of instruments. See Surgery.

Extraction, in genealogy, implies the stock or family from which a person is descended. See Descent.

Extraction of Roots, in Algebra, and Arithmetic, the method of finding the roots of given numbers or quantities. See Algebra and Arithmetic.

Extractor, in Midwifery, an instrument or forceps for extracting children by the head.

Extrajudicial, something done out of the proper court, or the ordinary course of law. As when judgment is given in a cause, or case, not depending in that court where such judgment is given, or wherein the judge has no jurisdiction.

Extraordinarii, amongst the Romans, was a body of men consisting of the third part of the foreign horse and a fifth of the foot, which was separated from the rest of the forces borrowed from the confederate states with great policy and caution. To prevent any design that they might possibly entertain against the natural forces. A more choice body of men were drawn from among the extraordinarii, under the name of abelli. See Abelli.

Extraordinary, something out of the common course.

Extraordinary Couriers are those sent express on some urgent occasion.

Extraordinary Ambassador, or envoy, is such a one as is sent to treat or negotiate some special and important affair, as a marriage, a treaty, confederacy, &c. or even on occasion of some ceremony, as condolence, congratulation, &c.

A gazette, journal, or other newspaper extraordinary is that published after some great and notable event, containing the detail or particulars thereof, which are not found in the ordinary papers.

Extraordinary epistles which were published from the Clementines. They were so called, because at first they were not digested or ranged with the other papal constitutions, but seemed to be, as it were, detached from the canon law. They continued to be called by the same name when they were afterwards inserted in the body of the canon law. The first extravagantes are those of John X. ii. successor of Clement V. The last collection was brought down to the year 1493, and was called the common extravagantes, notwithstanding that they were likewise incorporated with the rest of the canon law.

Extravasation, in contusions, fissures, depressions, fractures, and other accidents of the cranium, is when one or more of the blood-vessels, that are distributed
distributed in the dura mater, is broken or divided, whereby there is such a discharge of blood as greatly oppress the brain, and disturbs its office; frequently bringing on violent pains and other mischiefs; and at length death itself, unless the patient is timely relieved. See SURGERY and MEDICINE Index.

EXTREME, is applied to the last and outermost part of any thing; or that which finishes and terminates it on that side.

EXTREME, in Logic, denote the two extreme terms of the conclusion of a syllogism; viz. the predicate and subject. They are called extremes, from their relation to another term, which is a medium or mean between them. The predicate, as being likewise had in the first proposition, is called the major extremum, greater extreme; and the subject, as being put in the second or minor proposition, is called the minor extremum, lesser extreme. Thus, in the syllogism, "Man is an animal; Peter is a man, therefore Peter is an animal;" the word animal is the greater extreme, Peter the lesser extreme, and man the medium. See SYLLOGISM.

EXTREMES and mean proportion, in Geometry, is when a line is so divided, that the whole line is to the greater segment, as that segment is to the other: Or, as it is expressed by Euclid, when the line is so divided that the rectangle under the whole line, and the lesser segment, is equal to the square of the greater segment.

EXTREME Unction. See UNCTION.

EXTREMITIES of figures, in Painting, is used for the head, hands, and feet. These should be drawn with more nicety and exactness, or more terminated than other parts; and thus help to render the action more expressive.

EXTRINSIC, among metaphysicians, is taken in various senses. Sometimes it signifies a thing's not belonging to the essence of another; in which sense the efficient cause and end of a thing are said to be extrinsic. Sometimes it signifies a thing's not being contained within the capacity of another; in which sense, those causes are called extrinsic which introduce something into a subject from without, as when a fire introduces heat. Sometimes it signifies a thing added or applied to another; in which sense accidents and accidents are said to be extrinsic to the subjects to which they adhere. Sometimes the vision is said to be extrinsic from some form which does not exist in that thing, but is adjacent to it, or by some means or other without it.

EXTUBERANCES, in Medicine, are swellings or risings up in the flesh or other parts of the body.

EXUBERANCE, (composed of ex and ubere, "plentiful"), in Rhetoric, a redundancy. See REDUNDANCY and EXPLOSIONISM.

EXUDATION. See EXUDATION.

EXVERRA, in antiquity, a kind of brush used in cleansing houses, out of which a dead person had been carried.

EXULCERATION, in Medicine, the act of causing or producing ulcers. Thus, arsenic exulcerates the intestines; corrosive humours exulcerate the skin.

EXULCERATION is sometimes also used for an ulcer itself; but more generally for those beginning erosions which wear away the substance, and form ulcers.

EXUVIAE, among naturalists, denote the cast off parts or coverings of animals, as the skins of serpents, EXUVIA caterpillars and other insects.

EXUVIAE is also used for shells and other marine EYMY bodies, frequently found in the bowels of the earth; supposed to have been deposited there at the deluge; as being the real spoils of once living creatures. See DELUGE, CONCHOLGY, and GEOLOGY.

EY, in our old writers, the same with insula, "an island," from which comes eyer, a small island or islet, vulgarly called eyrht.

EYCK. See BRUGES, John of.

EYE, in Anatomy. See ANATOMY Index.

A new born child shall be observed, perhaps, never to keep its eyes fixed on any one object, but continually changing from one to another, and if you put your hand before them, the child will not wink. Hence some have thought, that new-born infants have no sight; but this is a mistake; and the true reason why their eyes are in perpetual motion is, that they have not yet acquired the habit of examining one thing at once with their eyes; their not winking at the approach of the hand, arises from their want of experience how easily their eyes may be hurt; but in a few days they get the habit of winking, so that afterwards their eyes do it spontaneously at the approach of danger.

Artificial eyes are made of concave plates of gold, silver, or glass, and are stained so as to resemble the natural eye. They must, when fixed in the orbit, be taken out and cleaned every night, and replaced in the morning. If no more of a diseased eye is removed than what is preternaturally projected, or if enough is left to preserve the muscles unburst, the artificial eye will have a little motion from the muscles that remain. If the eye does not fit well, it irritates and inflames the other eye; in which case lay it aside, until one can be had that fits better.

Bull's EYE, in Astronomy. See ALEPHERAN.

EYE of a Block, in naval affairs, that part of the rope-strop which is fastened to some necessary place in the ship: the strop is a sort of wreath or rope formed into a ring, and fixed round the block for the double convenience of strengthening the block and fastening it in any place where it is wanted.

EYE, in Agriculture and Gardening, signifies a little bed or shoot, inserted into a tree by way of graft. See ENGRAFTING.

EYE of a Tree, a small pointed knot to which the leaves stick, and from which the shoots or spires proceed. See GEMMA.

EYE, a town of Suffolk, 22 miles from Ipswich and 97 from London. It may be called an island, because it is surrounded by a brook near the borders of Norfolk. It was incorporated by King John; has two bailiffs, 10 principal burgesses, 24 common council, a recorder, and town clerk. It is a mean-built place, with narrow streets. The chief manufacture is bone-lace and spining. Here is, however, a large handsome church; and near it are the ruinous walls of an ancient castle and monastery. The market is on Saturday, the fair on Whit-Monday. It has only sent members to parliament since the reign of Edward IV. Population 1893 in 1811.

EYE-Bright. See EURIFRASMA, BOTANY Index.

EYMOUTH, a town of Scotland in the county of Berwick, formerly fortified to curb the garrison of Berwick, formerly fortified to curb the garrison of Berwick, formerly fortified to curb the garrison of Berwick;
EZE 394 EZR


EZEKIEL, a canonical book of the Old Testament, prophecies at the same time in Judea. He foretold many events, particularly the destruction of the temple, the fatal catastrophe of those who revolted from Babylon to Egypt, and the happy return of the Jews to their own land.

EZION-GABER. See Asiongaber.

EZRA, a canonical book of the Old Testament, comprehending the history of the Jews from the time of Cyrus's edict for their return, to the 20th year of Artaxerxes Longimanus. It specifies the number of Jews who returned, and Cyrus's proclamation for the rebuilding the temple, together with the laying its foundation, the obstruction it met with, and the finishing thereof in the reign of Darius.

The illustrous author of this book was also the restorer and publisher of the canon of the Old Testament. See Bible.

The books of Ezra, called in the English version the First and Second Book of Ezra, though held by some, particularly the Greeks, for canonical, are thrown by the English church into the number of apocryphal books, being only extant in Greek.

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F.

THE fourth consonant, and sixth letter of the alphabet. The letter F is borrowed from the digamma or double gamma of the Eolians, as is evident from the inscription on the pedestal of the Colossus at Delos; and was undoubtedly formed from the old Hebrew y, and though this letter is not found in the modern Greek alphabet, yet it was in the ancient one, from whence the Latins received it and transmitted it to us.

It is formed by a strong expression of the breath, and joining at the same time the upper teeth and under lip. It has but one sort of sound, which has a great affinity with v and μ, the latter being written for it by us in all Greek words, as philosophia, &c. though the Italians write it filosofia.

The Romans for some time used an inverted F, ꞌ, instead of V. The consonant, which had no peculiar figure in their alphabet. Thus, in inscriptions we meet with TERMINA, DI, &c. Lipsius and others say, that it was the emperor Claudius who introduced the use of the inverted digamma, or ꞏ; but it did not long subsist after his death; for Quintilian observes, that it was not used in his time.

F, or ō, in music, is the fourth note in rising in this order of the gamut, ut, re, mi, fa. It likewise denotes one of the Greek keys in music, destined for the bass.

F, in physical prescription, stands for Fiat, or "Let it be done." Thus fascia signifies fast secundum aemum artem.

F, was also a numeral letter signifying 40; according to the verse,
A war against the Veientes. They came to a general engagement near the Cremers, in which all the family, consisting of 306 men, were totally slain, in the year of Rome 277. There only remained one whose tender age had detached him at Rome, and from him arose the noble Fabii in the following ages.

FABIIUS MAXIMUS RULLIANUS, was the first of the Fabii who obtained the surname of Maximus, for lessening the power of the populace at elections. He was master of horse: and his victory over the Samnites in that capacity nearly cost him his life, because he engaged the enemy without the command of the dictator. He was five times consul, twice dictator, and once censor. He triumphed over seven different nations in the neighbourhood of Rome, and rendered himself illustrious by his patriotism.

FABIIUS RUSTICUS, an historian in the age of Claudius and Nero. He was intimate with Seneca; and the encomiums which Tacitus passed upon his style, make us regret the loss of his compositions.

Q. FABIIUS MAXIMUS, a celebrated Roman, who from a dull and inactive childhood was raised to the highest offices of the state. In his first consulship he obtained a victory over Liguria; and the fatal battle of Thrasymenus occasioned his election to the dictatorship. In this important office he began to oppose Hannibal, not by fighting him in the open field, like his predecessors, but he continually harassed his army by counterambushes and ambuscades, from which he received the surname of Cunctator or Delayer. Hannibal sent him word, "That if he was as great a captain as he would be thought, he ought to come into the plain and give him battle." But Fabius coldly replied, "That if he was as great a captain as he would be thought, he would do well to force him to fight." Such operations for the commander of the Roman armies gave offence to some; and Fabius was even accused of cowardice. He, however, continued firm in his first resolution; and patiently bore to see his master of horse raised to share the dictatorial dignity with himself by means of his enemies at home. When he had laid down his office of dictator, his successors for a while followed his plan; but the rashness of Varro, and his contempt for the operations of Fabius, occasioned the fatal battle of Cannae. Tarentum was obliged to surrender to his arms after the battle of Cannae; and on that occasion the Carthaginian army observed that Fabius was the Hannibal of Rome. When he had made an agreement with Hannibal for the ransom of the captives, which was totally disapproved by the Roman senate, he sold all his estates to pay the money, rather than forfeit his word to the enemy. The bold proposal of young Scipio to go and carry the war from Italy to Africa, was rejected by Fabius as chimerical and dangerous. He did not, however, live to see the success of the Roman armies under Scipio, and the conquest of Carthage by measures which he treated with contempt and heard with indignation. He died in the 100th year of his age, after he had been five times consul, and twice honoured with a triumph. The Romans were so sensible of his great merit and services, that the expenses of his funeral were defrayed from the public treasury. His son bore the same name, and shewed himself worthy of his noble father's virtues. During his consulship he received a visit from his father on horseback in the camp. The son ordered his father to dismount; and the old man cheerfully obeyed, embracing his son, and saying, "I wished to know whether you knew what it is to be consul." He died before his father, and Censor, with the moderation of a philosopher, delivered a funeral oration over the dead body of his son.

FABIIUS, styled Pictor, a Roman general and historian. He first introduced painting at Rome; and having caused the walls of the temple of Health to be painted, some authors have erroneously reckoned him a painter. He died about 216 B.C.

FABLE, a tale, or feigned narration, designed either to instruct or divert, disguised under the allegory of an action, &c.

Fables were the first pieces of wit that made their appearance in the world; and have continued to be highly valued, not only in times of the greatest simplicity, but in the most polite ages of the world. Jotham's fable of the trees is the oldest that is extant, and as beautiful as any that have been made since. Nathan's fable of the poor man is next in antiquity. We find Aesop in the most distant ages of Greece; and in the early days of the Roman commonwealth, we read of a mutiny appeased by the fable of the belly and the members. As fables had their rise in the very infancy of learning, they never flourished more than when learning was at its greatest height; witness Horace, Boileau, and Fontaine.

Fable is the finest way of giving counsel, and most universally pleasing, because least shocking; for, in the reading of a fable, a man thinks he is directing himself, whilst he is following the dictates of another, and consequently is not sensible of that which is the most unpleasing circumstance in advice. Besides, the mind is never so much pleased as when she directs herself in any action that gives her an idea of her own abilities; this natural pride of the soul is very much gratified in the reading of fable.

FABLE is also used for the plot of an epic or dramatic poem; and is, according to Aristotle, the principal part, and, as it were, the soul of the poem. See POETRY.

FABRI, HONORIUS, a laborious Jesuit, born in the diocese of Bellay, distinguished himself by his skill in philosophy and the mathematics, and by writing a great number of books; the most curious of which treat of geometry, optics, the headstone, the motion of the earth, the ebbing and flowing of the sea, &c. He died at Rome in 1688.

FABRIANO, GENTILE DA, painter of history, was born at Verona in 1332, and became a disciple of Giovanni da Fiesole. In that early age of painting he rendered himself very famous, and was employed to adorn a great number of churches and palaces at Florence, Urbino, Siena, Perugia, and Rome, but particularly in the Vatican; and one picture of his, representing the Virgin and Child, attended by Joseph, which is preserved in the church of S. Maria Maggiore, was highly commended by Michael Angelo. By order of the doge and senato of Venice, he painted a picture in the great council chamber, which was considered as so extraordinary a performance, that his employers granted him a pension for life, and conferred on him the highest honour of their state, which was, the privilege...
Fabricius, John Albert, one of the most learned and laborious men of his age, was born at Leipsic in 1668. He was chosen professor of eloquence at Hamburg in 1699, and was made doctor of divinity at Kiel. His works are numerous: and he died at Hamburg in 1736, after a life spent in the severest literary application to collect and publish valuable remains of ancient learning.

Fabricius, Vincenzo, born at Hamburg in 1613, was a good poet, a great orator, an able physician, and a learned civilian. He was for some time counsellor to the bishop of Lubeck, and afterward burgomaster and syndic of the city of Dantzig; from whence he was 13 times sent deputy into Poland, where he died at Warsaw in 1657, during the diet of that kingdom. The most complete edition of Fabricius's poems and other works was published at Leipsic in 1682, under the direction of his son Frederico Fabricius.

Fabricius, Baron, one of the finest gentlemen of his time, and known to the public by his letters relating to the transactions of Charles XII. of Sweden during his residence in the Ottoman empire, was descended from a good family in Germany. He was taken early into the service of the court of Holstein; and was sent in a public character to the king of Sweden whilst he was at Bender; where he soon acquired the good graces of that prince. He accompanied him in his exercises: gave him a turn for reading; and it was out of his hand Charles snatched Boileau's satires, when he tore out those that represented Alexander the Great as a madman. Fabricius was also in favour with Stanislaus, and with our King George I. whom he accompanied in his last journey to Hanover, and was with him when he died. A translation of his letters was published in London 1761.

Fabrot, Charles Hanwibal, one of the most celebrated civilians of his time, was born at Aix in 1681; and acquired an extraordinary skill in the civil and canon law, and in the belles lettres. He published the 'Bibliothèque, or Constitutions of the Emperors of the East, in Greek and Latin, with learned notes, in seven vols. folio; and editions of Cedrenus, Nicetas, Anastasius Bibliothecarius, Constantine Monasses, and Casia, with learned and curious notes.

Fabulous, something consisting of, or connected with, a fable.

Fabulous Age, among ancient historians. See Age.

Face, the surface, or first side which a body presents to the eye. We say, the face of the earth, of the waters, &c. Polyhedrons have several faces. A die, or cube, has six faces.

Face, is particularly used for the visage of an animal, and especially of man; and comprehends, in the latter, all that part of the head which is not covered with the common long hair. The Latins call it facies, vultus, or, &c.

The human face is called the image of the soul, as being the seat of the principal organs of sense; and the place where the ideas, emotions, &c. of the soul are chiefly set to view. Pride and disdain are shown in the eyebrows, modesty on the cheeks, majesty in the forehead,
head, &c. It is the face shows the sex, age, temperament, health, or disease, &c.

The face, considered as the index of the passions, habits, &c. of the person, makes the subject of physiognomy. See Physiognomy.

Face, among painters and artists, is used to denote a certain dimension of the human body, adopted for determining the proportion which the several parts should bear to one another. See Drawing.

Face, in the military art, a word of command, intimating to turn about: thus, face to the right, is to turn upon the left heel a quarter-round to the right; and, face to the left, is to turn upon the right heel a quarter-round to the left.

Facies Hippocratica, in Medicine, is when the nostrils are sharp, the eyes hollow, the temples low, the tips of the ears contracted and cold, the forehead dry and wrinkled, and the complexion pale or livid.—The Hippocratic face is chiefly observed towards the period of phthisis polonialis, and other consumptions, and is held a sure prognostic of death. If it appear within three days after the attack of an acute disease, it is deemed to indicate death.

FACTION, a cabal or party formed in a state, city, or company.

Faction, in antiquity, a name given to the different companies of contestants in the circus. They were four, viz. the white, the red, the green, and the blue; to which Domitian added another of purple colour. They were so denominated from the colour of the livres they wore; and were dedicated, according to M. Aur. Cassiodorus, to the four seasons of the year; the green being consecrated to spring, the blue to winter, the red to summer, and the white to autumn. It appears from ancient inscriptions, that each faction had its procurators and physician; and from history, that party rage ran so high among them, that in a dissen- sion between two factions, in the time of Justinian, almost 40,000 men lost their lives in the quarrel.

FACTITIOUS, anything made by art, in opposition to what is the production of nature. Thus, factitious cinnabar is opposed to native cinnabar.

FACTOR, in commerce, is an agent employed by merchants residing at other places, to buy or sell goods, or negotiate bills, or transact any kind of business on their account; and entitled to a certain allowance for his trouble.

A supercargo differs from a factor in this: The business of the former is limited to the care of a particular cargo; he goes along with it, and generally returns when his business is completed; the latter has a fixed residence abroad, and executes business for different merchants. But their duties, and the circumstances for which they are accountable, are the same.

The duty of a factor is to procure the best intelligence of the state of trade at his place of residence; of the course of exchange; of the quantity and quality of goods at market, their present price, and the probability that it may rise or fall: to pay exact obedience to the orders of his employers; to consult his advantage in matters referred to his direction; to execute their business with all the dispatch that circumstances admit; to be early in his intelligence, distinct in his accounts, and punctual in his correspondence.

A factor’s power is either absolute or limited. Though intrusted with ample discretionary powers, he is not warranted to take unreasonable or unusual measures, or do anything contrary to his employer’s interest; but it is incumbent on the employer, if he challenges his proceedings, to prove that he could have done better, and was guilty of wilful mismanagement.

When a factor’s power is limited, he must adhere strictly to his orders. If he exceeds his power, though with a view to his employer’s interest, he is liable for the consequence. For example, if he gives credit when not empowered, or longer credit if not empowered, for the sake of a better price, and the buyer proves insolvent, he is liable for the debt. A factor has no power to give credit unless authorized: But if the goods consigned be generally sold on credit at the place of consignation, the factor will be vindicated for selling at the usual credit, unless expressly restricted.

Although opinion will never justify the factor for departing from orders, necessity sometimes will. If he be limited not to sell goods under a certain price, and the goods be perishable, and not in a situation for being kept, he may sell them, to prevent their destruction, even under the price limited.

A factor is never warranted to deal on trust, except with persons in good credit at the time. If the employer challenges the debtors, it is incumbent on him to prove that their bad circumstances were known at the time of sale; and the factor will be vindicated, if he trusted them at the same time for goods of his own.

If the factor sells his employer’s goods on trust, and, after the day of payment is elapsed, receive payment from the purchaser for a debt of his own, he becomes liable in equity for the debt.

In case of bankruptcy, the factor ought immediately to lay attachments, and advise his employers; and he cannot withdraw his attachments, nor compound debts, without orders.

If a factor sells goods belonging to different merchants to the same person, and the buyer proves insolvent, they shall bear the loss in equal proportions; and if the buyer has paid part before his insolvency, without specifying for which, the payment ought to be distributed in equal proportions; but, if the days of payment be fixed, and part of the debts only due, the payment ought to be applied, in the first place, to such debts as were due.

If he makes a wrong entry at the custom-house, and the goods be seized in consequence thereof, he must bear the loss, unless the error be occasioned by a mistake in the invoice, or letter of advice.

The owner bears the loss of goods seized when attempted to be smuggled by his orders; but the factor complying with an unlawful order is liable in such penalties as the laws exact.

If a factor saves the duty of goods due to a foreign prince, he shall have the benefit; for, if detected, he bears the loss.

If a factor sells goods bought by his employer’s orders for his own advantage, the employer may recover the benefit, and the factor shall be amerced for the same.

If a factor receives bad money in payment, he bears the loss; but if the value of the money be lessened by the government, the employer bears the loss.
A factor is not liable for goods spoiled, robbed, or destroyed by fire.

If a factor receives counterfeit jewels from his employer, and sells them, the employer is liable to indemnify him for any penalties he may incur.

If a factor be ordered to make insurance, and neglect it, and the subject be lost, he is liable to make it good, providing he had effects in his hands.

If a factor buys goods for his employer, his bargain shall be binding on the employer.

In case of a factor’s insolvency, the owner may reclaim his goods; and if they be sold on trust, the owner (not the factor’s creditors) shall recover payment of the debts.

Factor, in multiplication, a name given to the multiplier and multiplicand, because they constitute the product. See Arithmetic.

Factorage, called also commission, is the allowance given to factors by the merchant who employs them.

A factor’s commission in Britain, on most kinds of goods, is $2\frac{1}{2}$ per cent.; on lead, and some other articles, 2 per cent.; in Italy, $2\frac{1}{2}$ per cent.; in France, Holland, Spain, Portugal, Hamburg, and Danzig, 2 per cent.; in Turkey, 3 per cent.; in North America, 5 per cent. on sales, and 7 per cent. on returns; in the West Indies, 8 per cent. for commission and storage. In some places, it is customary for the factors to ensure the debts for an additional allowance, generally 1½ per cent. In that case, they are accountable for the debt when the usual term of credit is expired.

Factorage on goods is sometimes charged at a certain rate per cask, or other package, measure, or weight, especially when the factor is only employed to receive or deliver them.

Factory is a place where a considerable number of factors reside, to negotiate for their masters or employers. See Factor.

The most considerable factories belonging to the British are those established in the East Indies, Portugal, Turkey, &c. There are also English factories established at Hamburg, Petersburg, Dantzic, and in Holland; all endowed with certain privileges.

Factum, in Arithmetick, the product of two quantities multiplied by each other.

Facula, in Astronomy, certain bright and shining parts, which the modern astronomers have, by means of telescopes, observed upon or about the surface of the sun; they are but seldom seen. The word is pure Latin; being a diminutive of fox, “torch”; and supposed to be here applied from their appearing and disappearing by turns.

Faculty, in Law, a privilege granted to a person, by favour and indulgence, of doing what, by law, he ought not to do.

For granting these privileges, there is a court under the archbishop of Canterbury, called the court of the faculties. The chief officer of this court is styled master of the faculties, and has a power of granting dispensations in divers cases: as to marry without the banns being first published, to eat flesh on sabbats prohibited, to ordain a deacon under age, for a son to succeed his father in his benefice, a clerk to hold two or more livings, &c.

Faculty, in the schools, a term applied to the different members of an university, divided according to the arts and sciences taught there: thus in most universities there are four faculties, viz. 1. Of arts, which include humanity and philosophy. 2. Of theology. 3. Of physic. 4. Of civil law.

Faculty of Advocates. See Advocates.

Faculty is also used to denote the powers of the human mind, viz. understanding, will, memory, and imagination. See Metaphysics.

Fæces, in Chemistry, the gross matter, or sediment, that settles at the bottom after distillation, fermentation, and the like. The fæces of wine are commonly called Lees.

Fæces, in Medicine, the excrements voided by stool. See Excrements.

Fæculent, in general, is applied to things abounding with fæces or dregs: thus the blood and other humours of the human body are said to be fæculent, when without that purity which is necessary to health.

Faenza, a city and bishop’s see of Italy, situated in the pope’s territories, about 30 miles east of Bologna. E. Long. 12. 38. and N. Lat. 44. 30.

Faenza, a city of Romagna in Italy with a bishop’s see. It is an ancient place, and has undergone various revolutions. The river Armona washes its walls, and passes between the city and the suburbs, which are joined by a stone bridge defended by two good towers. The city is remarkable for its earthen ware, which is the best in all Italy.

Faernus, Gabriel, a native of Cremona in Italy, was an excellent Latin poet and critic of the 16th century. He was so skilled in all parts of polite literature, that the cardinal de Medicis, afterwards Pope Pius IV, was particularly fond of him. He was the author of some Latin elegies; of 100 Latin fables, selected from the ancients, written in iambic verse; and of several pieces of criticism, as Censorum emendationum Livianarum, De Metris Comitum, &c. He was remarkably happy in deciphering manuscripts, and restoring ancient authors to their purity: he took such pains with Terence in particular, that Bentley has adopted all his notes in the edition he gave of that writer. He died at Rome in 1561; and Thaurus, who wrote his elegy, says that the learned world was greatly obliged to him; yet had been still more so, if, instead of suppressing the then unknown fables of Phaedrus, for fear of lessening the value of his own Latin fables, written in imitation of Fæsop, he had been content with imitating them. M. Perrault, however, who translated Faernus’s fables into French, has defended him from this imputation, by affirming that the first MS. of Phaedrus’s fables, found in the dust of an old library, was not discovered till about 30 years after Faernus’s death.

Fagara, Iron Wood: a genus of plants belonging to the tetrandria class, and in the natural method ranking under the 43d order, Duminaceae. See Botany Index.

Fage, Raimund de la, an excellent designer and engraver, highly esteemed by Carlo Maratti, was born at Toulouse in 1648. He applied himself to designing, through inclination, in spite of his parents; and had no master nor any assistance: but his superior talents supplied the want of them, and he became one of the best designers in Europe; his performances on terminal
centious subjects are the most esteemed. It is reported of this artist, that he never made use of money, but contracted debts; and when the accounts were brought him, he made some design upon the back of the bills, and bid the owners sell the drawings to companions for the amount, by which they were generally great gainers. Several of these drawings are yet in the cabinets of the curious. He led a loose, depraved life; and his repeated debaucheries put an end to it at the age of 42.

FAGGOT, in times of Popery here, was a badge worn on the sleeve of the upper garment of such persons as had recanted or abjured what was then termed heresy; being put on after the person had carried a faggot, by way of penance, to some appointed place of solemnity. The leaving off the wear of this badge was sometimes interpreted a sign of apostasy.

Faggots, among military men, persons hired by officers, whose companies are not full, to muster and hide the deficiencies of the company; by which means they cheat the king of so much money.

FAGIUS, Paul, alias Buchlin, a learned Protestant minister, born at Rheinzabern in Germany in 1524. He was a schoolmaster at Iona; but afterwards became a zealous preacher, and wrote many books. The persecution in Germany menacing danger to all who did not profess the Romish doctrines, he and Bucer came to England in 1549, at the invitation of Archbishop Cranmer, to perfect a new translation of the Scriptures. Fagus took the Old Testament, and Bucer the New, for their respective parts; but the design was at that time frustrated by the sudden deaths of both. Fagus died in 1550, and Bucer did not live above a year after. Their bodies were dug up and burned in the reign of Queen Mary.

FAGONIA, a genus of plants belonging to the decandria class, and in the natural method ranking under the 14th order, Gruinac. See Botany Index.

FAGOPYRUM, or Buck-Wheat. See Polygonum, Botany Index.

FAGUS, the Beech Tree; a genus of plants belonging to the monoeccious class, and in the natural method ranking under the 30th order, Amentaceae. See Botany Index.

The chestnut tree, one of the species belonging to this genus, sometimes grows to an immense size. The largest in the known world are those which grow upon Mount Etna in Sicily. At Tortworth in Gloucestershire, is a chestnut tree 52 feet round. It is proved to have stood there ever since the year 1150, and was then so remarkable, that it was called the great chestnut of Tortworth. It fixes the boundary of the manor, and is probably near 1000 years old. As an ornamental, the chestnut, though unequal to the oak, the beech, and the oculus, has a degree of greatness belonging to it which recommends it strongly to the gardener's attention. Its uses have been highly extolled; and it may deserve a considerable share of the praise which has been given it. As a substitute for the oak, it is preferable to the elm. For door-jams, window-frames, and some other purposes of the house carpenter, it is nearly equal to oak itself; but it is very apt to be shakey, and there is a deceitful brittleness in it which renders it unsafe to be used as beams, or in any other situation where an uncertain load is required to be borne. It is universally allowed to be excellent for liquor casks; as not being liable to shrink nor to change the colour of the liquor it contains; it is also strongly recommended as an underwood for hop-poles, stakes, &c. Its fruit too is valuable, not only for wine and beer, but as a human food: Bread is said to have been made of it. Upon the whole, the chestnut, whether in the light of ornament or use, is undoubtedly an object of the planter's notice.

FAINT ACTION, in Law, a feigned action, or such as, although the words of the writ are true; yet for certain causes, the plaintiff has no title to recover thereby.

FAINT PLEADER, in Law, a covinious, false, or col- pusory manner of pleading, to the deceit of a third person.

FAINTING. See Lithophymia, Medicine Index.

FAINTS, in the distillery, the weak spirituous liquor that runs from the still in rectifying the low wines after the proof-spirit is taken off.

FAINTS are also the last runnings of all distilled spirits. The clearing the worm of these is so essential a point in order to the obtaining a pure spirit by the subsequent distillation, that all others are fruitless without it.

FAIR, a greater kind of market, granted to a town, by privilege, for the more speedy and commodious providing of such things as the place stands in need of.

The word fair, is formed from the French foire, which signifies the same thing; and foire is by some derived from the Latin forum, "market;" by others from the Latin feria, because anciently fairs were always held in the places where the wakes, or feasts of the dedications of churches, called feria, were held. See Feria.

It is incident to a fair, that persons should be free from being arrested in it for any other debt or contract than what was contracted in the same; or, at least, promised to be paid there. These fairs are generally kept once or twice a year; and, by statute, they shall not be held longer than they ought by the lords thereof, on pain of their being seized into the king's hands, &c. Also proclamation is to be made, how long they are to continue; and no person shall sell any goods after the time the fair is ended, on forfeiture of double the value, four-fourth to the prosecutor and the rest to the king. There is a toll usually paid in fairs on the sale of things, and for stallage, pickage, &c.

Fairs abroad are either free, or charged with toll and impost. The privileges of free fairs consist chiefly, first, in that all traders, &c., whether natives or foreigners, are allowed to enter the kingdom, and are under the royal protection, exempt from duties, impositions, tolls, &c. Secondly, that merchants, in going or returning, cannot be molested or arrested, or their goods stopped. They are established by letters-patent from the prince. Fairs, particularly free fairs, make a very considerable article in the commerce of Europe, especially that of the Mediterranean, and inland parts of Germany, &c.

The most celebrated fairs in Europe are those:
1. Of Frankfort, held twice a year, in spring and autumn: the first commencing the Sunday before Palm-Sunday, and the other on the Sunday before the eighth of September. Each lasts 14 days, or two weeks; the first of which is called the week of acceptance,
The fairs of Porto Bello, Vera Cruz, and the Havannah, are the most considerable of all those in America. The two first last as long as the flota and galleons continue in those ports; and the last is opened as soon as the flota or galleons arrive there upon their return for Spain; this being the place where the two fleets join. See Flota and Galleons.

The principal British fairs are, 1. Sturbridge fair, near Cambridge, by far the greatest in Britain, and perhaps in the world. 2. Bristol has two fairs, very near as great as that of Sturbridge. 3. Exeter. 4. West Chester. 5. Edinburgh. 6. Whethyll; and 7. Burford fair; both for sheep. 8. Pancras fair, in Staffordshire, for saddle-horses. 9. Bartholomew fair, at London, for lean and Welsh black cattle. 10. St Faith's, in Norfolk, for Scotch runs. 11. Yarmouth fishing fair for herrings; the only fishing fair in Great Britain. 12. Ipswich butter fair. 13. Woodborough-hill, in Dorsetshire, for west country manufactures, as kerseys, druggets, &c. 14. Two cheese fairs at Chipping Norton: with innumerable other fairs, besides weekly markets, for all sorts of goods as well our own as of foreign growth.

Fair, in sea-language, is used for the disposition of the wind, when it is favourable to a ship's course, in opposition to that which is contrary or foul. The term fair is more comprehensive than large, and includes about 16 or 18 points of the compass; whereas large is confined to the beam or quarter, that is, to a wind which crosses the keel at right angles, or obliquely from the stern, but never to one right a-tern.

Fair Isle, a small island lying between Orkney and Shetland, 10 or 12 leagues E. N. E. from the former; and seven, eight, or 10 leagues S. W. from the latter. It is three miles long, and scarcely half a mile broad, very craggy, with three high rocks which are visible both from Orkney and Shetland. It contains a small quantity of arable land, which is very fruitful and well manured; excellent pasturage for sheep; and affords great plenty of sea and water fowl, and all kinds of fish upon the coasts. There is in effect no port, though they have two that are nominally so; one at the south end, which is full of rocks, where only small boats can lie; the other at the north-east end, larger and safer in summer, so that it serves commodiously enough for their fishery. The duke of Medina Sidonia, when commander of the famous Spanish armada in 1588, was wrecked on the east coast of this island. The ship broke to pieces, but the duke and 200 made their escape. They lived here so long, that both they and the inhabitants were almost famished. At length the duke and the poor remains of his people were carried over to the main land of Shetland, and thence to Dunkirk, by one Andrew Humphrey, for which service Andrew was rewarded with 3000 merks. This island produced to its former proprietor between 50 and 60l. sterling. It was sold at Edinburgh in 1756, for about 8(gol. to James Stewart of Burgh, Esq.

Fair-curse, is a winding line, used in delineating ships, whose shape is varied, according to the part of the ship which it is intended to describe.

Fair-way, in sea-language, the path or channel of a narrow bay, river, or haven, in which ships usually advance
FAIRFAX, Edward, natural son of Sir Thomas Fairfax, was an English poet who lived in the reigns of Elizabeth and James I. He wrote several poetical pieces, and was an accomplished genius. Dryden introduces Fairfax with Spenser, as the leading writers of the times; and even seems to give the preference to the former in the way of harmony, when he observes that Waller owned himself indebted for the harmony of his numbers to Fairfax's Godfrey of Bouillon. He died about the year 1652, in his own house called Newhall, in the parish of Foynton, between Denton and Knaresborough, and lies under a marble stone.

FAIRFAX, Sir Thomas, general of the parliamentary forces against Charles I. in 1644. See (History of) BRITAIN, No 127, et seq. He resigned in 1653; after which he lived privately, till he was invited by General Monk to assist him against Lambert's army. He cheerfully embraced the occasion; and, on the third of December 1659, appeared at the head of a body of gentlemen of Yorkshire; when, upon the reputation of his name, a body of 12,000 men flocked Lambert and joined him. He was at the head of the committee appointed by the house of commons to attend King Charles II. at the Hague, to desire him speedily to return to England; and having readily assisted in his restoration, returned again to his seat in the country; where he lived in a private manner till his death, which happened in 1671, in the 60th year of his age. - He wrote, says Mr Walpole, Memorials of Thomas Lord Fairfax, printed in 1690; and was not only an historian, but a poet. In Mr Thorosby's museum were preserved in manuscript the following pieces: The Psalms of David, the Canticles, the Songs of Moses, and other parts of Scripture, versified, a poem on Solitude; Notes of Sermons, by his lordship; by his lady daughter of Horace Lord Vere, and by their daughter Mary the wife of George second duke of Buckingham; and a Treatise on the Shortness of Life. But of all Lord Fairfax's works, says Mr Walpole, the most remarkable were the verses he wrote on the horse on which Charles II. rode to his coronation; and which had been bred and presented to the king by his lordship. How must that merry monarch, unapt to keep his countenance on more serious occasions, have smiled at this awkward homage from the old victorious hero of republicanism and the covenant! He gave a collection of manuscripts to the Bodleian library.

FAIRFORD, a town in Gloucestershire, with a market on Thursdays. It is remarkable for the church, which has curious painted glass windows. They are said to have been taken in a ship by John Tame, Esq., towards the end of the 15th century, who built the church for their sake. They are preserved entire, and the figures are extremely well drawn and coloured. They represent the most remarkable histories in the Old and New Testament. They are frequently visited by travellers, and many go on purpose to view them, as one of the greatest curiosities in England. The painter was Albert Durer. Population 1442 in 1811. W. Long. 1. 46. N. Lat. 51. 42.

FAIRY, in ancient traditions and romances, sig.

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unifies a sort of deity, or imaginary genius, conversant on the earth, and distinguished by a variety of fantastic actions either good or bad.

They were most usually imagined to be women of an order superior to human nature, yet subject to wants, passions, accidents, and even death; sprightly and benevolent while young and handsome; morose, peevish, and malignant, if ugly, or in the decline of their beauty; fond of appearing in white, whence they are often called the white ladies.

Concerning these imaginary beings, no less a person than Jervois of Tillebury, marshal of the kingdom of Arles, who lived in the beginning of the 15th century, writes thus in a work inscribed to the emperor Otho IV. "It has been asserted by persons of unexceptionable credit, that fairies used to choose themselves gallants from among men, and rewarded their attachment with an influence of worldly goods; but if they married, or boasted of a fairy's favours, they were severely smitten for such indiscretion." The like tales still go current in Languedoc: and throughout the whole province, there is not a village without some ancient seat or cavern which had the honour of being a fairy's residence, or at least some spring where a fairy was used to bathe. This idea of fairies has a near affinity with that of the Greeks and Romans, concerning the nymphs of the woods, mountains, and springs; and an ancient scholar on Theocritus says, "The nymphs are demons which appear on the mountains in the figure of women:" and what is more surprising, the Arabs and other orientals have their ginn and pevi, of whom they entertain the like notions. But fairies have been likewise described as of either sex, and generally as of minute stature, though capable of assuming various forms and dimensions. The most charming representation imaginable of these children of romantic fancy, is in the Midsummer Night's Dream of Shakespeare; in referring to which, we no doubt have been anticipated by the recollection of almost every reader.

Spenser's Faery Queen is an epic poem, under the persons and characters of fairies. This sort of poetry raises a pleasing kind of horror in the mind of the reader, and amuses his imagination with the strangeness and novelty of the persons who are represented in it; but, as a vehicle of instruction, the judicious object to it, as not having probability enough to make any moral impression.

The belief of fairies still subsists in many parts of our own country. The

"Swift fairy of the mine"

(of German extraction), has scarce yet quitted our subterraneous works; (vid. next article. Puck, or Robín Goodfellow, still haunts many of our villages.

And in many parts of Scotland, new-born children are watched till the christening is over, lest they should be stolen or changed by some of these fantastical existences.

FAIRY OF THE MINE; an imaginary being, an inhabitant of mines. The Germans believed in two species; one fierce and malevolent: the other a gentle race, appearing like little old men dressed like the miners, and not much above two feet high. These wander about the drifts and chambers of the works; seem perpetually employed.
employ, yet do nothing; some seem to cut the ore, or fling what is cut into vessels, or turn the windlass; but never do any harm to the miners, unless provoked; as the sensible Agricola, in this point credulous, relates in his book of de Animantibus Subterraneis.

Fairly Circle or Ring, a phenomenon pretty frequent in the fields, &c. supposed by the vulgar to be traced by the fairies in their dances. There are two kinds of it; one of about seven yards in diameter, containing a round bare path, a foot broad, with green grass in the middle of it. The other is of different bigness, encompassed with a circumference of grass. Mess. Jessop and Walker, in the Philosophical Transactions, ascribe them to lightning; which is thought to be confirmed by their being most frequently produced after storms of that kind, as well as by the colour and brilliancy of the grass roots when first observed. Lightning, like all other fires, moves round, and burns more in the extremity than in the middle; the second circle arises from the first, the grass burnt up growing very plentifully afterwards. Others maintain that these circles are made by ants, which are frequently found in great numbers—Mr. Cowles, in his treatise on electricity, does not think that lightning is at all concerned in the formation of them: "They are not (says he) always of a circular figure; and, as I am informed, they seem to be rather beds of mushrooms than the effects of lightning.

We have frequently observed beds of mushrooms arranged in a circular form like what are called fairy rings; but it will be difficult to account for the mushroom seed being disposed in this manner. It is probable that the seed is dispersed over the whole field, and remains dormant till it is acted on by some stimulus to excite its vegetating powers. Perhaps this stimulus is atmospheric electricity, which acting on particular spots only, produces on them an abundant crop of mushrooms, while none appear in other places.

Faith, in Philosophy and Theology, that assent which we give to a proposition advanced by another, the truth of which we do not immediately perceive from our own reason or experience; or it is a judgment or assertion of the truth wherein is not any intrinsic evidence, but the authority or testimony of some other who reveals or relates it. Hence, as there are two kinds of authorities and testimonies, the one of God, and the other of man, faith becomes distinguished into divine and human.

Divine Faith, is that founded on the authority of God; or it is that assent we give to what is revealed by God.

The objects of this faith, therefore, are matters of revelation. See Revelation and Religion.

Human Faith, is that whereby we believe what is told us by men. The object hereof is matter of human testimony and evidence. See Metaphysics.

Faith, in practical theology, makes the first of the theological virtues or graces.

Faith in God, in this sense, denotes such a conviction of his being, perfections, character, and government, as produces love, trust, worship, obedience, and resignation.

But faith in Christ, as it has been defined by some, is a mere assent to the gospel as true; according to others, it signifies such a persuasion that he is the Messiah, and such a desire and expectation of the blessings which he has promised in his gospel to his sincere disciples, as engage the mind to fix its dependence upon him, and subject itself to him in all the ways of holy obedience. See Theology.

Faith, likewise, in respect to futurity, is a moral principle, implying such a conviction of the reality and importance of a future state, as is sufficient to regulate the temper and conduct.

Faith, or Fidelity (Fides), was defined by the ancient Romans, and had a temple in the Capitol consecrated to her by Attalina Catalinus. Her priests wore white veils: unbloody sacrifices were offered to her, and the greatest oaths were taken in her name. Her race clothes her in white, places her in the retina of Fortune, and makes her the sister of Justice, Od. 24, 35. 1. 1. Public Faith is represented in a great number of medals; sometimes with a basket of fruit in one hand, and some ears of corn in the other; and sometimes holding a turtle-dove. But the most usual symbol is two hands joined together. The inscriptions are generally, Fides Augusti, Fides Emercitus, or Fides Maximum, &c.

FAITHFUL, an appellation assumed by the Mahometans. See Mahometans.

FAITHORN, William, an ingenious English artist, a native of London, was the disciple of Peake the painter, and worked with him three or four years. At the breaking out of the civil war, Peake espoused the cause of his sovereign; and Faithorn, who accompanied his master, was taken prisoner by the rebels at Baringhouse, from whence he was sent to London, and confined in Aldersgate. In this uncomfortable situation he exercised his graver; and a small head of the first Villars duke of Buckingham, in the style of Melan, is reckoned among his performances at that time. The solicitations of his friends in his favour at last prevailed; and he was released from prison, with permission to retire to the continent. In France he found encouragement and protection from the Abbe de Marolles; and it was at this time that he formed an acquaintance with Nanteuil, from whose instructions he derived very considerable advantages. About the year 1650 he returned to England, and soon after married the sister of a Captain Crown. By her he had two sons; Henry, who was a bookseller, and William an engraver in mezzotinto. Faithorn opened a shop near Temple-Bar, where he sold not only his own engravings, but those of other English artists, and imported a considerable number of prints from Holland, France, and Italy. About the year 1680, he retired from his shop, and resided in Printing-House Yard; but he still continued to work for the booksellers, especially Royston, Martin, and Peake the younger, his former master's brother. He painted portraits from the life in crayons; which art he learned of Nanteuil during his abode in France. He also painted in miniature; and his performances in both these styles were much esteemed. His spirits were broken by the indiscretion and dissipation of his son William; and a lingering consumption put an end to his life in 1693. He wrote a book Upon Drawing, Graving, and Etching, for which he was celebrated by his friend Thomas Flatman the poet.

FAKIRS, Indian monks or friars. They outdo
the severity and mortification of the ancient Anchorites or Solitaries. Some of them make a vow of continuing all their lifetime in one posture, and keep it effectually. Others never lie down; but continue in a standing posture all their lives, supported only by a stick, or rope under their arm pits. Some mangle their bodies with scourges and knives. They look upon themselves to have conquered every passion, and triumphed over the world; and accordingly scruple not, as if in a state of innocence, to appear entirely naked in public.

The common people of East India are thoroughly persuaded of the virtue and innocence of the fakirs; notwithstanding which, they are accused of committing the most enormous crimes in private.

They have also another kind of fakirs, who do not practise such severities; these flock together in companies, and go from village to village; prophesying, and telling fortunes. They are wicked villains, and it is dangerous for a man to meet them in a lone place: nevertheless the Indian idolaters have them in the utmost veneration. They make use of drums, trumpets, and other musical instruments, to rouse their souls, and work themselves up into an artificial ecstasy, the better to publish their pretended prophecies.

Some of the votaries of these sages most devoutly kiss their privy parts; and they receive this monstrous declaration of respect with a kind of ecstatic pleasure. The most sober and discreet Indians consult them in this preposterous attitude; and their female votaries converse with them a considerable time with the most indecent freedom.

The fire they burn is made of cows dung, dried in the sun. When they are disposed to sleep, they repose themselves on cows dung, and sometimes on ordure itself. They are so indulgent towards every living creature, that they suffer themselves to be overrun with vermin, or stung by insects, without the least reluctance or complaint.

It is more than probable, those Indian friars have some secret art to lull their senses asleep, in order to render themselves in a great measure insensible of the excessive torments they voluntarily undergo. Ovington assures us, that “as he was one day in an assembly of fakirs, he observed, that they drank opiates infused in water; the intoxicating virtue thereof was enough to turn their brain.”

The garment of the chief fakirs consists of three or four yards of orange-coloured linen, which they tie round them, and a tiger’s skin, which hangs over their shoulders. Their hair is woven in tresses, and forms a kind of turban. The superior of the fakirs is distinguished from the rest by having a greater number of pieces in his garment, and by a chain of iron, two yards long, tied to his leg. When he designs to rest in any place, a garment is spread upon the ground; on which he sits and gives audience, whilst his disciples publish his virtues.

Some persons of quality in India have become fakirs: among others, five great lords belonging to the court of Schah Gehan, Mogul of the Indies. It is said, there are about two millions of fakirs in the East Indies.

FALASHA, a people of Abyssinia, of Jewish origin, described by Mr. Bruce, who was at great pains to acquaint himself with their history by cultivating the friendship of the most learned persons among them he could meet with.

According to the accounts received from them, the Falasha are the descendants of those Jews who came from Palestine into Ethiopia, as attendants of Menilek the son of the queen of Sheba or Saba by Solomon. They agree in the relation given by the Abyssinians of that princess, but deny that the posterity of those who came with Menilek ever embraced the Christian religion, as the Abyssinians say they did. They say, that at the decline of the Jewish commerce, when the ports of the Red sea fell into the hands of other nations, and no intercourse took place between them and Jerusalem, the Jewish inhabitants quitted the sea coasts and retired into the province of Dambea. While they remained in the cities on the Red sea, they exercised the trades of brick and tile making, pottery, thatching houses, &c. and after leaving these coasts, they chose the country of Dambea on account of the plenty of materials it afforded for exercising the trades they professed. Here they carried the art of pottery to a great degree of perfection, multiplied exceedingly, and became very numerous and powerful about the time that the Abyssinians were converted to Christianity. As this event was accounted by them an apostasy from the true religion, they now separated themselves from the Abyssinians, and declared one Phineas, of the line of Solomon, their king. Thus, they say, they have still a prince of the house of Judah for their sovereign, though their assertion is treated with contempt, and a nickname bestowed on the Falashan family by the other Abyssinians. About the year 960 the queen of this people, after extirpating the Abyssinian princes on the rock Damo, assumed the sovereignty of the whole empire, which they retained for some time; but their power being by degrees reduced, they were obliged to take up their residence among the rugged mountains of Samed; one of which they chose for their capital, and which has ever since been called the Jew’s Rock. About the year 1600, they were almost entirely ruined by an overthrow from the Abyssinians, in both which their king and queen were slain; since which time they have been in subjection to the emperors of that country, but are still governed by their own princes. When Mr Bruce was in Abyssinia they were supposed to amount to about 100,000 effective men. Gideon and Judith were the names of the king and queen at that time; and these, according to our author, seem to be preferred to others for the royal family.

The language of this people is very different from the Hebrew, Samaritan, or any other which the Jews ever spoke in their own country. On being interrogated concerning it by Mr Bruce, they said, that it was probably one of those spoken by the nations on the Red sea, among whom they had settled at their first coming. They arrived in Abyssinia speaking Hebrew, and with the advantage of having books in that language; but had now forgot it, which indeed is not to be wondered at, as they had lost their Hebrew books, and were entirely ignorant of the art of writing. At the time of their leaving Jerusalem, they were in possession both of the Hebrew and Samaritan copies of the law; but when their fleet was destroyed in the
time of Rehoboam, and no further communication with Jerusalem took place, they were obliged to use translations of the Scriptures; or, those copies which were in possession of the shepherds, who, they say, were all Jews before the time of Solomon. On being asked, however, where the shepherds got their copy, and being told, that notwithstanding the invasion of Egypt by Nebuchadnezzar, there was still a communication with Jerusalem by means of the Ishmaelite Arabs through Arabia, they frankly acknowledged that they could not tell: neither had they any memorials of the history either of their own or any other country; all that they believed in this case being derived from mere tradition, their histories, if any existed, having been destroyed by the famous Moorish captain Cragado. They say that the first book of Scripture they received was that of Enoch; and they place that of Job immediately after it, supposing that patriarch to have lived soon after the flood. They have no copy of the Old Testament in the Falasha language; what they make use of being that of Geez. This is sold to them by the Abyssinian Christians, who are the only scribes in that country. No differences take place about corruption of the text; nor do the Falashas know anything of the Jewish Talmud, Targum, or Cabala. See ABBYSSINIA.

FALCATE, in the manage, the motion of a horse when he throws himself upon his haunches two or three times, as in very quick curverts; which is done in forming a stop and half stop. See STOP.

FALCATED, something in the form of a sickle; thus the moon is said to be falcated when she appears thinned.

FALCO, the eagle and hawk, a genus of birds belonging to the order of Accipitræae. See Ornithology Index.

FALCON, or Faucon, a bird of prey of the hawk kind, superior to all others for courage, docility, gentleness, and nobleness of nature. Several authors take the name faulcon to have been occasioned by its crooked talons or pouces, which resemble a falx or sickle. Giraldeus derives it a falcando, because it flies in curves.

The falcon, or falcon gentle, is both for the fast and for the lure. In the choice, take one that has wide nostrils, high and large eyelids, a large black eye; a round head, somewhat full on the top; barb feathers on the clap of the beaks, which should be short, thick, and of an azure colour; the breast large, round and flashy; and the thighs, legs, and feet, large and strong, with the scar of the foot soft and bluish: the pouces should be black, with wings long and crossing the train, which should be short and very pliable.

The name falcon is restrained to the female: for the male is much smaller, weaker, and less courageous than the female; and therefore is denominated tassel, or tireulent. The falcon is excellent at the river, brook, and even field; and flies chiefly at the larger game, as wild goose, kite, crow, heron, crane, phe, shoveler, &c. For further particulars, see FALCONRY and HAWKING.

The custom of carrying a falcon extended to many countries; and was esteemed a distinction of a man of rank. The Welsh had a saying, That you may know a gentleman by his hawk, horse, and greyhound. In fact, a person of rank seldom went without one on his hand. Harold, afterwards king of England, is painted going on a most important embassy, with a hawk on his hand and a dog under his arm. Henry VI. is represented at his nuptials, attended by a nobleman and his falcon. Even the ladies were not without them in earlier times; for in an ancient sculpture in the church of Milton Abbas, in Dorsetshire, appears the consort of King Athelstan with a falcon on her royal fin taring a bird.

FALCENER, a person who brings up, tame, and makes, that is, tutors and manages, birds of prey; as falcons, hawks, &c. See FALCONRY.

The grand signior, it is said, usually keeps 6000 falconers in his service. The French king had formerly a grand falconer, which was an office dismembered from that of great hunter, grand cernier. Historians take notice of this post as early as the year 1250.

A falconer should be well acquainted with the quality and mettle of his hawks, that he may know which of them to fly early and which late. Every night after flying he should give them casting; one while plumeage, sometimes pellets of cotton, and at another time physic; and he finds necessary. He ought also every evening to make the place clean under the perch, that by her casting he may know whether she wants occurring upwards or downwards. Nor must he forget to water his hawk every evening, except on such days as she has bathed; after which, at night, he should put into a warm room, having a candle burning by her, where she is to sit unhooded, if she be not tame, that she may pick and prune herself. A falconer should always carry proper medicines into the fields, as hawks frequently meet with accidents there. Neither must he forget to take with him any of his hawking implements; and it is necessary he should be skilful in making lures, hooses of all sorts, jesses, bawdes, and other furniture. Neither ought he to be without his coping irons, to cope his hawk's beak when overgrown, and to cut her pouces and talons as there shall be occasion: nor should his cantanising irons be wanting.

FALCNER, Williams, an ingenious Scots sailor, who, about the year 1702, coming to London with a pretty pathetic poem, called the Shipwreck, founded a disaster of his own experience. The publication of this piece recommended him to the late duke of York; and he would in all probability have been suitably preferred, if a second shipwreck, as may be supposed, had not proved fatal to him, and to many gentlemen of rank and fortune with whom he sailed. In 1770, he went out a volunteer in the Annaea frigate, sent to carry Maseris Vansittart, Scarsatou, and Ford, the superintendents appointed to regulate our East India settlements; which vessel, after it had touched at the Cape of Good Hope, was never more heard of. Before his departure, he published a very useful Marine Dictionary, in six volumes.
chasing game with birds trained for that purpose; but
he contends that they employed some species of the
most rapacious of the winged tribe in hunting and fowling.
In the days of Caesar, the Indians hunted hares
and foxes by means of rapacious birds; and Aristotle
says expressly, "In Thrace, the men go out to catch
birds with hawks. They beat the reeds and bushes
which grow in marshy places, in order to raise the small
birds, which the hawks pursue and drive to the ground,
where the fowlers kill them with poles."

Respecting Thrace, which is situated above Amphipolis,
a wonderful circumstance is related, which to
many may appear almost incredible. We are informed
that boys went into the fields, and pursued birds by the
assistance of hawks. When they found a convenient place
for their purpose, they called their hawks by their
particular names, which came immediately on hearing
their voices, and pursued the birds into the bushes, where
the boys killed them with sticks, and thus made them
their prey. When the hawks themselves were held by
any birds, they threw them to the fowlers, and received,
for their fidelity, a share of the game. If we add the
spoil, the mou ss, or the game, and find out the
hood placed upon the head of the hawk, and the thing
for holding it, we may clearly perceive in these ancient
accounts the practice of modern times. Falconers still
give a portion of the game to the hawk, as was the
usual practice of the boys in Thrace.

According to the testimony of Philo, Pliny, Aelian,
and others, the birds were sometimes driven into nets
by the hawks employed in these sports. From India
and Thrace, therefore, it seems manifest, that the
Greeks obtained their first information as to the method
of fowling with birds of prey; but they themselves do
not appear to have adopted the practice at a very early
period. In Italy, however, it must have been extremely
well understood, since it is mentioned by Martial and
Apuleius as a thing everywhere known. After being
once known, it was never totally forgotten; but it
shared the fate of other inventions in this respect, that
it was originally adopted, and afterwards much neglected,
by which means it received no material improvements
for a considerable time; yet it was at length brought
to the utmost perfection. We find mention made of this sport in the Roman laws, and in many
authors of the fourth and subsequent century. In
the time of Constantine the Great, Julius Firmicus
Materanus assures us, according to the superstitious notions
of that period, that such as are born under certain signs,
will become great sportsmen, and keep hounds and fal-
cons. Sidonius, who flourished about the end of the
fifth century, praises Herdicon, the brother of his wife,
because he was the first in his territory who practised
hunting and fowling with dogs and hawks.

Falconry appears to have been carried to the greatest
perfection, and to have been much esteemed at the chief
courts of Europe, so early as the 12th century, for
which reason some have ascribed the invention to the
emperor Frederic I, whereas it appears to have been
only the first who introduced the practice into Italy,
according to the testimony of Rodericius and Colonna-
cio; and Frederic II wrote a book entitled, De arte
evansci cum avibus, to which the practice has been
much indebted. Falconry has had a number of admirers
among the fair sex, perhaps in a superior degree to
say other sport or amusement whatever of a similar na-
ture; but their attachment was destroyed by the inven-
tion of gunpowder, which was accompanied both with
alarm and danger. We conclude our remarks on the
history of falconry with an observation of Demetrius,
who flourished in the 13th century, and who expressly
wrote at large on this subject. He desires sportsmen
to say their prayers (Te Sol venenam) before they
go out to the field, which appears wholly incompatible
with the practice of modern times, and seems as impi-
ous as to crave assistance of God when preparing for a
paratical expedition.

Falconry, the art of training all manner of hawks,
but more especially the larger ones called falcons, to the
exercise of hawking. See Hawking.

When a falcon is taken, she must be subdued in such
a manner, that, as the saying goes, she may see what
provision lies before her, but care ought to be taken,
not to see her too hard. A falcon or hawk newly tak-
en should have all new furniture, as new jesses of good
leather, snared lassies with buttons at the end, and
new breeches. There should also be provided a small
round stick, to stroke the hawk; because, otherwise
this is done, the sooner and better she will be maimed.
She must also have two good bells, that she may be
found when she scatters. Her head should be well
fashioned, raised, and embossed against her eyes, deep
and yet strait enough beneath, that it may fasten about
her head without hurting her; and her beak and talons
must be a littlecoped, but not so near as to make them
bleed.

If it be a young-falcon, which had already passed the
same, she will indeed be harder to reclaim, but will prove
the best of falcons. Her food must be good and warm,
and given her twice or thrice a day till she be full gorged:
the best for this purpose is pigeons, larks, or other live
birds; because she must be broken off by degrees
from her accustomed feeding. When she is fed, you
must hoop and lure, as you do when you call a hawk,
that she may know when you intend to give her meat.
In this case she must be unhooded gently; and
after giving her two or three bits, her hood must be
put on again, when she is to get two or three bits more.
Care must be taken that she be close seceded; and after
three or four days, her diet may be lessened: the falconer
setting her every night to perch by him, that he may
awaken her often in the night. In this manner
he must proceed, till he find her to grow tame and
gentle; and when she begins to feed eagerly, he may
give her a sheep's heart. He may now begin to unhod
her in the day time; but it must be far from company,
first giving her a bit or two, then hooding her gently,
and giving her as much more. When she is sharp set,
he may now unhoode her; and give her some meat just
against his face and eyes, which will make her less a
fraid of the countenance of others. She must be borne
continually on the fist, till she is properly manured,
causing her to feed in company, giving her in the morning,
about sunrise, the wing of a pullet; and in the evening,
the foot of a hare or scone, cut off above the joint,
flayed and laid in water, which being squeezed, is to
be given her with the pinion of a bee's wing. Ever two
or three days give her washed meat, and then plumes in
more or less quantity as she is thought to be more or
less fool within. After this, being hooded again, she
is to get nothing till she has gleamed and cast, when a little hot meat may be given her in company; and, towards evening, she may be allowed to plume a hen's wing in company also. Cleanse the feathers of her casting, if foul and slimy; if she be clean-within, give her gentle castings; and when she is reclaimed, maimed, and made eager and sharp set, he may venture to feed her on the lure.

However, three things are to be considered before the lure be showed her: 1. That she be bold and familiar in company, and not afraid of dogs and horses. 2. Sharp set and hungry, having regard to the hour of morning and evening, when you would lure her. 3. Clean within, and the lure well garnished with meat on both sides; and when you intend to give her the length of a leash, you must abscond yourself.

She must also be unhooded, and have a bit or two given her on the lure as she sits on your fist; afterwards take the lure from her, and hide it that she may not see it; and when she is unseel'd, cast the lure so near her, that she may try it, and then give the length of her leash, and as soon as she has seiz'd it, use your voice as falconers do, feeding her upon the lure, on the ground, with the heart and warm thigh of a pullet.

Having so lured your falcon, give her but little meat in the evening; and let this lure be so timely, that you may give her plumage, and a jack of a joint next morning on your fist. When she has cast and gleamed, give her a little reaching of warm meat. About noon, tie a creance to her leash; and going into the field, there give her a bit or two upon her lure: then unwind the creance, and draw it after you a good way; and let him who has the bird hold his right hand on the tassel of her hood, ready to unhood her so soon as you begin to lure; to which if she come well, stoop readily upon it, and hastily seize it, let her cast two or three bits thereon. Then, unseizing and taking her off the lure, hood her and give her to the man again; and, going farther off, lure and feed her as before.

In this manner is the falconer to proceed, luring her every day further and farther, and as the time is approach'd to come freely and eagerly to the lure; after which she may be lured in company, taking care that nothing affright her. When she is used to the lure on foot, she is to be lured on horseback; which may be effected the sooner, by causing horsemen to be about her when she is lured on foot.

When she has grown familiar to this way, let somebody on foot hold the hawk, and he on horseback must call and cast the lure about his head, the holder taking off the hood by the tassel; and if she seize eagerly on the lure without fear of man or horse, then take off the creance, and lure her at a greater distance. And if you would have her love dogs as well as the lure, call dogs when you give her her living or plumage. See Hawkings.

Falerii, in Ancient Geography, a town of Etruria, on the west or right side of the Tiber: Falerici, the people of the town and territory. The territory was famous for its rich pastures; hence the genus Faliscum in authors. The town Falisci; which, according to the last, was surnamed Colonia Junonia. The Falisci are called Equi by Virgil; because they afforded supplemental laws to the 12 tables, (Servius). Here they made an excellent massacre, called Venter Faliscus (Martial).

When the Falisci were besieged by Camillus, a schoolmaster went out of the gates of the city with his pupils, and proposed to betray them into the hands of the Roman enemy, that by such a possession he might easily oblige the place to surrender. Camillus heard the proposal with indignation, and ordered the man to be stripped naked, and whipped back to the town by those whom his perfidy wished to betray. This instance of generosity operated upon the people so powerfully that they surrendered to the Romans.

Falerius, Mons Massicus so called, (Martial); Falerius ager, a district at the foot of Mount Massicus in Campania; famous for its generous wines, (Horace, Pliny). Now called Monte Massico.

Falkland. See Falkirk.

Falkirk, a town of Stirlingshire in Scotland, situated in W. Long. 33° 8', N. Lat. 56° 30'. It is a large ill-buil'd place, and is supported by great fairs for black cattle from the Highlands. A great deal of money is also got here by the carriage of goods landed at Carron wharf to Glasgow. The population of the town and parish, in 1811, was 9939. This town is remarkable for a battle fought in its neighbourhood between Edward I. of England, and the Scots commanded by the steward of Scotland, Cummin of Badenoch, and Sir William Wallace. The latter had been invested with the supreme command; but perceiving that this gave unbroken to the nobility, he resigned his power into the hands of the noblemen above mentioned, reserving to himself only the command of a small body who refused to follow another leader. The Scots generals placed their pikemen along the front, and lined the intervals between the three bodies of which their army was composed, with archers: and dreading the great superiority of the English cavalry, endeavoured to secure their front by palliades tied together with ropes. The battle was fought on the 22nd of June 1298. The king of England divided his army likewise into three bodies; and by the superiority of his archers, defeated the Scots with great slaughter. Wallace alone preserved entire the troops he commanded; and retiring behind the Carron, marched leisurely along the banks of that river, which protected him from the enemy. In this battle fell John de Graham, a gentleman much celebrated for his valour, and styled the right hand of the gallant Wallace. His epitaph is still to be seen on a plain stone in the churchyard of Falkirk. On the 18th of January 1746, a battle was fought here between the king's forces commanded by General Hawley, and the Highlanders headed by Charles Stuart. The former was seized with a panic, and fled: but Colonel Husk with two regiments, who kept their ground, prevented the Highlanders from pursuing their victory. Extensive ruins are perceived in the neighbourhood of this town, supposed by some antiquarians to have been the capital of the Ficial government; but others believe them to be the remains of some Roman stations.

Falkland, a small town of Fifeshire in Scotland, made a royal burgh by James II. in 1428. Here stood one of the seats of the Macduff earl of Fife.
the attainder of Monro Stewart, the 17th earl, it became forfeited to the crown in 1424. James V., who grew very fond of the place, enlarged and improved it. The remains of its former magnificence and elegance, and the fine taste of the princely architect. The gateway is placed between two fine round towers; on the right hand joins the chapel, whose roof is of wood, handsomely gilt and painted, but in a most ruinous condition. Beneath are seven apartments. The front of the court was beautifully adorned with statues, heads in bass relief, and elegant columns not reducible to any order, but of fine proportion, with capitals approaching the Ionic scroll. Beneath some of these pillars were inscribed I. R. M. G. 1337, or Jacobus Rex, Maria de Guise.—This place was also a favourite residence of James VI. on account of the fine park and plenty of deer. The east side was accidentally burnt in the time of Charles II. and the park ruined during Cromwell's usurpation, when the fine oaks were cut down in order to build the fort at Perth.—This place gives title of viscount to the English family of Carey; Sir Henry Carey being seated by James VI. His son and heir, Lord Carey, who sacrificed his life in a fit of loyal despair at the battle of Newbury, and from whom the present family is linearly descended.

FALKLAND, LORD. See CAREY.

FALL, the descent of a heavy body towards the centre of the earth. It is also the name of a measure of length used in Scotland, containing six ells.

FALL of Man, in sacred history, that terrible event by which sin and death were introduced into the world. See ADAM; and ANTEDILUVIANS, and Original Sin. The account which Moses gives of this transaction is extremely brief and concise. The serpent, he informs us, being more subtle than any beast of the field, asked the woman, whether it was true that God had not given her and her husband leave to eat of every tree in the garden? She answered, That God had allowed them to eat of all, except only the fruit of the tree in the midst of the garden; which he commanded they should not taste, nor so much as touch, lest they should die. The reason was, That they should not die; for God knew the virtue of the tree; and that so soon as they ate of it, their eyes would be opened, and they would become like gods, knowing good and evil. Eve, seeing the fruit tempting to the view, took of the fruit and ate; and gave also to her husband of it, and he did eat. Immediately the eyes of both were opened; when perceiving they were naked, they sewed fig leaves together and made themselves aprons. Adam and Eve, hearing the voice of God walking in the garden in the cool of the day, hid themselves among the trees; but, on God's calling for Adam, he excused himself for not appearing, because he was naked. God demanded of him, who it was that told him he was naked; and whether he had disobeyed his command in eating the forbidden fruit? Adam confessed that the woman had offered him the fruit, and he had tasted it. She being examined likewise, acknowledged what she had done; but said, the serpent had seduced and deceived her. God then proceeded to judgment; he first cursed the serpent above all beasts, and condemned him to go on his belly, and eat the dust; adding, that he would put enmity between him and the woman, and their offspring; that the seed of the woman should bruise the serpent's head, who should bruise the other's heel. The woman was subjected to the pains of childbirth, as well as the dominion of her husband; and as to the man, God cursed the ground for his sake, declaring that it should bring forth thorns and thistles, and he should earn his bread by the sweat of his brow, till he returned to the dust, from whence he was taken. At last, having clothed them both with skins, he turned them out of the garden, lest they should take of the tree of life, and eat, and live for ever: then, to prevent any attempt to return to their former habitation, he placed cherubims at the east of the garden, and a flaming sword which turned every way, to guard the passage to the tree of life.

This concise account being, at first view, encumbered with some difficulties, several learned and pious men have been inclined to believe the whole ought to be taken in an allegorical sense, and not according to the strictness of the letter: they allege, that the ancients, particularly the eastern nations, had two different ways of delivering their stories; one popular, and the other mysterious; that the Scripture uses both occasionally; sometimes accommodating itself to the capacities of the people, and at other times to the real but more veiled truth; and that, to obviate the many difficulties which occur in the literal history of this sad catastrophe, the safest way is to understand it as a parabolical story, under which the real circumstances are disguised and concealed, as a mystery not fit to be more explicitly declared.

Though it cannot be denied that some of the ancient philosophers affected such an allegorical way of writing, to conceal their notions from the vulgar, and keep their learning within the bounds of their own school; yet it is apparent Moses had no such design; and as he pretends only to relate matters of fact, just as they happened, without art or disguise, it cannot be supposed but that this history of the fall is to be taken in a literal sense, as well as the rest of his writings. It is generally agreed, that the serpent which tempted Eve was the devil, who, wearying the privilege of man in innocence, tempted him, and was the cause of his forfeiting all those advantages which he had received from God at his creation; and that to this end he assumed the form of a serpent. These interpretations are supported by many passages of Scripture, where the devil is called the serpent, and the old serpent, (See John viii. 44. 2 Cor. xi. 3. and Rev. xii. 9.) Some believe that the serpent had then the use of speech, and conversed familiarly with the woman, without her conceiving any distrust in him; and that God, to punish the malice with which he had abused Eve, deprived him of the use of speech. Others maintain, that a real serpent having eaten of the forbidden fruit, Eve from thence concluded, that she too might eat of it without danger; that in effect she did eat of it, and incurred the displeasure of God by her disobedience. This, say these last authors, is the plain matter of fact which Moses would relate under the allegorical representation of the serpent conversing with Eve.

The opinion of such as believe this was not a real serpent, but only the devil under that name, is no less liable
liable to exception than any of the rest. For though the devil is frequently styled in Scripture the serpent and the old serpent, yet why he should be called the most subtle beast of the field, we cannot conceive; neither will the punishment inflicted on the serpent suffer us to doubt, but that a serpent’s body at least was employed in the transaction.

The nature of the forbidden fruit is another circumstance in this relation that has occasioned no less variety of conjectures. The Rabbins believe it was the vine; others that it was wheat; and others, from the circumstance of Adam and Eve’s covering themselves with fig leaves immediately after their transgression, tell us, that this fruit must have been the fig; some think it was the cherry; and the generality of the Latins will have it to be the apple.

Those who admire allegorical interpretations, will have the forbidden fruit to have been no other than the sensual act of generation, for which the punishment inflicted on the woman was the pain of child-bearing. But this opinion has not the least foundation in the words of Moses, especially if we consider that Adam knew not his wife till after their expulsion out of Paradise.

Many have been the suppositions and conjectures upon this subject in general; and some have so far indulged their fancy in the circumstances of the fall, that they have perverted the whole narration of Moses into a tale full of the most shameful extravagances.

FALLACY, a deception, fraud, or false appearance.

The Epicureans deny that there is any such thing as a fallacy of the senses: for according to them, all our sensations and perceptions, both of sense and phantasy, are true; whence they make sense the primary criterion of truth.

The Cartesian, on the other hand, maintain, that we should suspect as false, or at most as dubious, every thing that presents itself to us by means only of the external senses, because they frequently deceive us. They add, that our senses, as being fallacious, were never given us by nature for the discovery of truth, or the contemplation of the principles of things; but only for pointing out to us what things are convenient or hurtful to our bodies.

The Peripatetics keep a middle course. They say, that if a sensible object be taken in its common or general view, the sense cannot be deceived about it; but that if the object be taken under its specific view, the sense may be mistaken about it, from the want of the dispositions necessary to a just sensation, as a disorder in the organ, or any thing uncommon in the medium: thus, in some disorders of the eye, all objects appear yellow; a stick in water appears broken or crooked, &c.

FALLING SICKNESS, or EPILEPSY. See MEDICINE INDEX.

FALLING-STARS. See STAR.

FALLOPIAN TUBES, in ANATOMY, two ducts arising from the womb, one on each side of the fundus, and thence extended to the ovaries, having a considerable share in conception. They are called tubae, from their form, which bears some resemblance to a trumpet; and their denomination Fallopiana, they take from Gabriel Fallopius, mentioned in the next article. FALLOPIUS

See ANATOMY INDEX.

FALLOPIUS, GABRIEL, a most celebrated physician and anatomist, was born at Meduna in Italy, in the year 1523, and descended of a noble family. He made several discoveries in anatomy, one of which was that of the tubes, called from him the Fallopian tubes. He travelled through the greatest part of Europe, and obtained the character of being one of the ablest physicians of his age. He was made professor of anatomy at Pisa in the year 1548, and at Padua in the year 1551: here he died in 1562, aged 39. His writings, which are numerous, were first printed separately, and afterwards collected under the title of "Opera genuine, tam practica quam theoretica, in tres tomes distribuita." They were printed at Venice in 1585 and in 1606, at Frankfort in 1600, cum operum appendices, and in 1616, in folio.

FALLOW, a pale red colour like that of brick half burnt; such is that of a fallow deer.

FALLOW FIELD, or Fallow ground; laid up, or that has been untilled for a considerable time.

FALLOWING OF LAND, a particular method of improving land. See AGRICULTURE INDEX.

FALMOUTH, a port town of Cornwall in England, situated in W. Long. 5. 30. N. Lat. 50. 15. on a fine bay on the English Channel. It is the richest and most trading town in the county, and larger than any three of its boroughs that send members to parliament. It is so commodious a harbour, that ships of the greatest burden come up to its quay. It is guarded by the castle of St Mawes and Pendennis, on a high rock at the entrance: and there is such shelter in the many creeks belonging to it, that the whole royal navy may ride safe here in any wind, being next to Plymouth and Milford-Haven, the best roads for shipping in Great Britain. It is well built; and its trade is considerably increased since the establishment of the packet-boats here for Spain, Portugal, and the West Indies, which not only bring very variety of goods in specie, but in bars, on account of the merchants in London; but the Falmouth merchants trade with the Portuguese in ships of their own, and they have a great share also in the gainful pilchard trade. The custom-house for most of the Cornish towns, as well as the head collector, is settled here, where the duties, including those of the other ports, are very considerable. The number of houses in 1664 amounted to 200; in 1801, they amounted to 468; in 1811, 478, and at this last period the number of inhabitants was 3933.

FALSE, in general, something contrary to truth, or not what it ought to be: thus we say a false action, false weights, false claim, &c.

FALSE Action, if brought against one whereby he is cast into prison, and dies pending the suit, the law gives no remedy in this case, because the truth or falsehood of the matter cannot appear before it is tried; and if the plaintiff is barred, or non-suited at common law, regularly all the punishment is ament.

FALSE IMPRISONMENT, is a trespass committed against a person, by arresting and imprisoning him without just cause, contrary to law; or where a man is unlawfully detained without legal process: and it is al-
so used for a writ which is brought for this trespass. If a person be any way unlawfully detained, it is false imprisonment; and considerable damages are recoverable in those actions.

**False News**, spreading of, is made to discover between the king and nobility, or concerning any great man of the realm, is punishable by common law with fine and imprisonment; which is confirmed by statutes Westminster, 2 Edw. I. cap. 54; 2 Rich. II. stats. I. cap. 3 and 12 Rich. II. cap. 31.

**False Oath.** See Perjury.

**False Prophecy.** See Prophecy.

**False Quarter.** In Farriery. See Quarter, Farriery Index.

**False Boy,** a bay lying to the eastward of the Cape of Good Hope; frequented by vessels during the prevalence of the north-westerly winds, which begin to exert their influence in May, and render it dangerous to remain in Table bay. It is terminated to the eastward by False Cape, and to the westward by the Cape of Good Hope. It is 18 miles wide at its entrance, and the two capes bear due east and west from each other.

**False Crimen,** in the civil law, is fraudulent subornation or concealment, with design to darken or hide the truth, and make things appear otherwise than they are. The crimine falsi is committed; 1. By words, as when a witness swears falsely. 2. By writing, as when a man testifies a contract, or the like. 3. By deed, as when he sells by false weights and measures.

**Falseify,** in Law, is used for proving any thing to be false. Hence we find.

**Falseifying,** a record, for showing it to be erroneous. Thus lawyers teach, that a person purchasing land of another, who is afterwards outlawed of felony, &c. may falsify the record, not only as to the time wherein the felony is supposed to have been committed, but also as to the point of the offence. But where a man is found guilty by verdict, a purchaser cannot falsify as to the offence; though he may for the time, where the party is found guilty generally in the indictment, because the time is not material upon evidence.

**Falstaff.** See Factotum.

**Falx,** in Anatomy, a part of the dura mater, descending between the two hemispheres of the brain, and separating the fore part from the hinder. It is called falx, i. e. “sickle,” because of its curvature, occasioned by the convexity of the brain. It divides the brain as low as the corpus callosum.

**Fama clamosa,** in the judicial procedure of the church of Scotland, a ground of action before a presbytery against one of its members, independent of any regular complaint by a particular accuser. See Presbytery.

Any person who is of a good character, may give to the presbytery a complaint against one of its members; but the presbytery is not to proceed to the citation of the person accused, until the accuser under his hand gives in the complaint, with some account of its probability, and undertakes to make out the libel, under the pain of being considered as a slanderer. When such an accusation is brought before them, they are obliged candidly to examine the affair. But besides this, the presbytery considers itself obliged to proceed against any of its members, if a fame clamosa of the

scandal is so great that they cannot be vindicated unless they begin the process. This they can do without any particular accuser, after they have inquired into the rise, occasion, and author, of this report. It is a maxim of the kirk of Scotland, that religion must suffer if the scandalous or immoral actions of a minister are not corrected. And wherever a minister is reputed guilty of any immorality (although before the most popular preacher in the kingdom), none almost will attend upon his ministry. Therefore the presbytery, for the sake of religion, is obliged to proceed against a minister in case of a fame clamosa. This, however, is generally done with great tenderness. After they have considered the report raised against him, then they order him to be cited, draw out a full copy of what is reported, with a list of the witnesses names to be led for proving this allegation. He is now to be formally summoned to appear before them; and he has warning given him, at least 10 days before the time of his appearance, to give in his answers to what is termed the libel; and the names of the witnesses ought also to be sent him. If at the time appointed the minister appear, the libel is to be read to him, and his answers are also to be read. If the libel be found relevant, then the presbytery is to endeavour to bring him to a confession. If the matter confessed be of a scandalous nature, such as uncleanness, the presbytery generally depose him from his office, and appoint him in due time to appear before the congregation where the scandal was given, and to make public confession of his crime and repentance. If a minister absent himself by leaving the place, and be contumacious, without making any relevant excuse, a new citation is given him, and intimation is made at his own church, when the congregation is met, that he is to be held in as confessed, since he refused to appear before them; and accordingly he is deposed from his office.

**Fame,** a beathen goddess, celebrated chiefly by the poets. She is said to have been the last of the race of Titans produced by the earth, to have bare palace in the air, and to have a vast number of eyes, ears, and tongoes. She is mentioned by Hesiod, and particularly described by Ovid and Virgil.

**Famescanina.** See Bulimia, Medicine Index.

**Fama, or Asfama,** the modern name of one of the ancient Aspammas. See Aspamka.

**Famiillars of the Inquisition,** persons who assist in apprehending such as are accused, and carrying them to prison. They are assistants to the inquisitor, and called familiars, because they belong to his Household. In some provinces of Italy they are called cruz-decoro, and in others the scholars of St Peter's oratory; and they were a cross before them in the outside garment. They are properly bailiffs of the inquisition; and the vile office is esteemed so honourable, that noblemen in the kingdom of Portugal have been ambitious of belonging to it. Nor is this surprising, when it is considered that Innocent III granted very large indulgencies and priviliges to these familiars; and that the same plenary indulgence is granted by the pope to every single exercise of this office, as was granted by the Lateran council to those who succoured the Holy Land. When several persons are to be taken up at the same time, these familiars are com-
manded to order matters, that they may know nothing of one another's being apprehended; and it is related, that a father and his three sons, and three daughters, who lived together in the same house, were carried prisoners to the inquisition without knowing anything of one another's being there till seven years afterwards, when they that were alive were released by an act of faith.

FAMILY denotes the persons that live together in one house, under the direction of one head or chief manager. It also signifies the kindred or lineage of a person; and is used by old writers for a hide or portion of land sufficient to maintain one family. See Hide.

FAMILY, in Natural History, a term used to express any order of animals, or other natural productions, which exhibit certain affinities, or the same characters. FAMINE, dearth, or scarcity of food. For preservatives against hunger in times of famine, see the article Hunger.

FAN, a machine used to raise wind, and cool the air by agitating it.

That the use of the fan was known to the ancients is very evident from what Terence says,

Caepe hoc flabellum, et ventulum huic sic facito;

Praefuit et tenues ventos movisse flabellum.

The fans of the ancients were made of different materials; but the most elegant were composed of peacocks feathers, or perhaps painted so as to represent a peacock's feather.

The custom which now prevails among the ladies of wearing fans, was borrowed from the east, where the hot climate renders the use of fans and umbrellas almost indispensable.

In the east they chiefly use large fans made of feathers, to keep off the sun and the flies. In Italy and Spain they have a large sort of square fans, suspended in the middle of their apartments, and particularly over the tables: these, by a motion at first given them, and which they retain a long time on account of their perpetual suspension, help to cool the air and drive off flies.

In the Greek church, a fan is put into the hands of the deacons in the ceremony of their ordination, in allusion to a part of the deacon's office in that church, which is to keep the flies off the priests during the celebration of the sacrament.

What is called a fan amongst us and throughout the chief parts of Europe, is a thin skin, or piece of paper, taffety, or other light stuff, cut semicircularly, and mounted on several little sticks of wood, ivory, tortoiseshell, or the like. If the paper be single, the sticks of the mounting are pasted on the least ornamented side: if double, the sticks are placed between them. Before they proceed to place the sticks, which they call mounting the fan, the paper is to be plaited in such a manner, as that the plates may be alternately inward and outward.

It is in the middle of each plait, which is usually about half an inch broad, that the sticks are to be pasted; and these again are to be all joined and riveted together at the other end; they are very thin, and scarcely exceed one-third of an inch in breadth; and where they are pasted to the paper, are still narrower, continuing thus to the extremity of the paper. The two outer ones are bigger and stronger than the others. The number of sticks rarely exceeds 22. The sticks are usually provided by the cabinet-makers, or toy-men; the fan-painters plait the papers, paint, and mount them.

The common painting is either in colours or gold leaf, applied on a silvered ground, both prepared by the goldbeaters. Sometimes they paint on a gold ground, but it is rarely; true gold being too dear, and false too paltry. To apply the silver leaves on the paper, they use a composition, which they pretend is a great secret, but which appears to be no other than gum arabic, sugar-candy, and a little honey, melted in common water, and mixed with a little brandy. This composition is laid on with a sponge; then laying the silver leaves thereon, and pressing them gently down with a linen ball stuffed with cotton, they catch hold, and adhere together. When, instead of silver, gold ground is laid, the same method is observed. The ground being well dried, a number of the papers are well beaten together on a block, and by this means the silver or gold get a lustre as if they had been burnished.

FAN is also an instrument to winnow corn. The machine used for this purpose by the ancients seems to have been of a form similar to ours. The fan, which Virgil calls mystica vanus Iacchi, was used at initiations into the mysteries of the ancients: For as the persons who were initiated into any of the mysteries, were to be particularly good, this instrument, which separates the wheat from the chaff, was the fittest emblem that could be of setting apart the good and virtuous from the vicious and useless part of mankind. It is figuratively applied in a similar manner in Luke iii. 17.

FANATICS, wild, enthusiastic, visionary persons, who pretend to revelation and inspiration.

The ancients called those fanatici who passed their time in temples (fana), and being often seized with a kind of enthusiasm, as if inspired by the divinity, showed wild and antic gestures. Prudentius represents them as cutting and slashing their arms with knives. Shaking the head was also common among the fanatici; for Lampridius informs us, that the emperor Hadrianeus was arrived at that pitch of madness, as to shake his head with the gashed fanatics. Hence the word was applied among us to the Anabaptists, Quakers, &c. at their first rise, and is now an epithet given to the modern prophets, Muggletonians, &c.

FANCY, or imagination. See Imagination.

FANIONS, in the military art, small flags carried along with the baggage.

FANNERS, a machine for winnowing corn, or for separating the chaff from the grain. See, for its description, Mechanics.

FANSHAW, SIR RICHARD, famous for his embassies and writings, was the tenth and youngest son of Sir Henry Fanshaw of Ware Park in Hertfordshire, where it is supposed he was born about the year 1607. He distinguished himself so early by his abilities, that in 1635 he was taken into government employments by King Charles I. and sent resident to the court of Spain; whence being recalled in the beginning of the trouble
troubles in 1641, he adhered to the royal interest, and was employed in several important matters of state. During his vacant hours he wrote several poems, and made several translations. At the Restoration it was expected he would have been made one of the secretaries of state; however, he was made master of the requests; a station in those times of considerable profit. Afterwards, on account of his skill in the Latin language, he was made secretary for that tongue. In 1661, he was sent envoy to the king of Portugal. In 1662, he was again sent to that court with the title of ambassador, and negotiated the marriage of his master King Charles II. with the infanta Donna Catherine. Upon his return he was made one of the privy council. In 1664, he was sent ambassador to both the courts of Spain and Portugal; at which time the foundation of peace between those crowns and England was laid by him. His conduct during his former employments in those courts gained him such high esteem there, that his reception was magnificent, exceeding all that were before, which those kings declared was not to be a precedent to succeeding ambassadors. He died at Madrid in 1666, on the very day he had fixed for setting out on his return to England. Besides some original poems, and other translations, he published a translation of Bathistus Guarini's Pastor Fido, and another of the Lusiad of Camoens. Among his posthumous publications are, "Letters during his embassies in Spain and Portugal; with his life prefixed.

FANTASIA, in the Italian music, signifies fancy; and is used for a composition, wherein the composer ties himself to no particular time, but ranges according as his fancy leads, amidst various movements, different airs, &c. This is otherwise called the capricious style: before sonatas were used, there were many of this kind, some of which remain even now.

FANUM, among the Romans, a temple or place consecrated to some deity. The defaced men and women among the heathens had likewise their fama; even the great philosopher Cicero erected one to his daughter Tullia.

FANUM Vaccinae, in Ancient Geography, a village of the Sabines, situated between Cures and Mandelar, where stood the temple of Vaccina, goddess of the idle or unemployed, in an old decayed state: and hence the epithet pater, used by Horace. Now called Focena, in the Ecclesiastical State.

FARANDMAN, a traveller, or merchant stranger, to whom, by the laws of Scotland, justice ought to be done with all expedition, that his business or journey be not hindered.

FARCE, was originally a droll, petty show, or entertainment exhibited by charlatans and their buffoons, in the open street, to gather the crowd together. — The word is French, and signifies literally, "force-meat or stuffing." It was applied on this occasion, no doubt, on account of the variety of jests, gibes, tricks, &c. wherewith the entertainment was intermixed. Some authors derive farce from the Latin facettia; others from the Celtic farce, "mockery;" others from the Latin farcire, "to stuff."

At present it is removed from the street to the theatre: and instead of being performed by merry-andrews to amuse the rabble, is acted by comedians, and become the entertainment of a polite audience. Poets have reformed the wildness of the primitive farces, and brought them to the taste and manner of comedy. The difference between the two on our stage is, that comedy keeps to nature and probability, and therefore is confined to certain laws prescribed by ancient critics; whereas farce disallows all laws, or rather sets them aside on occasion. Its end is purely to mock merry; and it sticks at nothing which may contribute thereto, however wild and extravagant. Hence the dialogue is usually low, the persons of inferior rank, the fable or action trivial or ridiculous, and nature and truth everywhere heightened and exaggerated to afford the more palpable ridicule.

FARIN, or FARY, a disease in horses, and sometimes in oxen, &c. somewhat of the nature of a scabies or mange. See FARRIERY, Indic.

FARDING-DEAL, the fourth part of an acre of land. See ACRE.

FARE, most commonly signifies the money paid for a voyage, or passage by water; but, in London, it is what persons pay for being conveyed from one part of the town to another in a coach or chair.

FAREWELL-CAPE, the most southerly promontory of Greenland, in W. Long. 50°, and N. Lat. 60°.

FARINA, a Latin term signifying meal, or the flour of corn. See CORN.

FARINA, a Latin term signifying meal, or the flour of corn. See CORN.

FARINA Faccundiae, among Botanists, the supposed impregnating meal or dust on the spicces or antherac flowers. See FOLLEN.

The manner of gathering the farina of plants for microscopical observations is this: Gather the flowers in the midst of a dry sunny day when the dew is perfectly off, then gently shake off the farina, or lightly brush it off with a soft hair pencil, upon a piece of white paper; then take a single tacle or isinglass between the nippers, and, breathing on it, apply it instantly to the farina, and the moisture of the breath will make the light powder stick to it. If too great a quantity be found adhering to the tale, blow a little of it off; and, if there is too little, breathe upon it again, and take up more. When this is done, put the tale into the hole of a slider, and, applying it to the microscope, see whether the little grains are laid as you desire; and if they are, cover them up with another tale, and fix the ring; but be careful that the tales do not press upon the farina in such a manner as to alter its form.

FAREL, money paid by the tenants in the west of England, in lieu of a heriot. In some manners of Devonshire, farrel is often distinguished to be the best goods, as heriot is the best beast, payable at the death of tenant.

FARM, FARIN, or Farm, in Law, signifies a little country messuage or district, containing house or land, with other conveniences; hired, or taken by lease, either in writing, or parole, under a certain yearly rent. See LEASE.

This in divers parts is differently termed: in the north, it is a tack; in Lancashire, farmeault; in Essex, a wike, &c.

In the corrupted Latin, forma signified a place inclosed or shut in: whence, in some provinces, Menage
Far [412] Far

Farm. observe, they call close or close, what in others they call a farm. Add, that we find location ad formans, to signify to let to farm; probably on account of the sure hold the tenant here has in comparison of tenants at will.

Spelman and Skinner, however, choose to derive the word farm from the Saxon ferme or ferme, that is, exitia, “provision”; by reason the country people and tenants anciently paid their rents in victuals and other necessaries, which were afterwards converted into the payment of a sum of money. Whence a farm was originally a place that furnished its landlord with provisions. And among the Normans they still distinguished between farms that pay in kind, i.e., provisions, and those which pay in money; calling the former simply ferme, and the latter blanche ferme, “white farm.”

Spelman shows, that the word ferme, anciently signified not only what we now call a farm, but also a feast or entertainment, which the farmer gave the proprietor or landlord, for a certain number of days, and at a certain rate, for the lands he held of him. Thus ferme in the laws of King Canute is rendered by Mr Lambard, exitia; and thus we read of reddere fermae successa nociis, and reddat sustum diem de ferme; which denote provision for a night and day, the rents about the time of the Conquest being all paid in provisions; which custom is said to have been first altered under King Henry I. We also say to farm duties, inspects, &c.

Culture of a Farm. See Agriculture.

Farm, as connected with gardening, and susceptible of embellishment. See Gardening.

In speculation, it might have been expected that the first essays of improvement should have been on a farm; to make it both advantageous and delightful; but the fact was otherwise; a small plot was appropriated to pleasure, the rest was reserved for profit only. And this may, perhaps, have been a principal cause of the vicious taste which long prevailed in gardens. It was imagined that a spot set apart from the rest should not be like them: the conceit introduced deviations from nature, which were afterwards carried to such an excess, that hardly any objects truly rural were left within the enclosure, and the view of those without was generally excluded. The first step, therefore, towards a reformation, was by opening the garden to the country, and that immediately led to assimilating them; but still the idea of a spot appropriated to pleasure only prevailed, and one of the latest improvements has been to blend the useful with the agreeable; even the ornamental farm was prior in time to the more rural; and we have at last returned to simplicity by force of refinement.

Of a pastoral farm.

x. The ideas of pastoral poetry seem now to be the standard of that simplicity; and a place conforable to them is deemed a farm in its utmost purity. An allusion to them evidently enters into the design of the Leasowes (A), where they appear so lovely as to en- dear the memory of their author; and justify the re-putation of Mr Skeneume, who inhabited, made, and-celebrated the place: it is a perfect picture of his mind, simple, elegant, and amiable; and will always suggest a doubt, whether the spot inspired his verse, or whether, in the scenes which he formed, he only re-aled the pastoral images which abounded in his muse. The whole is in the same taste, yet full of variety; and, except in two or three tribes, every part in rural and natural. It is literally a grazing farm lying round the house; and a walk, as unaffecting and as undisturbed as a common field-path, is conducted through the several enclosures. But for a detail of the plan and scenery, as illustrative of the present subject, the reader is referred to the particular description of the Leasowes published by the late Mr Dodsley. We shall only take notice of one or two circumstances independent on the general delineation.

The art with which the divisions between the fields are diversified is one of them. Even the hedges are distinguished from each other; a common quickset fence is in one place the separation: in another, it is a leafy hedge-row, thick from the top to the bottom; in a third, it is a continued range of trees, with all their stems clear, and the light appearing in the intervals between their branches, and the bushes beneath them; in others, these lines of trees are broken, a few groups only being left at different distances; and sometimes a wood, a grove, a copse, or a thicket, is the apparent boundary, and by them both the shape and the style of the enclosures are varied.

The inscriptions, which abound in the place, are another striking peculiarity: they are well known and justly admired; and the elegance of the poetry, and the aptness of the quotations, attune for their length and their number. But, in general, inscriptions please no more than once: the utmost they can pretend to, except when their allusions are emblematical, is to point out the beauties, or describe the effects, of the spots they belong to; but those beauties and those effects must be very faint, which stand in need of the assistance. Inscriptions, however, to commemorate a depauperated friend, are evidently exempt from the censure; the monuments would be unintelligible without them; and an urn, in a lonely grove, or in the midst of a field, is a favourite embellishment at the Leasowes: they are indeed among the principal ornaments of the place; for the buildings are mostly mere seats, or little root-houses; a ruin of a priory is the largest, and that has no peculiar beauty to recommend it: but a multiplicity of objects is unnecessary in the farm; the country is commands is full of them; and every natural advantage of the place within itself has been discovered, applied, contrasted, and carried to the utmost perfection, in the purest taste, and with inexhaustible fancy.

Among the ideas of pastoral poetry which are here introduced, its mythology is not omitted: but the allusions are both to ancient and to modern fables; sometimes to the fairies; and sometimes to the unities and muses. The objects also are borrowed partly from the scenes which this country exhibited some centuries ago, and partly from those of Arcadia: the

(a) In Shropshire, between Birmingham and Stourbridge.
FARM.

priory, and a Gothic seat, still more particularly characterized by an inscription in absolute language and the black letters, belong to the one; the urn, Virgil's obelisk, and a rustic temple of Pan, to the other. All these allusions and objects are indeed equally rural: but the images in an English and classical ecolage are not the same; each species is a distinct imitative character. Either is proper; either will raise the farm it is applied to above the ordinary level; and within the compass of the same place both may be introduced; but they should be separate: when they are mixed, they counteract one another; and no representation is produced of the times and the countries they refer to. A certain district should therefore be allotted to each, that all the fields which belong to the respective characters may lie together, and the corresponding ideas be preserved for a continuance.

2. In such an assortment, the more open and polished scenes will generally be given to the Arcadian shepherd; and those in a lower degree of cultivation, will be thought more conformable to the manners of the ancient British yeomanry. We do not conceive that the country in their time was entirely cleared, or distinctly divided; the fields were surrounded by woods, not by hedges; and if a considerable tract of improved land lay together, it still was not separated into a number of inclosures. The subjects, therefore, proper to receive this character, are those in which cultivation seems to have encroached on the wild, not to have subdued it; as the bottom of a valley in corn, while the sides are still overgrown with wood; and the outline of that wood indented by the tillage creeping more or less up the hill. But a glade of grass, this circumstance, does not peculiarly belong to the species; that may occur in a park or pastoral farm; in this, the pastures should rather border on a waste or common; if large, they may be broken by straggling bushes, thickets, or coppices; and the scattered trees should be beet with hawthorns and briars. All these are circumstances which improve the beauty of the place; yet appear to be only remains of the wild, not intended for embellishment. Such interruptions must, however, be less frequent in the arable parts of the farm; but there the opening may be divided into several lands, distinguished, as in common fields, only by different sorts of grain. These will sufficiently break the sameness of the space; and the tillage does not furnish a more pleasing scene, than such a space so broken, if the extent be moderate, and the boundary beautiful.

As much wood is essential to the character, a spot may easily be found, where turrets rising above the covert, or some arches seen within it, may have the semblance of a castle or an abbey. The partial concealment is almost necessary to both; for to accord with the age, the buildings must seem to be entire; the ruins of them belong to later days: the disposition is, however, advantageous to them as objects; none can be imagined more picturesque, than a tower bowed in trees, or a cluster appearing between the stems and the branches. But the summit is the times furnish other objects which are more within compass; hermitages were then real; solitary chapels were common; many of the springs of the country being deemed holy wells, were distinguished by little Gothic domes built over them; and every hamlet had its cross, even this, when perfect, set on a little rustic pillar, and that raised upon a base of circular steps, may in some scenes be considerable: if a situation can be found for a Maypole, whence it would not obstruct itself on every view, that also might not be improper; and an ancient church, however unwelcome it may be when it breaks into the design of a park or a garden, in such a farm as this would be a fortunate accident: nor would the old yew in the church-yard be indifferent: it would be a memorial of the times when it was useful.

Many other objects, significant of the manners of our ancestors, might perhaps, upon recollection, occur; but these are amply sufficient for a place of considerable extent; and cottages must abound in every age and every country; they may therefore be introduced in different forms and positions. Large pieces of water are also particularly proper; and all the varieties of rills are consistent with every species of farm. From the concurrence of so many agreeable circumstances in this, be the force or the effect of the character what it may, a number of pleasing scenes may be exhibited, either in a walk or riding, to be contrasted to those which in another part of the place may be formed on Arcadian ideas; or even to be substituted in their stead, if they are omitted.

3. A part may also be free from either of these imitate of a simple taste characters, and laid out in a common simple farm. Some of the greatest beauties of nature are to be found in the fields, and attend an ordinary state of cultivation: wood and water may there be exhibited in several forms and dispositions; we may enlarge or divide the inclosures; and give them such shapes and boundaries as we please; every one may be an agreeable spot, together, they may compose beautiful views; the arable, the pasture, and the mead, may succeed one another; and now and then a little wild may be intermixed without impropriety; every beauty, in short, which is not unusual in an inclosed country, whether it arises from respect or improvement, is to have its share of the same.

The buildings, also, which are frequent in such a country, are often beautifull objects; the church and the mansions are considerable: the farm-yard itself, if an advantageous situation be chosen for it; if the ricks, and the barns, and the out-houses, are ranged with any design to form them into groups, and if they are properly blended with trees; may be made a picturesque composition. Many of them may be detached from the group, and dispersed about the grounds: the dovecot, or the dairy, may be separated from the rest; they may be elegant in their forms, and placed wherever they will have the best effect. A common barn, accompanied by a -shump, is sometimes pleasing at a distance; a Dutch barn is so when near; and a hay-stack is generally an agreeable circumstance in any position. Each of these may be single; and besides these, all kinds of cottages are proper. Among so many buildings, some may be converted to other purposes than their construction denotes; and, whatever be their exterior, may within be made agreeable retreats, for refreshment, indulgence, or neither.

With such opportunities of improvements, even to decoration within itself, and with advantages of prospect into the country about it, a simple farm may undoubtedly be delightful. It will be particularly acceptable.
FARM

Acceptable to the owner, if it be close to his park or his garden: the objects which constantly remind him of his rank, impose a kind of constraint; and he feels himself relieved, by retiring sometimes from the splendor of a seat into the simplicity of a farm: it is more than a variety of scene; it is a temporary change of situation in life, which has all the charms of novelty, ease, and tranquility, to recommend it. A place, therefore, can hardly be deemed perfect, which is not provided with such a retreat. But if it be the whole of the place, it seems inadequate to the mansion: a visitor is disappointed; the master is dissatisfied; he is not sufficiently distinguished from his tenants; he misses the appendages incidental to his seat and his fortune; and is hurt at the similarity of his grounds with the country about them. A pastoral or an ancient farm is a little above the common level; but even these, if brought close up to the door, set the house in a field, where it always appears to be neglected and naked. Some degree of polish and ornament is expected in its immediate environs; and a garden, though it be but a small one, should be interposed between the mansion and any species of farm.

4. A sense of the propriety of such improvements about a seat, joined to a taste for the more simple delights of the country, probably suggested the idea of an ornamental farm, as the means of bringing every rural circumstance within the verge of a garden. This idea has been partially executed very often; but nowhere, perhaps, so completely, and to such an extent, as at Woburn farm, near Woburn (Sawrey). The place contains 150 acres: of which about 35 are adorned to the highest degree; of the rest, about two-thirds are in pasture, and the remainder is in tillage. The decorations are, however, communicated to every part: for they are disposed along the sides of a walk, which, with its appendages, forms a broad belt round the grazing-grounds; and is continued, though on a more contracted scale, through the arable. This walk is properly garden; all within it is farm; the whole lies on the two sides of a hill, and on a flat at the foot of it: the flat is divided into corn fields; the pastures occupy the hill; they are surrounded by the walk, and crossed by a communication carried along the brow, which is also richly dressed, and which divides them into two laws, each completely encompassed with garden.

These are in themselves delightful; the ground in both lies beautifully: they are diversified with clumps and single trees; and the buildings in the walk seem to belong to them. On the top of the hill is a large octagon structure; and, not far from it, the ruin of a chapel. To one of the laws the ruin appears, on the brow of a gentle ascent, backed and grouped with wood; from the other is seen the octagon, upon the edge of a steep fall, and by the side of a pretty grove, which hangs down the declivity. The lawn is further embellished by a near Gothic building; the former by the house, and the lodge at the entrance; and in both, other objects of less consequence, little seats, alcoves, and bridges, continually occur.

The buildings are not, however, the only ornaments of the walk; it is shut out from the country, for a considerable length of the way, by a thick and lofty hedge-row, which is enriched with woodbine, jasminine, and every odoriferous plant whose tendrils will entwine with the thicket. A path, generally of sand or gravel, is conducted in a winding line, sometimes close under the hedge, sometimes at a little distance from it; and the turf on either hand is diversified with little groups of shrubs, of fern, or the smallest trees, and often with beds of flowers: these are rather too profusely strewn, and hurt the eye by their littleness; but then they replenish the air with their perfume, and every gale is full of fragrance. In some parts, however, the decoration is more chaste; and the walk is carried between larger clumps of evergreens, thickets of deciduous shrubs, or still more considerably open plantations. In one place it is entirely simple, without any appendages, any gravel, or any sunk fence to separate it from the lawn; and is distinguished only by the richness of its verdure, and the nicety of its preservation. In the arable part it is also of green swing, following the direction of the hedges about the several inclusions: these hedges are sometimes thickened with flowering shrubs; and in every corner or vacant space, is a rosary, a close or an open clump, or a bed of flowers: but if the parterre has been rified for the embellishment of the fields, the country has on the other hand been searched for plants new in a garden; and the shrubs and the flowers which used to be deemed peculiar to the one, have been liberally transferred to the other; while their number seems multiplied by their arrangement in so many and such different dispositions. A more moderate use of them would, however, have been better; and the variety more pleasing, had it been less licentious.

But the excess is only in the borders of the walk; the scenes through which it leads are truly elegant, everywhere rich, and always agreeable. A peculiar cheerfulness overspreads both the laws, arising from the number and splendor of the objects with which they abound, the lightness of the buildings, the inequalities of the ground, and the varieties of the plantations. The clumps and the groves, though separately small, are often massed by the perspective, and gathered into considerable groups, which are beautiful in their forms, their tints, and their positions. The brow of the hill commands two lovely prospects: the one gay and extensive, over a fertile plain, watered by the Thames, and broken by St Anne's Hill and Windsor Castle; a large mead, of the most luxuriant verdure, lies just below the eye, spreading to the banks of the river; and beyond it the country is full of farms, villages, and villages, and every mark of opulence and cultivation. The other view is more wooded: the steeples of a church, or the turrets of a seat, sometimes rise above the trees; and the bold arch of Walton bridge is there a conspicuous object, equally singular and noble. The inclusions on the flat are more retired and quiet; each is confined within itself; and altogether they form an agreeable contrast to the open exposure above them.

With the beauties which enliven a garden are everywhere intermixed many properties of a farm: both the laws are pastured; and the lowings of the herds, the bleating of the sheep, and the tinklings of the bell-welder, resound through all the plantations: even the clucking of poultry is not omitted; for a menagerie of a very simple design is placed near the Gothic building;
a small serpentine river is provided for the water-fowl; while the others stray among the flowering shrubs on the banks, or struggle about the neighbouring lawn; and the corn fields are the subjects of every rural employment which enable land from seed-time to harvest to furnish. But though so many of the circumstances occur, the simplicity of a farm is wanting, that idea is lost in such a profusion of ornament; a rusticity of character cannot be preserved amidst all the elegant decorations which may be lavished on a garden.

FARMER, he that tenants a farm, or is lessee thereof. Also generally every lessee for life, years, or at will, is called farmer. As this word implies no mystery, except it be that of husbandry, husbandman is the proper addition for a farmer.

FARMER, Hugh, an English clergyman and a man of literature, belonging to the protestant nonconformists, was descended from people of respectability in North Wales, and drew his first breath at Shrewsbury, in the year 1714. Dr Charles Owen was for some time his tutor, and prior to that period he was educated at a school in Llanegrin. His parents from the first having designed him for the ministry, he was sent to prosecute his studies under the justly celebrated Dr Doddridge at Northampton, in 1730. Here, by his industriousness and wonderful proficiency, he gained the esteem of that great man, who always spoke of him in the most respectful terms. Having completed his academical studies, Mr Farmer became the chaplain of William Coward, Esq. of Walthamstow, in the county of Essex, and was at the same time chosen minister to a dissenting congregation in that village. Notwithstanding the gratitude with which Mr Coward ought to be remembered by many for his charitable institutions, he had certain peculiarities of temper which rendered him a very disagreeable domestic. His doors were shut at an uncommonly early hour of the night, and neither visitor nor constant resident could afterwards obtain admission. Mr Farmer having one evening been detained a little beyond that hour, found the doors shut against him, and was under the necessity of applying to a William Snell, Esq. solicitor, a man of eminence, and possessed of many excellent qualifications, in whose family he remained for 30 years, living in the greatest friendship and intimacy. In that gentleman's house he grew, he prepared those valuable treatises and dissertations which were afterwards given to the public, and acquired him so much celebrity as a man of letters. He also continued to discharge the duties of his ministerial function to the people of Walthamstow.

When a day of thanksgiving was appointed for the fortunate suppression of the rebellion in 1745, Mr Farmer preached a sermon on that occasion which was published the following year. His next work was of considerably greater importance, and was entitled, "An Inquiry into the Nature and Design of our Lord’s temptation in the wilderness," 8vo. In this work it was the design of Mr Farmer to prove that the whole was transacted in vision, the different stages of which were intended to point out to him the difficulties and duties of his subsequent ministry. The originality of thought and profound erudition which this work displayed, soon gave it a very extensive circulation, and called forth the exertions of those who were of an opposite opinion. It received one reply under the title of "Christ's temp-

tations real facts," which possessed considerable merit, but much inferior to Mr Farmer's for energy of expression, depth of thinking, and force of argument. But the most masterly, perhaps, of all Mr Farmer’s literary productions, was his "Dissertation on Miracles," designed to show that they are arguments of a divine interposition, and absolute proofs of the mission and doctrine of a prophet." Some have believed, and perhaps not without reason, that this work has no proper rival, notwithstanding the many able treatises upon that subject which have made their appearance in different ages. It was first published in the year 1771. But as great talents are frequently envied, and as this infernal principle is the prolific source of calumny and detraction, so this supereminent work of Mr Farmer was declared to have been chiefly borrowed from M. Le Moine on the same subject; a slander which Mr Farmer refuted in a very able and satisfactory manner. In the year 1775, he published his celebrated "Essay on the Demoniacs of the New Testament," which may be considered as a masterly completion of the design he had in view by his dissertation on miracles. The hypothesis he adopted had been formerly defended with great ability by Made, Sykes, Lardner, and others; but it was reserved for the critical acumen of Mr Farmer to free it completely from those difficulties which still hung around it. His essay on demoniacs was successively attacked by Dr Worthington and Mr Fell, both of them men of considerable erudition, but much inferior to their able antagonist.

Mr Farmer having continued for several years the sole pastor of the congregation at Walthamstow, an able colleague was appointed him in 1764, in consequence of which he became the afternoon preacher to the congregation of Salter’s-hall, in the city of London, and soon after the Tuesday lecturer at the same place. He resigned his ministerial employments as he advanced in years, which the people committed to his charge very much regretted. In the year 1783 his eyes gave him very much trouble, of the sight of which he was nearly deprived, but by means of a surgical operation, he was for some time enabled to resume his studies. But mortality is the inevitable lot of all men, and the growing infirmities of Mr Farmer brought him to the grave in 1787, in the 73rd year of his age.

By his last will he had ordered all his manuscripts to be burnt after his death, a circumstance which men of letters have just reason to lament. It is no doubt the duty of executors to pay attention to the will of the deceased; yet for the benefit of the Christian world they would have been justified in taking a certain latitude in the explanation of his meaning; as it does by no means appear probable that he meant to consign to the flames his manuscript entitled, "A Dissertation on the story of Balaam," which appeared written in a fair hand, as if manifestly intended for the press. When we say that Mr Farmer was a consummate scholar, we trust that his numerous and able works will fully justify the assertion; and his talents as a preacher were equally conspicuous. His voice was remarkable for its clearness and harmony, and his whole manner was peculiarly impressive. His piety was not morose, his conversation was lively, and his whole deportment was a beautiful transcript of his moral injunctions.

FARMER, Richard, D. D. a scholar and critic of considerable...
It was at one time the intention of Dr. Farmer to publish a history of the town and antiquities of Leicester, the expenses to be defrayed by subscription; but either his independent circumstances, or a degree of native indolence, made him relinquish the design, and the few materials he had collected were given to Mr. John Nichols, at that time engaged in an elaborate work on the same subject. After a painful illness of some length, Dr. Farmer died at Emanuel college in the month of September, 1779, in the 62d year of his age. Dr. Parr wrote an epitaph for his tombstone, in which we find the following testimony to his worth. "Virtus facetus et dulcis, festiva sermo, Graecus et Latinus doctus, in explicatione veterum Anglorum poesi subjicit et elegans." He had a considerable library, in which were a vast number of books purchased at the stalls of London, and afterwards disposed of for much more than they cost.

FARMER, in mining, is the lord of the field, or one that farms the lot and cope of the king.

FARN ISLANDS, two groups of little islands and rocks, 17 in number, lying opposite Bamborough castle in Northumberland. At low water the points of several others are visible besides the 17 just mentioned. The nearest island to the shore is called the House Island, and lies exactly one mile and 68 chains from the coast. The most distant is about seven or eight miles. Their produce is kelp, feathers, and a few seals, which the tenant watches and shoots for the sake of the oil and skins. Some of them yield a little grass that may serve to feed a cow or two; which the people transport over in their little boats. The largest or House Island is about one mile in compass, and has a fort and a lighthouse. It contains about six or seven acres of rich pasture; and the shore abounds with good coals which are dug at the ebb of tide. St. Cuthbert is said to have passed the two last years of his life on this island. A priory of Benedictines was afterwards established here, for six or eight monks, subordinate to Durham. A square tower, the remains of a church, and some other buildings, are still to be seen on this island; and a stone coffin, which is pretended to be that of St. Cuthbert. At the north end of the island is a deep chasm, from the top to the bottom of the rock, communicating with the sea; through which, in tempestuous weather, the water is forced with great violence and noise, and forms a fine jet d'eau of 60 feet high. It is called by the inhabitants of the opposite coast, the Churn. One of the islands in the most distant group is called the Finnisters, from some vast columnar rocks at the south end, even at their sides, flat at the top, and entirely covered with guillotins and shags. The fowlers pass from one to the other of these columns by means of a board, which they place from top to top, forming a narrow bridge over such a dreadful gap that the very sight of it strikes one with horror.

FARNABLE, Thomas, son of a carpenter at London, born in 1575, staid a short while at Oxford; where being enticed to abandon his religion, he went to Spain, and was there educated in a college belonging to the Jesuits. Being weary of their severe discipline, he went with Sir John Hawkins and Sir Francis Drake in their last voyage in 1595. He was afterwards a soldier in the Low Countries: but being reduc
abroad and reduced to nothing. Farnovius was engaged by Gneussius to prefer the Arian system to that of the Socinians, and consequently asserted, that Christ had been produced out of nothing by the Supreme Being before the creation of this terrestrial globe. His sentiments concerning the Holy Ghost are not certainly known; however, it appears that he warned his disciples against paying the tribute of religious worship to the Divine Spirit.

FARQUhar, George, an ingenious poet and dramatic writer, the son of a clergyman in Ireland, was born at Londonerry in 1678. He was sent to Trinity College, Dublin; but his volatile disposition not relishing a college life, he betook himself to the stage; where, having dangerously wounded a brother actor in a tragic scene, by forgetting to change his sword for a foil, it shocked him so much that he left the Dublin theatre and went to London. Here he procured a lieutenant's commission by the interest of the Earl of Orkney; which he held several years, and gave many proofs both of courage and conduct. In 1698, he wrote his first comedy called Love and a Bottle; which for its sprightly dialogue and busy scenes, was well received. In the beginning of the year 1700, which was the jubilee year at Rome, he brought out his Constant Couple, or a Trip to the Jubilee; and suited Mr. Wilks's talents so well in the character of Sir Harry Wildair, that the player gained almost as much reputation as the poet. This tempted him to continue it in another comedy called Sir Harry Wildair, or The sequel of the Trip to the Jubilee; in which Mrs. Oldfield acquired great applause. In 1702, he published his Miscellanies, which contain a variety of humorous sallies of fancy. In 1703, appeared the Inconstant, or the Way to Win him; in 1704, a farce called the Stage-coach; in 1705, the Twin Rivals; and in 1706, the Recruiting Officer, founded on his own observations while on a recruiting party at Shrewsbury. His last comedy was the Beaux Stratagem, of which he did not live to enjoy the full success. Mr. Farquhar married in 1703. Before that time his manner of life had been rather dissipated. The lady, therefore, who afterwards became his wife, having fallen violently in love with him, but judging that a gentleman of his honour would not easily be drawn into the trammels of matrimony, contrived to have it given out that she was possessed of a large fortune; and finding means afterwards to let Mr. Farquhar know her attachment to him, interest and vanity got the better of his passion for liberty, and the lady and he were united in the hymeneal bands. But how great was his disappointment when he found all his prospects overclouded so early in life (for he was then no more than 24), by a marriage from which he had nothing to expect but an annual increase of family, and an enlargement of expense in consequence of it far beyond what his income would support. Yet, to his honour be it told, though he found himself thus deceived in a most essential particular, he never was known once to upbraid his wife with it; but generously forgave an imposition which love for him alone had urged her to, and even behaved to her with all the tenderness and delicacy of the most indulgent husband. Mrs. Farquhar, however, did not very long enjoy the happiness she had purchased by this stratagem; for the circumstances that attended this union were in some respects perhaps the
FARRIERY.

INTRODUCTION.

The term farrier is probably a corruption of farrier, from the verb ferre, to shoe a horse; all these words being derived from the Latin ferrum, iron. There is no doubt that the word farrier was at first used to denote a person who shod horses; but as these persons were for a long period the only horse-doctors, the term was soon used in the more extensive sense of horse-doctor or horse-leech; and hence farrier came to signify the art of curing the diseases of horses.

There can be little doubt that the word farrier was originally spelt ferrier or ferre; as we meet with this latter orthography in some of our older writers. Thus Blandeville, who wrote in the time of Queen Elizabeth, in his "Address to the Gentlemen of England," book iv. has the following sentence.

"All horses, for the most part, do come into their decay, sooner than they should do, by one of these four visits; that is to say, either for lack of being well bred, or through the rashness of the rider, the negligence of the keeper, or else through the unskilfulness of the ferrier."

Again, the same author mentions "Martin Gheffy of Aston, called Martin Alman, the queen's magiste."

Farriery, in the usual acceptance of the word, forms only a part of the more general art, which has been commonly called the veterinary art; by which is understood the art of medicine as applied to the inferior animals, which has been long called by the French Pâtre, or medical veterinary. This word veterinary is of very ancient date, being derived from the Latin veterinarius, which is used by Columella to denote a horse-doctor or cattle-doctor. The term veterinary, being derived from veterinus, pertaining to, affecting, tending, or dealing in, animals, is properly applicable only to beasts of burden; but veterinary medicine is now commonly employed in a more comprehensive sense, to denote the art of curing the diseases of domestic animals in general.

The French, who appear to have first used the term in this general sense, usually distinguish that part of the art which we call farriery, by the appellation of Hippométrie from iens, a horse, and medecin, physician. Thus, they have a Cours d'Hippométrie, a Dictionnaire d'Hippométrie, &c.

As there are considerable advantages attending the consideration of the diseases of the several domestic animals in the same treatise, we propose, in the present article, not to confine ourselves to the medical treatment of the horse, but to extend our views to the diseases of such other of the domestic animals, as are of the most importance to man, particularly the ox, sheep, and dog.

The diseases of the horse, as they are better known, and more interesting, than those of the other domestic animals, will of course occupy the greatest share of our attention. The diseases of the dog have been as yet too little investigated for us to give a very satisfactory account of them; but as the subject of veterinary medicine has of late been much cultivated, it is probable that these, as well as some other obscure diseases of animals, may ere long receive some elucidation. If any considerable improvements or discoveries shall be made before the completion of our work, we shall notice them under veterinary medicine.

It may be thought, that, considering veterinary medicine in this extensive point of view, it would have been more correct to defer the subject to the article veterinary, but most of our readers who have been accustomed to see in our dictionary the article farriery, will expect an account of, at least, the diseases of the horse, under this article, and would probably not be pleased to have this delayed till nearly the end of the work; besides, it is of little importance under which article the diseases of animals are treated of, as, when we have once defined our terms, we cannot be misunderstood, provided we always employ them in the sense of the definition. Again, as the term veterinary has departed from its original signification, there can be no objection to our employing the word farriery, a term that is more familiar in the same general sense. In fact, it has been so employed by a late writer on the subject, Mr. Ferron, who has entitled his work, "A new System of Farriery." Though he professes to treat in it of the horse, ox, and sheep.

In this article, then, we shall use farriery as synonymous with veterinary art, and shall consider both as
the art of preserving the health and curing the diseases of domestic animals.

The study of veterinary medicine must be an interesting subject to every person, whose profession, or situation in society, requires him to attend to the comforts and diseases of domestic animals.

To the veterinary practitioner, the study of the principles of his art, the history of the diseases which he is called on to relieve, and the methods of treating them that have been found most successful, are as essential as the study of the human economy, and the diseases to which it is exposed, are to the medical practitioner. A farrier who has studied his art scientifically, is as much superior to the ignorant empiric, to whose mercies the lives and limbs of horses and cattle are usually intrusted; as the regular physician to the illiterate quack, who passes off his pernicious nostrums in every newspaper, and carishes himself, by imposing on the credulity and folly of the public. The necessity of a regular education to the farrier, as well as to the surgeon or physician, which has long been seen, has led to the institution of veterinary schools; at first in France, and within these few years in England. Of these we shall presently give an account.

To the farmer and country gentlesman this subject must be highly interesting. They will find their account in being able themselves to superintend the management of their horses, dogs, sheep, and cattle, so as to best preserve their health, and relieve their diseases, without relying implicitly on their grooms, horsemen, and farriers, herdsmen and cattle-doctors, who are probably either notoriously ignorant, or are induced from interested views, to make false and protracting the cure, and pick the pockets of their masters (A). These gentlemen therefore cannot employ a part of their leisure time to greater advantage than in acquiring a knowledge of the diseases of domestic animals.

The medical practitioner who wishes to derive an advantage from analogy in some of the obscure diseases to which the human frame is subject, and which would probably receive considerable elucidation from a comparison with similar diseases that affect the inferior animals, must engage with peculiar interest, in a research that promises so well to repay his labour. "It is not a little remarkable, (say the editors of a well-conducted medical journal), that the diseases of horses, cattle, and sheep, which occur so frequently, and are so seriously lamented, should be so imperfectly understood. No greater benefit could be conferred on physical science than a complete history of the diseases of our domestic animals, especially if given by any one endowed by nature with superior acuteness, and a talent for observation, improved by habit and experience; who could describe the symptoms and appearances of the different disorders, paint out the analogies with those incident to the human body, detect those minute circumstances which serve to distinguish them, class them under their proper heads, and correct all the confusion in which they now lie involved. Veterinary medicine has lately occupied some share of attention, chiefly as relating to horses, and as a distinct pursuit from the general study of all the diseases of animals, but considered apart from any relation or inquiry concerning the treatment of the morbid states of the human system. It is in this last point of view, that comparative pathology seems to offer subjects worthy investigation; and, when looked upon in this light, it strikes us as one of those studies, que ad nos pertinent, et quo verserem malum est."

We shall see, from the historical sketch of farriery, which will immediately be given, that the art never much importance was before or after, and is not admitted to have made any considerable progress, or assumed any thing like a scientific form, till it attracted the attention of men who had made the human economy their study. Almost the only rational improvements, that have been made in the art, were either suggested or carried into effect by medical men; and nothing will contribute so much to its perfection as the interest which the profession has lately shewed to it, and the attention that has of late been paid to the study of comparative anatomy and pathology. The healing art in general must profit by this analogy. There is not only an intimate connection between the diseases of man and that of the inferior animals; but, of man and especially in those that have been domesticated, the diseases of both are nearly allied.

The priests, that in the early part of the last century so frequently attended the herded cattle throughout almost all Europe, nearly depopulating most of the farms, are very analogous to some of the epidemic diseases of man; and pestilential diseases among cattle, have not unfrequently been the forerunners of similar epidemics among the human race. Homer, in describing the plague that harassed the Grecian camp, in consequence of the avert given by Agamemnon to the priest of Apollo, says that the domestic animals were first affected.

"O Deucalion, thou art the cause of my death, and I am the cause of thine."

"If mules and dogs th' infection first began,"

"And last the venomous arrows fix'd in man."

Pope.

The plague of boils that raged among the Egyptians (Exod. ix. 12.) affected both man and beast. Similar instances are related both by sacred and profane historians.

Almost the whole tribe of inflammations, even the goat (according to Van Swieten) are found to affect the domestic animals, are produced by the same causes, and

(A) It may be thought by some, that we have gone too far in accrediting the farriers and grooms, &c. of having a fellow-feeling; but, when it is known, that "a part of every shilling paid to common farriers, is in some cases returned to the groom, as a fee or perquisite;" that "the servant receives at least five per cent. from the farrier on every bill paid by his master;" and that "if a horse dies under the care of a farrier, he generally becomes the property of the groom;" See Veterinary Transactions, No. x. Introduction; it will be allowed that there is some ground for the surmise.
Domestic animals are subject to eruptive diseases, both chronic, and such as are attended with fever; and both are very similar to those by which man is affected. It is pretty certain that the smallpox sometimes rages among sheep, as we shall see hereafter; and a complaint very like the measles often attacks swine. Some of them are transferable to man; and to this transference in the case of the cowpox, a blessing which will render immortal the name of Jenner, we owe the probable annihilation of one of the most dreadful pests that ever affected the human race.

Scrofula and consumption attack monkeys. Apoplexy, epilepsy, and many others of what are called nervous diseases, indigestion, and even mental derangement, are not uncommon among domestic animals; spasmodic affections are very frequent among them, and it is said, that for one case of tetanus or locked jaw among the human species in these climates, there are ten or twenty among horses.

The analogy might be pursued much farther; but what has been stated is sufficient to shew the advantages that medical men may derive from the study of veterinary medicine. Many obscure and dangerous diseases may thus in time be illustrated or mitigated; and the effect of doubtful remedies may be ascertained by experiments on the inferior animals. For, though there are a few instances of different effects following the exhibition of the same medicines in man and animals; yet, on the whole, the analogy is nearly as complete with respect to remedies as diseases (a).

It will appear, from what has been said, that the reasoning, and much of the treatment, in the diseases of animals must be nearly the same as in man, and, of course, that the veterinary practitioner will gain much by acquiring a knowledge of human medicine. Were the practitioners in farriery generally instructed in the principles of medicine, little more would be required in a treatise on farriery, than to point out the difference in the structure and functions of domestic animals, to describe the diseases peculiar to these, and to mark the varieties that it is necessary to observe in the treatment of disease and the administration of remedies. But, as many of these gentlemen have not the opportunity of attending medical lectures, and most of them have not received an education that would enable them to understand the language in which medical writings are usually composed; it becomes necessary in a treatise of this kind to accommodate the language to the taste and capacity of general readers, and to introduce such that will be found in other articles on subjects connected with medicine.

To prevent repetition, as much as possible, and to avoid swelling this article to a greater length than is necessary, we shall, however, where the similarity of the subject will admit of it, occasionally refer to some of the medical articles in this dictionary.

The successful practice of farriery, like that of medicine in general, requires that the practitioner should possess a considerable share of knowledge. It is not requisite for sufficient to have been long in the habit of managing horses and cattle; this, indeed, to a person of a strong nervous mind, and attentive observation, will furnish a considerable number of facts, with respect to the symptoms and progress of the diseases to which domestic animals are subject. But to mark the minute differences between such as resemble each other, to investigate their causes, and to contrive a rational mode of treatment, requires a much greater share of abilities, and much more extensive information, than we can expect to find among grooms and shepherds, or fails to the lot of most of those who call themselves farriers and cattle-doctors.

It must be obvious to every thinking mind, that no practice either in medicine or farriery can be rational, and yet such as is founded on a comprehensive knowledge of the structure and functions of those animals, the treatment of whose diseases is the object of that practice. The first thing, therefore, necessary to the veterinary practitioner is, to acquire some idea of the anatomical structure of the domestic animals. We have already, in the second part of the article Anatomy, given a general account of the structure of quadrupeds; and in exemplifying this, in the chapter on the anatomy of a dog, we pointed out the most striking peculiarities that are to be found in this animal; as we have done with respect to ruminating animals, viz. the cow and sheep, in the succeeding chapter of that part. To that article we must refer our readers for the anatomical part of our subject, as far as relates to the ox, the sheep, and the dog. It will naturally be expected, that a description of the structure of the horse should be given in this article; but this description must, in general, be concise, as the nature of our plan prevents us from enlarging on the subject, excepting in those parts where a pretty minute knowledge appears to be necessary.

Those who wish to study the anatomy of the horse minutely, may consult Viter’s Medicine Veterinario, tom. i.; Blaine’s Outlines, and Stubb’s elegant work on the anatomy of the horse.

The practitioner should take every opportunity of inspecting the bodies of those animals that die of diseases, which are very important, or which are not very well understood. Morbid dissections often throw considerable light on the nature and treatment of diseases; and it fortunately happens, that with respect to domestic animals, these dissections are very easy, and are not obstructed by those absurd prejudices which, especially in this country, are opposed to the dissection of human bodies. In treating of the diseases of domestic animals, in a

(a) One of the most remarkable cases of anomaly in the effect of remedies is that of arsenic, which, in the quantity of a few grains will produce a deadly poison to man and most animals, but may be given with impunity to horses to the amount of two drams or more. The story of the different effects of antimonies, on hogs and monkeys, is well known. See Antimony. As to the example of white vitriol (sulphate of zine), which proves emetic in the human subject, but produces no such effect in the horse; it is owing to the different structure of the stomach in this animal, by which he is incapable of vomiting. Colocynthis, or bitter apple, is well known to be a most violent purgative to man, but in the horse it has produced no effects in the enormous dose of four ounces.
FARRIERY.

The study of the functions of domestic animals ought to go hand in hand with that of their structure; and the student will find it of considerable advantage, to compare the functions of these animals with those of man. This comparative view will be given in some future article. In the present treatise, we can only speak of the functions of domestic animals, as far as it is necessary to illustrate the nature or the treatment of their diseases.

The natural history of these animals ought to form a part of the studies of the veterinary practitioner. It is a subject that is not only highly curious and interesting, but extremely useful. We find, that these animals, in their native fields, enjoy a state of health and vigour, which is interrupted only by those accidents to which a life of liberty and wildness may expose them. It is only when they are received under the protection of man, that they become subject to disease. It is therefore an interesting inquiry, to examine into their native habits; as, in our endeavours to preserve their health, we should, as nearly as is compatible with convenience and economy, imitate the habits that are found to prevail amongst these animals in a state of nature. It is the province of the naturalist to describe the external conformation of these animals, and the advantages, and defects dependant on it, that fit or disqualify them for the various purposes for which they are destined under the service of man; it is his business to describe the methods of breeding these animals in a state of nature, and how far this may be improved for the purposes of domestication, and to detail the method of training and managing them. Many of these circumstances are treated of by some of the writers on the veterinary art, in a complete system of which they ought not properly to be omitted. We shall, however, not treat of them in this article, as, according to the plan of our work, they more properly fall to be considered under the article MAMMALIA, in which will be given the natural history of all quadrupeds.

Chemistry must form a necessary part of the studies of every man who engages in the practice of medicine, whether human or veterinary, as, without a knowledge of its principles, neither the functions of the animal economy, the intimate structure of its component parts, nor the action of many remedies, can be properly understood. In the article Chemistry, we have prepared abundant matter for the reader to make himself acquainted with the elements of that admirable science.

The practitioner, whether of human or veterinary medicine, who is a proficient in anatomy, wants but a little manual dexterity, and some practical experience, to make him a tolerable surgeon. The operations to be performed on brutes are few, and these are in general very clumsily executed. Humanity, however, as well as prudence, will readily point out to the farrier the necessity of learning the best methods of performing those operations with dexterity and dispatch, so as to give the least pain to the unfortunate animals that are placed under his care. We shall describe the usual operations immediately after treating of the anatomy of the horse.

It is of considerable consequence, that the person who undertakes the management of domestic animals, should make himself acquainted with those circumstances which experience has shown to be most favourable to the preservation of their health, and the prevention of their diseases. This subject forms what may be called veterinary hygiene, and will be considered at some length in the fourth part of this article.

Before the practitioner can attempt to remove or alleviate the diseases to which domestic animals are subject, he must acquire a competent knowledge of the remedies employed for that purpose, their nature, uses, and doses, as adapted to the different animals, in various situations, and various diseases; with the methods of preparing and compounding them into the several forms that are usually employed; and with the best means of administering them. This comprehends what is called the veterinary materia medica, and will form the subject of our fifth part.

With this previous knowledge, the veterinary practitioner is prepared to enter on the consideration of the diseases, which will be treated of in the sixth part of our article. He must be particularly attentive to the symptoms of each disease, as, on an accurate knowledge of these, will depend the means of distinguishing those complaints, which upon a superficial view bear considerable resemblance to each other, but which require a very different, and perhaps opposite mode of treatment. He must attend to the greater or less violence of these symptoms, to the nature of the part which they attaek, and to the greater or less rapidity of their progress; as these circumstances must considerably influence the judgment he is to form of the danger, and probable termination, of the disease. He must, as far as possible, investigate the causes, that appear to have produced the disease in question, or which seem to aggravate or keep up the morbid symptoms; as on the removal or mitigation of these causes, must depend the only rational and scientific method of cure. Lastly, he must make himself acquainted with the treatment that experience has found most successful in the cure of each particular disease, as well as with that which has been found to be attended with little or no advantage.

As the proper means of attaining the best information is of the greatest importance, we shall here give Mr. Blaine's instructions on this point.

The mode in which any art is attained, must be in a great measure directed by the future views of the learner. It appears to me that there are three distinct classes of persons, who are likely to study this branch of useful knowledge. The first are persons of enlarged minds, and extended fortunes. The second are surgeons, whose situation in country villages may render their services in this art highly useful, upon occasions when no farrier is at hand, or, in the end, in cases in which farriers of the common class are unable to judge. The third are farriers themselves, or persons intending to profess veterinary medicine.

Gentlemen and amateurs, who wish to accumulate information on this curious and interesting subject, within the reach of the veterinary college, will find their account in attending a course of lectures there; if
FARIRBY.

Introduction.

not, they should apply themselves to the study of the more general parts of the body, both of the human and animal; the latter, I hope, they may attain by the following sheets. They may direct the cellarer, butcher, or tanner, to cut up their dead horses in their presence. They may study physiology in a pleasant and interesting manner, from the ingenious work on this subject by Mr. Sumner. The lighter parts of the veterinary art may be acquired with pleasure, from the elegant publication of Mr. Richard Lawrence of Birmingham; and a course of chemistry will amply reward them for their pains in acquiring it.

A good surgeon has travelled three-fourths of the road towards making a good veterinarian, but he must diligently travel the remainder to arrive at excellence. He must by no means sit down contented with the analogy between the human and brute; which, if he does, will lead him into very great error; for though this analogy is in some cases very striking, yet there are others in which the similarity fails, and he is left to act upon other principles. Hence in those diseases that are conquered or mitigated by vomiting in the human; in the horse he must pursue another mode of treatment. In those diseases removed by purging in the human, his attempts on the horse would probably fail; as before the effects were produced, the animal might be past relief. It must be remembered that the operations of medicines are very different in the one, and the other. It is not sufficient that a surgeon has an intimate acquaintance with the human frame; he must be equally conversant with the animal he treats, or he will treat in vain; particularly those diseases originating in a peculiarity of form from the human, as all the diseases of the feet. He should make himself particularly conversant with the specific diseases of the horse, which bear an analogy to any thing in the human body; as far as, glands, strangury, greese, &c. From the great strength of the arterial system, he must ever be aware how prone the diseases of the horse are to a rapid termination, and hence his treatment must be decided and energetic; therefore, in all cases, he must be very attentive to diagnostics. But what will much embarrass a surgeon in practising the veterinary art, will be a want of knowledge of the general usages, nomenclature, and idioms, if I may so express it, among grooms and farriers; without an acquaintance with which, these people at once detect and despise the practitioner. It should be the business therefore of the surgeon, with his other acquisitions, to learn their manners, and to make himself acquainted with their terms. The third class of persons, either farriers already practising, or persons intending to practise, will easily gain that. When it is in their power, I would advise their taking the advantage of the veterinary college; but when they cannot, I would recommend the prosecution of their studies in a regular manner. Begin by first reading some general description of the human body, such as Bynon’s Anatomy, or the anatomical part of the present work, carefully; let them pay attention to the functions and uses of the parts, particularly where the same uses are brought about by a variation in structure; this enlarges the mind, and prepares it to receive the benefits of dissection, which should now be proceeded to. Any small animal may be first dissected, to enable the learner to use his instruments properly. He may then proceed to dissect the horse with some satisfaction by himself, which will assist him at first to make his observations, but too scrupulous an attention to accuracy in descriptions will only bewilder. The necessary instructions for dissection, and the preservation of parts, may be gained, by a recourse to Poel’s Anatomical Instructor, which as profusely written to instruct the pupil in these particulars. When he is well acquainted with the appearance of the animal in health, he must take every opportunity of examining diseased appearances, which are seldom wanting at the ten-yard or kennel. He should now make himself acquainted not intimately with physiology, for which purpose I may read Euler’s works; those at present a translation of Cuvier’s Treatise on Comparative Anatomy, which I may likewise avail myself of. When he has become acquainted with pathology, as at present received, he may pursue the older authors on farriery; to the end he may succeed a knowledge in chemistry, procured by an acquaintance with the materia medica; the proper use for which he may see by a reference to that article, that nothing will now be wanting, but experience to perfect him.

Since the establishment of a veterinary school in Rostock, little is wanting to promote the progress and improvement of the veterinary art, as far as relates to the diseases of horses. But the art, with respect to medical treatment of other animals, is still in the most incomplete state of imperfection. Proposals have been made for improving cattle medicine; and among the reasons we think the following of Mr. John Lawrence, entitled to attention; though, probably the most palpable works may be much improved and enlarged, by referring to the account of authors which will be immediately given.

Mr. Lawrence’s proposal is simply, that the animals providing the country with regular-bred surce, the practice of cattle medicine, be immediately taken by the agricultural societies; at least, in experiment he made by some of the most consistence, I may say, each society engaging a gentleman of that description as a sufficient and respectable annual stipend. The proposed may run in such form, that should the several annual emoluments from practices come short of the stipulated sum, the deficiency should annually be made up by his patrons the society. No person to be supposed any pretence, but who shall have received the best education of a surgeon, and have attended the hospitals the usual length of time. A selection of Veterinary text-books to be made, and the books purchased for the use of the surgeon, but to remain the property of the society. This may consist of Gibson’s last edition, &c. 

1. Brucken, Bartlett, Osmer, Laplay, and the best writers; and Lafane and Beugelant from the French with whatever may have been published since that time, by authority of the French veterinary schools. All the members of the society and their connections, as far as their influence may extend, to entreat the care of the diseased animals to the surgeon appointed, at a fair and liberal charge for his attendance and medicines. The surgeon, to keep a regular history of all the cases which shall come under his inspection, and include the present causes and symptoms of the disease, with the probable methods of prevention, his mode of treatment, a particular detail of the medicines prescribed, their operation, with every relative and useful remark which may occur.
FARRIERY.

A clear written copy of such veterinary transactions, to be delivered annually, and on a certain day, to the society, to remain at their disposal. 13

It is of considerable consequence for the practitioner to be informed of the rise and progress of the art which he professes, and to be acquainted with the principal authors that have written on the subject. We shall therefore, give a brief sketch of the history of Farriery, with a concise view of the writings that have appeared from the earliest authentic records to the present time (1806).

Though we shall enumerate all the authors that have written professedly on this subject, who appear deserving of notice, we shall here characterize only the general treatises, reserving our remarks on such works as have appeared on individual diseases, &c. to that part of our treatise, in which we shall consider those subjects.

PART I. HISTORY.

THE early history of farriery, as of every other art and science, is involved in great obscurity. We shall not attempt to penetrate the clowd that hangs over the ancient state of the art, or to supply the want of facts, by conjectures, which, however rational, can lead to no certain or useful conclusions.

There seems no doubt that in the time of Hippocrates, and probably long before, the medical practitioners exercised their office in favour of the domestic animals, as well as of men; and Galen seems to have been well skilful in the knowledge and treatment of some of the diseases of animals.

Perhaps the earliest authentic writings on the subject of the veterinary art, now extant, are to be found in the works of Columella, the celebrated Roman author on husbandry, who, in his work De Re Rustica, has given many sensible directions for the management of horses and cattle. Columella lived about the second century, under the reign of the Roman emperor Tiberius, or, as some say, of Claudius Caesar.

It is understood that Celsus, the elegant imitator of Hippocrates, who lived some time before Columella, wrote much on the diseases of animals; but none of his writings on this subject have survived the general wreck of science and literature that accompanied the fall of the Roman empire.

We have no certain accounts of any author who wrote expressly on this subject earlier than Vegetius, who flourished, as is supposed, some time in the fourth century, and probably during the reign of the emperor Valentinian the third. The work of Vegetius, De Arte Veterinaria, is still considered as extremely valuable, as it has handed down to us the only certain account of the opinions and practice of the early practitioners in this art. The body of the work appears to have been compiled from the most celebrated Greek writers on the subject. It is divided into four books; the prefaces or introductory chapters to which are written in very elegant language.

An edition of Vegetius was published at Basel, in 1741; and the work has been translated into several modern languages. Such of our readers as wish for a particular account of the contents of Vegetius's treatise, will find a copious analysis of it, in the third volume of M. Vitelet's Medicine Veterinaire.

A collection of fragments of ancient writers on the veterinary art, was made by Rufillus, physician to Francis I. King of France. It was first published in Latin, in the year 1530; and afterwards, in 1557, the original Greek was published. The writers who contributed to this collection were chiefly Abyratus, Evemon, Hierotheus, Petarchus, and Theonnessus. Some part of this collection is tolerably good; but, on the whole, it appears to be a strange jumble of good, bad, and indifferent, collected without judgment, and arranged without taste.

It is said that Xenophon, who lived three or four hundred years before the Christian era, wrote a small treatise in twelve chapters, on the training, management, and external figure of horses; but, as he says little or nothing with respect to their diseases, he cannot properly be ranked among the writers on veterinary medicine.

A book of more than a thousand years now occurs, among the writings on the history of Farriery. During this long period of darkness, ignorance, and barbarity, the veterinary art, like most others, rather sank than advanced. During some part of this gloom, however, the art of shoeing horses with iron appears to have been invented; an art which seems to have contributed not a little to throw the management of this noble animal into the hands of a set of artful blacksmiths, who were now first called farriers. We cannot here enter on a discussion of the medical pretensions of these smiths; the health of horses. They have been amply commented on, by some of the best writers on the subject of Farriery, as Gissone, Bracken, Lefouill, and particularly Mr. John Lawrence, to whose useful and humane treatise on horses we refer our readers for some very spirited remarks on the subject.

The first modern writer on Farriery, when we can refer to him by name, is Carlo Ruini, an Italian, who, in 1608, published at Venice his Anatomia del Cavallo. This work, of which very few copies are now to be found, is embellished with many copperplates, which, for the time, when they were engraved, are very elegant. It is said that many succeeding writers on the anatomy of the horse have been indebted to them for most of their figures.

We now come to a period at which the veterinary Progress of art began to assume something of a scientific form. In France and England, countries which have been the most distinguished for their accession to the management and diseases of domestic animals. As the French writers were the first who did any thing considerable towards the improvement of Farriery, we shall trace the progress of the art in that country, before we examine the improvements it has received in England.

In 1659, Lallemand published his great work...
FARRIERY.

Part I.

History. parson Marchal," the complete Horsman, a work which gained its author a high reputation, and was long the only guide, as well in farriery as in the manage.

M. Solleseul was principal riding-master in France, and this situation led him to pay much attention to the diseases of horses; and being a man of considerable abilities, and enlightened understanding, he saw the errors that prevailed in his time; and his genius and experience led him to expose and correct them. His practical observations and remarks, which it would be out of place to particularize in this early part of our article, in general merit considerable attention. His observations on the external figure of the horse, and of his blemishes and defects, are also very valuable. It is much to be regretted that this ingenious author had not studied the anatomy of the horse, as he would then have avoided many errors and much false reasoning, into which his ignorance of anatomy betrayed him. Solleseul's work passed through many editions, and was translated into most of the modern languages. A version of it into English was executed by Sir William Hope, one of his pupils, early in the 18th century.

The dreadful havoc committed by the murrains or epidemic diseases among horned cattle, that ravaged Europe during the first half of the 18th century, attracted the attention of medical men, and thus led to a greater improvement in the veterinary art, than it had ever before experienced. These epidemics were first described by two Italian physicians, Ramazzini, in a treatise De Contagione Epidemica; and Lancisi, physician to the pope, in a treatise De Bovina Peste. But the most celebrated works on the prevailing epidemic seem to have been written by the faculty in France. Among the first appeared a memoir by M. Hermant, physician to the king.

In 1746 was published a memoir Sur la Maladie Epidemique des Bœufs du Vivarais, by the celebrated nosologist Sauvages.

About the middle of this century, the first steps were taken towards the establishment of schools for the public instruction of practitioners in farriery. One of the most celebrated of these was the veterinary college of Lyons.

Bouygrelat.

Over this institution presided the famous Bouygrelat, a name that will be ever respectable in the history of farriery. Besides his office of professor at Lyons, he was inspector general of the veterinary schools in France; commissary general to the royal stables; honorary member of the Royal Academy of Paris, and member of the Royal Academy of Berlin. M. Bouygrelat was a voluminous writer, and most of his works are still in much repute. In 1752, he published Éléments d'Hippotistique, "Elements of Farriery," in 3 vols. The first volume is divided into eight chapters, comprehending the knowledge of the horse, as far as regards his external form. The first chapter treats of the denomination and division of the parts that compose the body of this animal; the second treats of the beauties and defects of the fore part of the horse, or what the French writers call l'Avant Main; the third treats of the beauties and defects of the several parts of the body; the fourth of the beauties and defects of the hind part of the horse, or l'Arrière Main; the fifth, of the different marks of horses; the sixth of the means of ascertaining the age of horses; the seventh, of the geometrical proportions of the horse; and the eighth, of shoeing.

The second volume describes the anatomy of the horse, as far as relates to the bones, the integuments, the muscles, and blood vessels; and the third volume concludes the anatomy with a description of the parts that compose the head and breast.

In 1755, M. Bouygrelat's Materia Medica, for the use of the veterinary pupils, came out. Soon after was published his Elementary Treatise on the Anatomy of the Horse, which is the most complete work of the kind that has ever yet appeared. In 1766 he published his Elementary Botanical Demonstrations, for the use of the pupils of the veterinary college. He likewise gave to the world a treatise on bandages applicable to the horse.

M. Bouygrelat also furnished many of the best articles on farriery for the French Encyklopédie.

About this time appeared a number of works on the Buffon and manage, and on natural history, particularly a work by Daubenton. M. de la Guerincere, entitled École de Cavalerie, and the celebrated natural history by M. de Buffon and Daubenton; but as these works have little connection with the diseases of animals, which they mention only incidentally, we shall not here particularize their contents.

Contemporary with Bouygrelat, and equal to him in Lafaosse the celebrity, Bounoephous Lafaosse the Elder, a member of Eider, the Royal Academy of Sciences at Paris, and farrier to the king of France. He made many discoveries, and introduced several valuable improvements in the art of farriery, particularly an improved method of shoeing, and a treatise on the glands. These were first communicated in the form of memoirs to the French academy, and published in their annals. They were afterwards collected in 1754 into one volume, under the title of Observations et Discoveries Faites sur des Chevaux; "Observations and Discoveries on Horses." We shall have occasion, in future parts of our article, to consider the merits of these memoirs, which were well received, and have contributed much to the advancement of farriery.

The elder Lafaosse also wrote some of the articles on farriery in the Encyklopédie.

He was soon followed by his son Lafaosse the Younger, who occupied the same post as his father, Younger, and has acquired much reputation, by following his steps, and extending his improvements. He published in 1766, his Guide de Marchal; or "Farrier's Guide;" a work well known in this country, though it has never, we believe, appeared in an English dress. It is divided into five parts, treating, 1st, Of the means of ascertaining the age of horses, and a succinct enumeration of the several parts; 2d, Of the blunders and tricks of farriers; 3d, Of the internal diseases of the horse; 4th, Of the external diseases, and the most important operations; and, 5th, Of shoeing. This work is characterized by M. Vitet, as one of the most accurate, simplest, and most precise, that had ever appeared. The anatomical part of the work is short, but comprehensive, and is illustrated by some tolerably good plates. It appears to have been a sort of text-book to a course of lectures on farriery, which were afterwards, in 1772, published in a superb form, with 65 coloured plates, under the title of Cours de Hippotistique; or "Course of
Farriery.

This work is extremely scarce in Britain, where, according to Mr. Blaine, there are only three copies of it; one of which belongs to the Medical Society of Woolwich; another is in the hands of Mr. Mathias, ci-devant pupil of the Veterinary College; and he believes Mr. Morecroft has a third.

But the principal work of the younger Lafosse is his Dictionnaire d'Hypothétique, in four volumes, which is little known in this country, and which we have not seen. Mr. Blaine calls it "the best practical system of farriery that had ever appeared."

In 1803 was published an abridgment of M. Lafosse's Guide, of which an English translation has lately appeared under the title of The Veterinarian's Pocket Manual. It is a useful little book, but it is a pity that the author or translator had not observed a more methodical arrangement.

Though, for the sake of uniformity, we have mentioned the younger Lafosse immediately after his father; there were many works published in France between the Memoirs and the Guide.

In 1755, M. Garfalt published his Nouveau parfait Marchal, an improvement on the Farfait Marchal of Solleysele. It is divided into seven treatises; on the Conformation of the Horse; on Haras, or the Method of Breeding; on the Stallion; on the Diseases of Horses; on Operations; on Shoewing; and on Horse Medicines. This work is not without defects, but, for the most part, it is very good, and by no means deserves the adverse character given of it by Mr. Blaine in his History of the Veterinary Art, that it "does not seem to merit any distinction in this place."

The articles on farriery in the Encyclopædia that had been written by Bourgelat and Genson, called forth a work from M. Ronden, senior, farrier to the larger stables of the king; who, in 1759, published Observations sur les Articles de l'Encyclopædia concernant la Marchallerie. They appear to be ingenious, and contain much practical information.

In 1761 there appeared at Paris a work on agriculture in two volumes 4to., entitled, La Nouvelle Maison Rustique, which contains much useful matter respecting the breeding, management, and diseases of domestic animals, as well as quadrupeds.

The contagious epidemics among horned cattle still appeared occasionally in France and other parts of Europe; and many essays were written on them by various physicians, particularly by M. Bovard of Besançon, in 1766; by M. Leclerc and M. Barbaret, of Paris, in the same year.

In 1768 Daubenton, the celebrated naturalist, already mentioned, published a memoir on the mechanism of rumination in sheep; and in 1769, appeared a small volume entitled La Medicine des Bêtes a Laine; "the Medical Treatment of Sheep."

Between 1776 and 1782, M. Vitet, a physician at Lyons, published his Medicine Veterinaire, in 3 vols. 8vo., of which the first contains a pretty full account of the anatomy of the horse and ox, with some judicious remarks on the beauties and defects of both, and on some of the more important operations to which they are exposed; the second treats of the diseases of horses, sheep, and cattle; and the third gives an account of the remedies employed in veterinary medicine; and ends with a copious analysis of most of the continental writers on farriery, and a few English, that had happened on the subject, from Vegetius to 1770.

M. Vitet's work is, for the most part, a compilation from the best writers who have gone before him; but as he had read much, and appears to have selected with judgment, his book is one of those which may be consulted with advantage. We know that it bears a high character in France, and is often quoted with respect.

We are therefore disposed to rate it at a higher value than a late writer has done; and are inclined to suspect that some of those who affect to think lightly of it are indebted to it for much more than the "names of many of those who have written on this subject."

Much about this time, but in what precise year we regret cannot say, the abbé Rozier, well known as the editor of the early volumes of the Journal de Physique, published his Cours d'Agriculture et de Medecine Veterinaire; a work of much reputation in France, but, we believe, little known on this side the water.

Another work appeared about this time on the epi-Paullet, demics among cattle, entitled Recherches Historiques et Physiques sur les Maladies Epizootiques; "Historical and Philosophical Researches respecting Epidemic Diseases," by M. Paullet. It contains an abridgment of almost all that had been written on the subject, and particularly valuable for the account of the morbid appearances that were discovered on dissection.

We shall finish our account of French writers in the words of Mr. Blaine.

"After the death of Bourgelat and Lafosse, we bear Huard of no character of any great eminence for some years; and Chabert, but it appears, that since the revolution, the subject has been again more diligently studied, and the names of Chabert and Huard stand forward. Soon after, or about the time above alluded to, there appeared a considerable work, called, The Rational Dictionary of Medicine, Surgery, and Farriery, in six volumes; and very soon after, a Veterinary Dictionary, by Buchon; but it has no merit superior to that of Lafosse. In 1787, M. Chabert published a Treatise on the Mange of Horses; since which he has likewise published upon the peripneumonia of black cattle. There has also appeared an Essay on the Grea of Horses, which gained the prize medal of the society for the promoting the health of animals; to which is joined a report on thick wind and on broken wind; but we are not aware who is the author. In 1788, there came out a treatise on the farriery, with the method of shoeing, cutting, and all the lesser operations, translated from the Spanish of Hartmann, by Huard. Likewise "Instructions and Observations on Domestic Animals," with remarks on the breeding, rearing, buying and selling; with an analysis of previous authors, by Chabert, Huardin, and Huard. The above authors have also published, conjointly, a Veterinary Almanack, containing the history and progress of animal medicine, since the establishment of the veterinary schools. In 1791, M. Lamagnière Lapole, veterinary surgeon, published observations on the health of the animals of St. Domingo, dedicated to the veterinary colleges of Alfort. In 1797, M. Huard published, by order of government, a treatise on the advancement of the art, we must take a cursory view of the conti

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426


t of the principal writings that appeared during the 18th century in the rest of Europe.

Goelcke.

43

In 1740, Goelcke, a German, published a treatise in 4to, De Lue Contagious Bouche; "On the Contagious Disease of Cattle," in which the symptoms of the murrain that raged in Flanders about that time are well described; and there are added the appearances on dissection.

49

Saunier.

In 1734, appeared at the Hague a work entitled La parfaite Connaissance des Chevaux; "The Complete Knowledge of Horses," by John Saunier, and Gaspard his son. The latter boasts of this work, that it was drawn up from the lectures of his father, an experienced man; and that it contains the result of numerous experiments on subjects of every description, and diseases of every species; that it is the labour of the life of two men, the offspring of their continual application and study. After all their boasting, however, the work of Myrmheum Saunier is little worth.

In 1745 and 1746, appeared two other treatises on the epidemic of cattle by Mauchard and Enos.

50

Linnaeus.

In 1749, the illustrious and indefatigable Linnaeus published son, "The Senses," in which there is little that relates to our subject; if we except a table of such plants as are eaten or refused by the domestic animals, which is curious and useful.

51

Haastler.

Some time before 1756, Frederic Haastler, a Swede, published Instructions for Improving the Breed of Sheep, which was in much repute, and was translated into French.

52

Reynier.

In 1752, M. Reynier of Lausanne published a treatise on a contagious inflammatory disorder that raged among horses and cattle, and which the Genevese called la boueet. This will be considered hereafter.

53

Hartmann.

In the same year there appeared at Vienna a work on the epidemic of cattle by Dr Pleneiz; and in 1755 Mich. Sagard of the same city published a work on a contagious distemper that the year before attacked the cattle in the circle of Iglau in Moravia; and was attended with an appearance of aphtous crusts in the mouth.

54

Camper.

Late veterinary medicine has been much cultivated in Spain, where the works of Hartmann have held in much esteem. In that country, it is said, a work on farriery in nine volumes has been lately published; but of this we know nothing.

We must not close our account of continental writers without mentioning the name of the illustrious Camper, whose works were lately collected and published at Paris. Besides a long description of the structure of the orang-outang, and some lesser essays on comparative anatomy, these volumes contain an elaborate history of the epizootic disease that raged among the cattle on the continent in the middle of last century, in the form of lectures. We shall speak of this work hereafter.

We have thus brought the history of this art on the continent, in a concise manner, down to the present time; and from it may be learned what improvements have originated there, and at what periods. It would appear, that when the science began to command attention, from the exertions of Francis the First, and Vegetius before his time, had it progressively improved in the degree it might be supposed to be placed by a conversation with this author, it would ere this have been more approximating to perfection: but instead of proceeding on the rational system of Vegetius, it dwindled again into ignorance of barbarity; and the recipes of magoise-masters, and the operations of blacksmiths, were the only ostensible marks of its assistance. From this state the practitioner became in some degree roused by the improved system of Solleysel; but he could only combat present errors, he could not point the way to future improvement, for he was ignorant of the groundwork whereon to build it, i.e. the anatomy of the animal. This defect was only in a small degree supplied by the labours of Ruini, and in some measure farther assisted by the demonstrations of Bourgelat. Many of the remaining errors were combated by Laffosse with great advantage; and his experiments and discoveries on glanders, the rationality and improvements of his mode of shoeing, entitle him to great merit. Yet, though by these exertions, and by the establishment of veterinary seminaries, the art assumed a more regular and scientific form, its attainments were by no means adequate to its opportunities; which was almost wholly owing to an obstinate adherence to the humoral pathology, by which the treatment of internal and acute diseases continued indiscriminate. Their prescriptions were filled with decoctions of simples, and they were utterly unacquainted with the medicinal virtues of the more active remedies in use among us. Under an opinion that the blood and humours were the constant seat of disease, they were continually washing them sweet with correctors; entirely ignorant or unmindful of the derangement of the solids, and of the connections between living blood and living vessels. Nor did this influence only their treatment of internal and acute diseases; but even of local and chronic affections: hence their mode of treating farcy, grease, and other complaints of a similar nature, were equally inert, and all evinced an erroneous pathology. Upon a careful and unprejudiced review of the state of farriery among ourselves, and on the continent of Europe, we are not inclined to think it had any advantages of moment at the beginning of the war in their favour; though it must be allowed, we are indebted to them for many improvements, and for the first establishment of the art of farriery in its right form. Since the war, our means of communication are so few, that we are not aware of what is doing among our neighbours. But though farriery, as a branch of veterinary medicine here, has kept nearly equal pace with its continental improvements, I do not think (says Mr Blaine), the treatment of other animals, particularly of oxen, cows, and sheep, has been equally attended to; and, in this particular, I am disposed to think we are behind hand with them. Their severe visitations of the epizootic distemper have made them more attentive to this branch of the art."

55

Blaine's Outline.

In taking a review of the history of farriery, or veterinary medicine in general, in our own country, it will be seen, that we are much longer in improving the art, and reducing it under a rational and scientific form, than our neighbours on the continent. Our earliest writers on the diseases of horses and cattle, were deplorably ignorant, not only of all principles of general medicine and sound practice, but even of the common appearances of the diseases, which they professed to cure.

56

Our first writers on the treatment of the diseases of Blinde-horses, ville.
FARRIERY.

The names of many writers, after Blundeville, are those who have written on the history of farriery; but they are still inferior to Blundeville, except perhaps Burdon, on whose work notes were written by Dr Bracken.

About the end of the 17th century, lived Gervas Markham, a name in high repute amongst grooms and farriers even to this day. He published a work on Farriery, which is called his Maister Peco, and which is one of the strangest compounds of nonsense and absurdity that has ever appeared on the subject.

In the opinion of Mr Lawrence, Markham was nothing more than a mere vulgar and illiterate compiler; and his works, some few things excepted, are stuffed with all the execrable trash that had ever been invented by any writer, or practised by any farrier, ancient or modern, on the subject of horses. It is necessary, however, that we do justice to the character of Gervas Markham; he certainly possessed a species of merit which has not descended to all his successors, the copyists and plagiarists; he very honestly gives the names of those authors from whom he derives his knowledge.

Some years after Markham, Michael Baret published a book, which he called the Vineyarde of Horsemanship. This we have never seen, but it appears to be of some repute. The next writer on this subject, is the Duke of Newcastle, who gave to the world a most superb work on an improved method of breeding and managing horses. This work bears a very high character, not only from the name of the illustrious person by whom it was composed, but from its own intrinsic merit. The duke is quoted with respect by most succeeding writers; and his work has been translated into French, German, Dutch, and Italian. It chiefly relates to horsemanship, but as it contains some excellent observations and maxims on the breeding of horses, it naturally comes to be considered here.

In the latter end of the 17th century, Andrew Snape, who was farrier to Charles II. published a large work on the anatomy of the horse, illustrated with many copperplates. These plates appear not to have been taken from his own dissection, but are mostly copied from preceding authors, especially from Ruini. Mr Blaine, however, is mistaken in asserting that some of them are copied from Sauier, as Snape's work was published in 1683, whereas Sauier's did not appear (according to Vitet) before 1734. It is said that Snape had projected a larger work on the diseases of horses, but this he did not live to execute.

Early in the 18th century, farriery experienced a considerable improvement from the writings of Mr William Gibson. This gentleman had been a surgeon in the army, but relinquished that situation for the practice of farriery, which he probably expected to find more profitable. Mr Blaine places this writer in the middle of the last century; but his first work, entitled "The Farriery's New Guide," was certainly published previous to the year 1721, as we have seen a second edition of it advertised in that year. This was the most scientific work on the diseases of horses, that had then appeared in the English, or perhaps any language. The detail of symptoms is in general just, accurate, and the plan of treatment advised is for the most part very judicious. The anatomical part of Mr Gibson's work is not so valuable, being frequently incorrect, and evidently not the result of his own observation. The Farriers Guide was soon followed by The Farriers Dispensatory, containing an account of the remedies employed in farriery, and the means of preparing and exhibiting them. This work is far inferior to the former, and is now of little use. In 1721, Mr Gibson published a small work on The True Method of Dieting Horses, which contains some judicious remarks on the means of preserving the health of this useful animal; as also on the breeding of horses: with some observations on their external form, their sagacity, and habits. This book must have been very valuable at the time of its publication, but is now in a great measure superseded by Clark and other later writers.

About 1750, Mr Gibson published a larger work, On the Diseases of Horses, in which he has brought together the substance of his former works on farriery, with some improvements. There is, we believe, a later edition of it in two volumes. Mr Gibson must be considered as one of those to whom farriery is most indebted for its improvements. He was the first, at least in this country, to rescue the art from the hands of the illiterate empirics, to point out their blunders and correct their errors. Mr John Lawrence, who has given a very full account of Mr Gibson in the first volume of his treatise on horses, perhaps goes too far in ranking him on an equality with some of our present writers; while those again have erred as much on the other side, in detracting from the merits of a man to whom they are all more or less indebted for much of their most valuable matter.

Gibson was followed in his plan for the improvement, of farriery by Dr Bracken, a physician at Lancaster, and a pupil of Boerhaave, who published a work called Farriery Improved. "Bracken (says Mr Blaine) was a physician of great abilities and extensive knowledge in his profession, a man of considerable erudition, a sportsman, and a wit of a peculiar cast. His works have by some been as much admired and read for the peculiar style in which they are written, and that peculiar freedom and non-observance of rule or form, as for the real information they contain.

"Though there is great ingenuity in his writings, and though in many respects he improved upon Gibson, yet as a practical work it was much inferior; nor was his information given in a way that could benefit the generality of his readers: independent of his being too peculiar, and his reasoning too abstruse for farriers, his manner of pursuing his subject was so desultory, that few readers had patience to follow him. Nevertheless his works, which were several, and passed through many editions, have raised him a fame that can only die with the science."

These two writers may justly be considered as the fathers of English farriery; they established their system.
on the only sure foundation, the analogy which prevailed between the structure, economy, and diseases of man and of brutes. The best practice in this country has been derived from their instructions; and their works formed an example, by following which, later writers have greatly improved the art.

The next writer of reputation was Mr John Bartlet, also a medical man, who about the middle of the last century published his Gentleman’s Farriery, and afterwards his Veterinary Pharmacopoeia. Bartlet had formed himself on the model of Gibson and Bracken, the best parts of whose writings he has given in his farriery, condensed into a more compendious view. He also enriched his work by the most material improvements of Lacasque, whose memoirs on shoeing and on glanders, he translated into English.

Soon after Bartlet, appeared Mr William Osmer, a surgeon and a sportsman, who practised farriery in Oxford-street, London. He was the principal means of introducing into this country the French mode of shoeing, which, in his treatise on the lameness of horses, he adopted to the English manner, so as to render it a method that had been before nearly useless and impracticable. Mr Osmer’s mode of shoeing will be mentioned hereafter. From the above works many compilations were soon made; these were generally below mediocrity, amongst which, one called the Farrier’s Dictionary, though a very wretched composition, met with a very rapid sale. We must except from these a small treatise by Mr Blount, surgeon, which is above the common class, and worthy of notice, from an ingenious contrivance, illustrated by a plate, for securing a fractured limb.

The year 1746, Dr Richard Brocklesby, a friend of Dr Mead, published a pamphlet on the disorder that just before raged among horned cattle. It should seem that this book is very little known beyond the circle of medical men, as we have not seen it referred to by any writer on the diseases of cattle.

Brocklesby was followed on the same subject by Dr Layard. We shall speak particularly of these two authors, when we come to treat of the murmurs.

About 30 years ago, Mr James Clark, farriery to his majesty for Scotland, published an ingenious Treatise on Shoeing, and on the Diseases of the Feet of Horses. This was soon followed by his Treatise on the Prevention of Diseases Incidental to Horses. By this latter work Mr Clark has acquired much reputation as a scientific farrier, and a sensible writer. It contains some judicious observations on stables, diet, and exercise, on blood-letting, rowels, and setons; with remarks on the uses and administration of the more common remedies. Mr Clark’s book is in general well calculated to produce a more judicious and humane method of treating horses, than usually prevails. But it would have been more useful, had the author omitted much of the theoretic discussion, into which he has entered on some parts of the animal economy, on the nature of disease, and on the action of remedies. Mr Clark is a good practical writer, but his theory is often very lame, or very obscure. He had an easy opportunity of attending the medical lectors, which were taught at Edinburgh in his youth, when the humoral pathology, and the theory of Boerhaave were in full vogue. Mr Clark has here and there interspersed among his practical remarks much of this old leaven. But as he probably had not received such a previous liberal education as might fit him for the judicious application of what he heard, he is often deficient in that theoretical knowledge which he takes so much pains to display.

Some years before the publication of Mr Clark’s last mentioned treatise, viz. in 1778, Lord Pembroke with his excellent dissertation on the management of dragoon horses, with some remarks on shoeing. This work is entitled, Military Equitation, or a Method of Breaking Horses. Though the observations contained in his lordship’s work were intended for the use of the British cavalry, they are for the most part applicable to horses in general, and will merit the attention of farriers and others concerned in the management of horses. We do not well understand what Mr Blaine means by asserting that Lord Pembroke derived the principle of his medical hints from Mr Clark. If he means that his lordship borrowed any thing from Mr Clark’s treatise on preventing the diseases of horses, he is certainly mistaken, as the first edition of this treatise, which we believe has not been reprinted, appeared in 1788, and in it Mr Clark often quotes Lord Pembroke’s work (c).

Much about this time Mr Stubb published his elegant plates of the anatomy of the horse, of which work, as the production of an artist, we cannot speak too highly. Mr Stubb is a very eminent painter of animals, and to much professional excellence in this capacity, he has added a considerable share of anatomical knowledge. Hence his figures are in general extremely correct, and will be found very useful to those who have not the opportunity of availing themselves of real subjects.

One of the latest writers on the subject of farriery is Mr Taplin. Mr Taplin, who for some time enjoyed a considerable reputation, both as a practitioner and as a writer. But this reputation has been materially nullified, since it was discovered, that Mr Taplin is not only ignorant of the anatomy of the horse, but has liberally copied from those very writers whom he takes every opportunity to vilify and abuse. As from his flagrant plagiarism and arrogance, Mr Taplin has well deserved the dressing which he has recently received from several late writers, we shall turn him over into the bands of one of his rivals, who does not seem disposed to show him any mercy.

This gentleman likewise began his career as a surgeon, but turned aside to the then more profitable track of farriery. Mr Taplin set out by decrying all that had gone before him, all that were in practice with him, and in fact every thing that has been done by any one since. Yet Mr Taplin’s works are said to be compilations from those very authors whom he abuses; and, in some instances, after abusing egregiously, he copies literally.

(c) We find that Lord Pembroke’s work was first published about 1761. The edition mentioned in the text is, we believe, the second.
art I.

FARRIERY.

Unfortunately for this gentleman, from some late improvements, the people of this country have learned to distinguish in this art, as well as in others, between scientific investigation and verbose quackery. Had Mr. Taplin set out by studying the structure and economy of the animal, he might, and undoubtedly would, have proved an ornament to the profession; but when he permits his works to go through so many editions, in the face of criticism from all quarters, with a chapter on diseases of a part that has no existence in the horse, i.e. the gall bladder, we must be aware that he is entirely ignorant of that, upon which every pretension to professional merit must be grounded. Mr. Taplin indulges himself in the most unrestrained freedoms in speaking of those who have gone before him, yet copies verbatim from them; he cannot wonder, therefore, that he has been treated with considerable severity by later writers; nor can he be surprised that a practice so begun and so continued has ended as it has.

Mr. Taplin is the author of several works on farriery. His first publication was, we believe, The Stable Directory, which had a great sale. He next published a larger work, in two volumes; and lately he has sent out a small pamphlet called Multum in Parvo, which is supposed to be merely intended to advance the sale of his prepared horse medicines.

The end of the 18th century will ever be memorable in the history of farriery, for the establishment of an institution for the public teaching of the veterinary art in England, in imitation of those schools in France which we have already spoken.

The veterinary college owes its origin to M. St. Bel, a French gentleman, born at Lyons, and who was first junior assistant to the professor of the Royal Veterinary College there, and afterwards professor of anatomy at the veterinary college of Montpelier. This gentleman came to Britain in 1788, and published proposals for establishing a veterinary school in this kingdom. These proposals did not, at that time, meet with encouragement; but two years after, when M. St. Bel, driven from his native country by the horrors of the revolution, again visited England, his proposals were taken again into consideration by an agricultural society at Ockham in Hampshire. It had been the intention of this society, to send two young men to France, to study the veterinary art scientifically; but on hearing the proposals of M. St. Bel, they abandoned this idea, and appointed a committee to consult with him on the best means of forming a school for teaching the art in this kingdom. To this school they gave the name of the Veterinary College of London; and M. St. Bel was appointed the first professor.

The following gentlemen were appointed to the management of this institution.

His Grace the Duke of Northumberland, President.

Earl Grosvenor.

Earl Mortain.

Earl of Oxford.

Earl of Bath.

Sir George Baker, Bart.

Sir T. C. Bunbury, Bart. M. P.

Sir W. Fordyce.

John Hunter, Esq.

Vice Presid.

Sir John Ingleby, Bart. M. P.

Sir H. P. St John Mildmay, Bart.

G. M. Ascoagh, Esq.

Mr John Baynes.

Mr J. Burgess.

Rev. T. Burgess.

Rev. J. Cook.

Dr Adair Crawford.

John Grettion, Esq.

Dr Hamilton.

Mr Bennet.

Dr D. Mapleton.

Granville Penn, Esq.

Mr William Stone.

Richard Tophane, Esq.

Dr Williams.

J, Wollaston, Esq.

Messrs Bansom,

Moreland,

and Hammersly

Treasurers.

A house was taken, for the purpose of the institution, and pupils were admitted to board in the house.

The success of this institution, at first, by no means answered the expectations of the founders. It appears that M. St. Bel was prevented, by the embarrassed state of his circumstances, from executing the office of professor, with that ardour and activity which was necessary to the reputation of the infant school; and indeed it seems, from the specimen he has left us of his professional abilities, that these were not adequate to the office he had undertaken. He possessed considerable industry, and it is probable that, had he lived, he would have succeeded better than his outset had promised. But, in the year 1793, he was attacked with an illness, which proved fatal in about a fortnight.


We do not pretend to give our own opinion as to the merits of these works, as we have not seen them. But it is said that the Essay is merely an application of the proportions long ago laid down by Bourgelat in his Elements d'Hippiatique, to a particular case; and that many of his measurements are incorrect. Mr Blaine roundly taxes him with translating Lafosse to furnish matter for his Elements, and refers for proof of this to the description and treatment of quitter in St Bel's Elements, and Lafosse's Dictionaire d'Hippiatique.

Mr Blaine brings many other instances of M. St Bel's want of information and science, for which we must refer our readers to Mr Blaine's Outlines of the Veterinary art.

On the death of M. St Bel, there appears to have been a competition for the vacant chair, between two gentlemen, who were both well-qualified to fill it, Mr. Edward Coleman and Mr Morecroft. Both of these gentlemen had been bred to surgery and the former had acquired much reputation by an ingenious Essay on Suspended Respiration. The latter was lately returned from France, where he had been studying the veterinary art. We are not acquainted with the particulars.
Farriery.

As the great object of the veterinary establishment is to form a national school for the improvement of farriery, pupils paying twenty guineas are admitted into the college to learn the veterinary art. Lectures are given by the professor on the formation, economy, and diseases of horses, and other domestic animals; and most of the eminent medical teachers in London, with a liberality peculiar to themselves, have allowed the veterinary pupils to hear their lectures without any fee or reward. The veterinary students attend lectures on human anatomy and physiology, on the principles and practice of surgery, on the materia medica, and chemistry, and practice of physic.

The period requisite for obtaining a competent knowledge of the veterinary art, is regulated by the talents, previous information, and industry of the individual pupil. The students continue to attend the college until they are examined and approved by the medical committee. Those pupils who are duly qualified receive a diploma; but those who are found on examination to be deficient, are rejected. There are four general examinations in the year. When examined and approved, if no objections are made to their conduct, during their study at the veterinary college, they may be recommended to any regiment of cavalry, not already provided with a veterinary surgeon.

No fees of any kind are allowed by the college to any of the servants of subscribers; neither are the servants of the college permitted to receive any perquisites from the subscribers.

A veterinary college has also been established near Birmingham, and it is said that others are in contemplation in other parts of the empire.

The advantages that have already accrued from this establishment, to veterinary medicine in general, and to our national cavalry in particular, are very considerable. Almost every regiment of cavalry has been supplied from the college, with a veterinary surgeon; and many of these gentlemen have published works which, for the most part, do much credit to themselves and their academy.

In 1798, Mr. Coleman published the first volume, and in 1802, the second, of Observations on the Structure, Economy, and Diseases of the Foot of the Horse. This is a most useful and valuable work, but it is too splendid and costly, especially the second volume, for general circulation. The first volume contains a very full account of the method of shoeing practised at the veterinary college, of which we shall give an abstract hereafter.

About this period, appeared also a pamphlet by Mr. Coleman, On the Formation and Uses of the natural Frog of the Horse, with the description of an artificial Frog.

In 1801, appeared the first number of the Veterinary Transactions, published by order of the subscribers. This pamphlet commences with a long introduction, stating the object of the institution, the progress which it had made, and the causes that tended to prevent its complete success. These originate partly in the party opposition of the common farriers, who deem it their interest to do all in their power to circumvent the views of the subscribers; but they have still more been derived from the underhand malice of grooms and servants, with whose interest the institution, from the liberal manner in which
FARRIERY.

"It is much to be regretted that a gentleman who possesses so much ingenuity, should pass over subjects of such importance in such a light cursory manner. The description and treatment of some diseases occupy fewer lines than (to treat the subject in such a manner as to prove useful) they would require pages. The plates are elegant, and extremely well designed, particularly those that regard the proportions and paces of the horse; those that regard the internal structure and diseases are not so happy. The diction is very superior. As a cabinet work, it is most certainly elegant and interesting; but as a useful assistant to the art itself, it does not raise so high.

In the same year was published the first part of a Boardman dictionary of the veterinary art by Mr Thomas Boardman of the third regiment of dragoons. This work was intended to be completed in sixteen parts. The author seems to have availed himself of the latest and best information on the several articles that compose his work; and he has introduced into it a variety of subjects on the principles of general medicine.

One of the latest publications by pupils of the veterinary college, is a new system of farriery by Mr John Feron, veterinary surgeon to the thirteenth regiment of light dragoons. This work is printed in quarto, and affords a good instance to what extent a small quantity of matter may be carried by the modern typographical improvements of large type, broad margins, wide spaces, and frequent breaks. The work is indeed very elegant both in type and in plates. It also contains some useful information on the external structure of the horse, with a view to point out and illustrate what appeared to the author to be the most perfect form of a blood horse, with the blemishes and defects which appeared most likely to impede its velocity. This appears to be the best part of the work, and is well illustrated by the plates. The latter half of the book is occupied with the consideration of diseases; and here we are led, from the author's title page, to anticipate an account not only of the diseases of horses, but of the principal epidemics to which cattle, sheep, &c. are subject. These epidemics are however discussed in the course of seventeen pages; but we are given to understand that the author intends in a future publication to give a full comparative description, with the proper mode of treatment of every disease that affects domestic animals. Mr Feron's observations are rendered of less utility than they would otherwise have been, by the want of a table of contents prefixed to the work.

These are, we believe, the principal publications that have proceeded from the pupils of the veterinary college. A few other works on veterinary medicine still remain to be considered. In 1796, a very elegant Freeman work on horses was published by S. Freeman, Esq., whose character is given by Mr Blaine as an amateur in the manage, and a gentleman of fortune, learning, and great ingenuity. This publication consisted in a description of the structure and economy of the foot, accompanied with a set of plates highly finished in Skelton's best style. The subjects were dissected under the inspection of Mr Home, or an assistant; and except some slight errors in the ligaments of the navicular bone, appear very correct. This publication, for the elegance of its engravings, and the general spirit of the whole, will be long without a competitor. It recommends a very ingenious
FARRIERY.

Part I.

History.

About the same time Mr. John Lawrence published a small volume on horses, chiefly composed of extracts from St. Bel, Omer, Clarke, and Lord Pembroke; and in 1798, this gentleman brought forward his philosophical and practical treatise on horses, a work which is as remarkable for the good sense and humanity of the author, as for the whimsical eccentricity and angry irritability which he occasionally displays. The work embraces a great variety of subjects. It commences with an account of the principal former writers on farriery, in which high eulogies are paid to the memory of Gibson and Bracken, and a very violent attack is made on the ill-starred Mr. Taplin. The latter part of the work contains Mr. Lawrence's system of veterinary practice, which is chiefly taken from his favourite authors, as Mr. Lawrence seems at that time not to have had much practical experience. The work also contains some remarks on the diseases of horned cattle, on the treatment of cows, and on calving.

Mr. Lawrence has since, in 1805, published a separate treatise on cattle, in which the management of neat cattle, sheep, and swine, are handled in a masterly manner; and a much fuller account of diseases and their treatment are given than could be expected in his former treatise. We venture to recommend Mr. Lawrence's works as among the most instructive and most entertaining we have met with.

Some years ago there appeared a work on the description and treatment of the diseases of cattle, by a Mr. Downing, a professor of cattle medicine; which, though very expensive, sold very fast, and was very generally esteemed among farmers and graziers. We have not seen this work; but from the account of it that is given by Mr. Blaine in his outlines, it should seem that it abounds with important errors, and frequently incites a dangerous mode of practice. We cannot here enumerate the particular examples brought by Mr. Blaine in proof of his assertions, but we shall notice the most important of them under their proper heads.

Perhaps no part of veterinary medicine has been so little cultivated in this country, as that which considers the diseases of cattle. There is scarcely a work on this subject in the English language that is worth perusal. We cannot give a better idea of the little value that must be placed on these works than by the following extract from Mr. Lawrence's treatise on cattle.

"I have never yet seen any of these cattle-doctoring books, which appeared to me to be written bona fide. Well-intentioned ignorance, if not entitled to respect, is at least venial; but the slightest examination of most of these printed guardians of the health of cattle, by a person qualified to judge, will evince, that they are premeditated impostures, goods merely varnished up for sale. They have either the names of living men tacked to them, who, in the strongest probability, never did, or could write a line of them, or they are published in the name of some one of the mighty dead, among cow-doctors, who most unfortunately died at last, after sixty years practice. One would expect to find something original and valuable, from this long-continued and extensive practice; but the disappointment is always complete. The chief of that which we meet with, consists of transcriptions from former writers, interlarded with learned, medical, and physical dissertations, perhaps sound and good enough in their place, to which are loosely and clumsily tacked the most nonsensical and burlesque appendages by Mr. Editor. The medical forms in these books, are frequently the strangest jumble that imagination can conceive. Articles of a directly opposite nature and intention, are blended in one mass, which must inevitably act upon the animal system with an effect similar to that of two men pulling at opposite ends of a cord. We find balsam of Peru and Glauber's salts married together, the intent of which, no doubt must be, as a Suffolk farriar once described to the late Mr. Rush, "a kind of heater, and a kind of cooler." Indeed the far greater number of the prescritions wear rather the appearance of having been fabricated for the use of the book, than of having ever been used and approved in real practice. One truly laughable custom was introduced by the book published under the name of Topham's old one. It was to join to every prescription of note, a set character, conceived in the most high sounding terms of panegyric, at the same time, with a choice of words, at once so droll, and so gravely professional, with so formal an arrangement, that he must be a man far surpassing me in gravity, grave as I naturally am, who can peruse them without bursting into laughter. It must not be denied, however, that these books contain a number of useful hints, relative to the management and dieting of cattle, whether or not such may have originated with the doctor, or have been introduced by the editor. They may also, to a certain degree, be consulted as to the symptoms of diseases, although by no means to be implicitly relied on even in that respect. So far they have their use. With regard to doctoring, as it is termed, or prescribing medicines to cattle, they are most truly blind guides; and when, unfortunately, they are set to lead the blind, the fate of both parties may be very readily anticipated. I am speaking of books, which have been published within the last half century. As to the ancient veterinary writers, none of them, not even the celebrated Vegetius, were medical men, and their medical practice is utterly beneath modern notice. The same kind of books of our old English writers, consist of a strange medley of ancient practice with various sage additions of their own. A rational man cannot read over some of their prescriptions without amazement, nor a humane one without extreme pity for the harassed victim of such monstrous practice. By the way, they who, for interested purposes, fabricate pretended cattle medicines, of the effects of which they are careless or ignorant, commit an act of gross inhumanity and crime, in too probably adding to the load of sufferings of a helpless animal already tortured by disease. One of the greatest curiosities we meet with in the old books, is their grand universal specific. It seems as though they judged by a kind of compound arithmetic, that all medicines being conjounded and multiplied one into the other, the product must necessarily be the prevention or cure of all diseases.

Mr. Lawrence has excepted from the above general condemnation, a work lately published by Mr. Culley, of Northumberland; which, he says, ought to be in the hands of every farmer in Great Britain. He considers it as the only original work in our language, and, as containing in a small compass, a most valuable fund of information,
FARRIERY.

In the year 1800, Mr Morecroft, the rival candidate with Mr Coleman for the professorship of the veterinary college, published a small pamphlet containing a curious account of the various methods of shoeing horses, with incidental observations. This work displays considerable ingenuity. We shall notice Mr Morecroft's method of shoeing by and by.

In 1802, appeared Mr Blaine's Outlines of the Veterinary Art, or the Principles of Medicine as applied to a knowledge of the structure, functions, and economy of the horse, the ox, the sheep, and the dog; and to a more scientific and successful manner of treating their various diseases; in two volumes. Mr Blaine is well known as a practitioner of veterinary medicine, and as the advertiser of a specific against the distemper in dogs. In his Outlines, Mr Blaine, after giving a sketch of the history of medicine in general, enters on the history of veterinary medicine in particular, which he details at considerable length; not, however, without several errors, some of which we have already pointed out. He next proceeds to lay down very briefly what he conceives to be the proper means for the attainment of the veterinary art. Then follows a long section on a subject which we should scarcely expect to find in a work of this kind, the history of chemistry. The first part concludes with a sketch of comparative anatomy, in which the structure and economy of the ox, sheep, and dog are passed over much too lightly. The second part, which occupies the rest of the first volume, and one-half of the second, is taken up with a very minute account of the anatomy of the horse, with some observations on the economy and uses of the several parts. We consider this as the best part of Mr Blaine's book; but we think that he has made it unnecessarily prolix, as by carrying it to such an extent, he has not left room for a satisfactory account of diseases, which occupy the rest of the second volume. Here we cannot but consider the author as very defective. Neither the symptoms nor the treatment are given with that accuracy or precision, which the public had a right to expect from a practitioner of Mr Blaine's long experience. Many of the diseases of cattle, sheep, and especially of dogs, are passed over in a manner that is by no means satisfactory. The work is written in a very slovenly manner, and is everywhere filled with an ostentatious parade of medical phraseology that must render it nearly unintelligible to the generality of readers. In his receipts, Mr Blaine has for the most part adopted the new nomenclature, which, however we may approve in medical forms, we cannot think calculated for the meridian of farriers. We, however, by no means intend to inculcate that Mr Blaine's work is without merit: it certainly contains much valuable matter; but we must repeat that it is not what we should have expected from the advantages of information and experience which Mr Blaine appears to have possessed.

In the following year, Mr Blaine published a smaller work, which he calls a Domestic Treatise on the diseases of horses and dogs, which appears to be chiefly an abridgement of the Outlines, with a sort of advertisement for the sale of Mr Blaine's patent medicine.

In 1802 appeared a General View of the Agriculture of the county of Peebles, by the Rev. Charles Findlater, minister of the parish of Newlands, in that county. This work, though intended merely as a local survey of the state of agriculture and improvements in a small district, abounds with much excellent matter that must prove of general utility. Besides the observations which the ingenious author has made, on the general management of live stock, in the body of his work, he has added in one of his appendices some valuable information respecting some of the most important diseases of sheep, which are partly furnished from the communications of Dr Gillespie, late physician in Edinburgh, and Dr Coventry professor of agriculture in that university, and partly derived from his own experience.

In 1805 was published an elegant work on practical agriculture by Dr R. W. Dickson; the second volume of which contains much useful instruction respecting the choice, breeding, feeding, &c. of all the species of live stock employed on a farm; with a few very concise remarks on the diseases of each species. But as these are merely practical hints, they cannot be of much use, except to those who are already accustomed with the subject.

In the same year, the Rev. William Daniel performed a task, which, however ill suited to the character and avocation of a clergyman, must be highly grateful to every lover of the sports of the field, in the publication of his Rural Sports, which contains perhaps the most complete account of every thing relating to dogs that is to be found in the English language. Among other subjects connected with the management of this favourite companion of man, the reverend author takes occasion to treat pretty fully of his diseases. On this subject, Mr Daniel has not only collected matter from what he conceives to be the best sources, but, what is more useful, as well as more to be depended on, he has added much from his own observation and experience.

One of the latest works on the diseases of domestic animals, which we have seen, is An Enquiry into the Rot in Sheep, and other animals, by Dr Edward Harrison, a respectable physician of Horn castle, in Lincolnshire. Of this pamphlet we shall speak at large, when we come to treat of the disease, whose nature and causes it is intended to illustrate.

PART II. ON THE STRUCTURE OF THE HORSE.

In the sketch which we are to give of the anatomy of the horse, we must very slightly pass over such parts as appear not to be of immediate importance in the practice of farriery, in order to dwell more minutely on those organs that are of greater consequence. Thus we shall content ourselves with giving a tabular view of the bones and muscles; we shall entirely omit the brain and nerves; but we shall describe some of the other viscera, as the stomach, and the bowels, somewhat more minutely. We shall be most particular on the anatomy of the extremities, especially of the feet, as an accurate knowledge of these parts depend the principles of shoe-
Farriery.

1. Bones of the Head. A.

A, c, Half of the frontal bone, which in the horse is always composed of two pieces.

e, f, One of the two parietal bones.

g, h, i, k, The occipital bone, with a process at k, that is peculiar to the horse.

l, m, The temple, or temporal bone, of one side; n, the cheek-bone of one side.

o, One of the small bones within the socket of the eye, that answers to the os unguis in man.

p, p, Bones of the nose.

q, r, s, The upper jaw-bone.

t, The intermaxillary bone, or what is usually called by veterinary writers the inferior jaw-bone. This is not found in the human skeleton.

u, v, The posterior maxillary bone, which answers to the lower jaw-bone in man.

Bones of the Spine. B.

1, 2, 3, 4, 5, 6, 7. The seven vertebrae of the neck.

a, The atlas; b, the second vertebra, called in human anatomy, dentata; d, e, f, its transverse process; e, its oblique process; f, its ridge, answering for a spinous process; g, h, i, k, l, m, n, third cervical vertebra; g, its body; above the letter is the hole for the transmission of the vertebral arteries and veins; k, l, anterior and posterior transverse processes; i, a protuberance in the fore part of the body.

8—25. The eighteen vertebrae of the back; a, b, the body of each; k, l, the transverse processes that articulate with the ribs; c, the oblique processes; d, the spinous processes.

26 to 30. The five vertebrae of the loins, which have very long transverse processes, though these are not very easily distinguished in the figure, from its having a side view.

x, y, The sacrum bone, composed of five pieces, as in man.

From 31 to 43, the 13 bones composing the tail, answering to the os coccygis in man.

Bones of the Trunk. C.

a, b, x, y, The true ribs; 10 to 18 the false ribs;

a, the head articulating with the transverse process of the first dorsal vertebra; under is seen the lower branch of the head that unites with the seventh cervical and first dorsal vertebra; e, the end that unites with the sternum or breast-bone; a, b, c, d, e, f, g, the two hip-bones, answering to the os coxae in the human anatomy; a, b, c, the ilium, with its tuberosity a, forming the haeunch or hip; e, f, the ischium; g, g, the pubis with its juncture or symphysis between the two letters.

Bones of the Fore Extremity. D. D.

e, f, g, h, i, l, m, The scapula or blade-bone; e, its neck, below which is seen its glenoid cavity; f, anterispinatus fossa; h, its spine, which in the human ends in the processus acromion, but as there is no clavicle in the horse, it ends by a tuberosity; i, coracoid process; between m and i, the anterior costa; l, between this and e, posterior costa, between m and i, its base, and the line above it marks the extent and situation of the cartilage of the scapula; m, a, p, q, humerus, or arm; m, its neck, above which is seen its head; a, its anterior head, forming the point of the shoulder, as it is commonly called
Bones of the Hind Extremity. E. E. 435

A male horse has 40 teeth, when he has completed his full number. The mare has usually but 36. They are divided into three kinds; the cutting teeth or nippers; the cuspidate or tusks, and the molars or grinders. A knowledge of the horse's teeth and of the changes which they undergo, from their first appearance, is of the greatest consequence, as from it we derive the surest marks of the age of the horse; at least, till he is eight or nine years old.

Figs. 2, 3, 4, 5, 6, 7, and 8, show the appearance of the teeth from their first cutting to the age of eight years. Fig. 2, shows the appearance of the colt's teeth at the age of three weeks; fig. 3, that of the colt's teeth at three months. Fig. 4, shows the state of the teeth from three months to about four or five years, where a, a, are the pincers or nippers; b, b, what are called the separators; c, c, the corners, or the last of the front teeth at that age; d, d, the tusks. Fig. 5, shows the appearance of the teeth at the age of five years, and figs. 6, 7, and 8, their appearance at the respective ages of six, seven, and eight years.

The age of a horse is easily known by his mouth, till he comes eight, after which the usual marks wear out. A horse, like many other brute animals, has his teeth divided into three ranks; viz. his fore-teeth which are flat and smooth, his tusks, and his back-teeth. His back-teeth or jaw-teeth are called his grinders, being those by which a horse chews and grinds his provender, and are 24 in number, 12 above and 12 below; they are strong double teeth, with sharp edges; but when a horse grows old they wear much smoother.

The first that grows are his foal-teeth, which begin to appear a few months after he is foaled: they are 12 in number, six above and six below; and are easily distinguished from the teeth that come afterwards by their smallness and whiteness, not unlike the fore-teeth of a man.

When the colt is about two years and a half old he casts the four middlemost of his foal-teeth, viz. two above and two below; but some do not cast any of their foal-teeth till they are near three years old. The new teeth are easily distinguished from the foal-teeth, being much stronger, and always twice their size, and are called the incisors or gatherers, being those by which a horse nips off the grass when he is feeding abroad in the fields, or in the house gathers his hay from the rack. When a horse has got these four teeth complete, he is reckoned three years old.

When he is about three and a half, or in the spring before he is four years old, he casts four more of his foal-teeth, viz. two above and two below, one on each side the nippers or middle teeth: so that when you look into a horse's mouth, and see the two middle teeth full grown, and none of the foal-teeth except the common teeth remaining, you may conclude he is four that year about April or May. Some indeed are later colts, but that makes little alteration in the mouth.

The tusks appear near the same time with the four lower mentioned teeth, sometimes sooner than these, and sometimes not till after a horse is full four years old: they are curved like the tusks of other beasts; only in a young horse, they have a sharp edge all round the top and on both sides, the inside being somewhat grooved and flattish, inclined to a hollowness.

When a horse's tusks do not appear for some time after the foal teeth are cast and the new ones come in their room, it is generally owing to the foal-teeth having been pulled out before their time by the breeders or other dealers in horses, to make a colt of three years old appear like one of four, that he may be more saleable; for when any of the foal-teeth have been pulled out, the others soon come in their places; but the tusks having none that go before them, can never make their appearance till their proper time, viz. when a horse is about four or coming four; and, therefore, one of the surest marks to know a four years old horse is by his tusks, which are then very small and sharp on the top and edges.

When a horse comes five, or rather in the spring before he is five, the corner teeth begin to appear, and at first but just equal with the gums, being filled with flesh in the middle. The tusks are also by this time grown to a more distinct size, though not very large; they likewise continue rough and sharp on the top and edges. But the corner teeth are now most to be remarked; they differ from the middle teeth in being more fleshy on the inside, and the gums generally look rawish upon their first shooting out; whereas the others do not appear in this way. The middle teeth arrive at their full growth in less than three weeks; but the corner teeth grow leisurely, and are seldom much above the gums till a horse is full five: they differ also from the other fore-teeth, in this, that they somewhat resemble a shell; and thence are called the shell-teeth, because they encircle the flesh in the middle half-way round: and as they grow, the flesh within disappears, leaving a distinct hollowness and openness on the inside. When a horse is full five, these teeth are generally about the thickness of a crown-piece about the gums. From five to five.
and a half they will grow about a quarter of an inch high, or more; and when a horse is full six, they will be near half an inch, and in some large horses a full half inch, about the gums.

The corner teeth in the upper jaw fall out before those in the under, so that the upper corner teeth are seen before those below; on the contrary, the tushes in the under gums come on before those in the upper.

When a horse is full six years old, the hollowness on the inside begins visibly to fill up, and that which was at first fleshy, grows into a brownish spot, not unlike the eye of a dried garden bean, and continues so till he is seven; with this difference only, that the tooth is more filled up, and the mark or spot becomes faint, and of a lighter colour. At eight, the mark in most horses is quite worn out, though some retain the vestiges of it a long time; and those who have not had a good deal of experience, may sometimes be deceived by taking a horse of nine or ten years old for one of eight. It is at this time only, when a horse is past mark, that one can easily err in knowing the age of a horse; for what practices are used to make a very young horse or colt appear older than he is, by pulling out the foal-teeth before their time, may be discovered by feeling along the edges where the tushes grow, for they may be felt in the gums before the corner teeth are put forth; whereas, if the corner teeth come in some months before the tushes rise in the gums, we may reasonably suspect that the foal-teeth have been pulled out at three years old.

It will, perhaps, be needless to mention the tricks that are used to make a false mark in a horse's mouth, by hollowing the tooth with a graver, and burning a mark with a small hot iron; because those who are acquainted with the true marks, will easily discover the cheat by the size and colour of the teeth, by the roundness and bluntness of the tushes, by the colour of the false marks, which is generally blacker, and more impressed than the true mark, and by many other visible tokens, which denote the advanced age of a horse.

After the horse has passed his sixth year, and sometimes at seven, nothing certain can be known by the mouth. It must, however, be remembered, that some horses have but indifferent mouths when they are young, and soon lose their mark; others have their mouths good for a long time, their teeth being white, even, and regular, till they are 16 years old and upwards, together with many other marks of freshness and vigour; but when a horse comes to be very old, it may be discovered by several indications, the constant attendants of age, viz. his gums wear away insensibly, leaving his teeth long and naked at their roots. The bars of the mouth, which, in a young horse are always flashy, and form so many distinct ridges, are, in an old horse, lean, dry, and smooth, with little or no rising. The eye-pits in a young horse (except those come of old stallions) are generally filled up with flesh, look plump and smooth; whereas in an old horse, they are sunk and hollow, and make them look ghastly, and with a melancholy aspect. There are also other marks which discover a horse to be very old, viz. gray horses turn very white, and many of them all over fleas-bitten, except their joints. This, however, happens sometimes later and sometimes sooner, according to the variety of constitution.

Black horses are apt to grow gray over their eye-brows, and very often over a good part of their face, especially those who have a star or blaze fringed round with gray when they are young. All horses, when very old, sink more or less in their backs; and some horses, that are naturally long-backed, grow so hollow with age, that it is scarce possible to fit them with a saddle. Of this kind are several Spanish and Barbary horses, and many Danish and Flanders breed. The joints also grow stiff with old age, and their knees and hocks bend so, that they are apt to trip and stumble upon the least descent, though the way be smooth and noways rugged. After which they can be of little use to the owner.

### CHAP. II. Principal Muscles of the Horse.

We shall here only enumerate the muscles of the head, neck, and trunk, as being of less importance than those of the extremities. Of these latter we shall give a table, expressing, besides their usual names, their origin, insertion, and use.

#### Muscles of the Eyelids and Eye.

- Orbicular of the eyelids, \( a, b \), fig. 10.
- Elevator of the upper eyelid, \( a, b \), fig. 10.
- Elevator of the eye.
- Depressor of the eye.
- Adductor of the eye.
- Abductor of the eye.
- Trochlear muscle of the eye.
- Oblique major.
- Lesser oblique.
- Retractor of the eye.

#### Muscles of the Mouth and Jaws.

- Orbicular, \( f, g, i, \) fig. 9, q, fig. 10.
- Buccinator, \( r \), fig. 9, s, fig. 10.
- Elevator of the corner of the mouth, \( m, n \), fig. 10.
- Long nasal of the upper lip, \( l, m, n, o \), fig. 9.
- Masseter, \( p, q \), fig. 9.
- Ciliaries, \( u, w \), fig. 9.
- Temporal, \( 2, 3 \), fig. 9.
- Canine, \( 6, 7 \), fig. 9, \( m, n \), fig. 10.
- Depressor of the lower lip, \( g, 10 \), fig. 9, p, q, r, fig. 10.
- Elevator of the chin, \( 12 \), fig. 9.
- Dilatator of the nostrils, \( a, b, c, d, g, f \), fig. 9.

#### Muscles of the Neck.

- Stermo-mastoid; \( s, b, c \), fig. 9.
- Coraco-hyoides; \( f, f \), fig. 9, and \( a, b, c, d, e \), fig. 10.
- Stermo-hyoides; \( g, g \), fig. 9, \( f, g \), fig. 10.
- Stermo-thyroides; \( A, i, e \), fig. 10.
- Transversals; \( h, i \), fig. 9, \( A, B, C, D, E, F, G, H \), fig. 10.
- Tracheo-mastoid; \( M, O, P, Q, S \), fig. 10.
- Rectus internus major capitis; \( m, n \), fig. 9, and \( w, n, y \), fig. 10.
- Intertransversals minores coeli; \( a, g \), fig. 9.
**TABLE of the Muscles of the Extremities.**

<table>
<thead>
<tr>
<th>Name</th>
<th>Origin and Insertion</th>
<th>Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trapezius</td>
<td>From the 4th, 5th, and 6th cervical vertebrae; from the first 12 or 15 dorsal vertebrae; and from the cervical ligament, into the spine of the blade-bone.</td>
<td>To raise and draw backwards the blade-bone.</td>
</tr>
<tr>
<td>Lager rhomboid</td>
<td>From the 3rd, 4th, 5th, and 6th dorsal vertebrae, below the cartilage of the blade-bone, into the whole length of that cartilage.</td>
<td>To raise the blade-bone, and draw it a little forwards.</td>
</tr>
<tr>
<td>Rhomboideus major</td>
<td>From the ligament of the neck, at about the 2nd vertebra, into the cartilage of the blade-bone.</td>
<td>To draw the blade-bone forwards when the neck is fixed, or vice versa.</td>
</tr>
<tr>
<td>Lesser rhomboid</td>
<td>From the lateral part of the breast-bone, into the upper and fore-part of the blade-bone.</td>
<td>To draw the blade-bone downwards.</td>
</tr>
<tr>
<td>Levator scapulae</td>
<td>From the 4th and 5th vertebrae of the neck, into the upper and fore part of the blade-bone, above the pectoral.</td>
<td>To draw the blade-bone forwards.</td>
</tr>
<tr>
<td>Lesser pectoral</td>
<td>From the true ribs, and from the 6th and 7th cervical vertebrae, into the last cervical vertebrae.</td>
<td>To connect the blade-bone with the chest, and to draw it downwards, and sometimes to assist other muscles.</td>
</tr>
<tr>
<td>Depressor scapulae</td>
<td>From the ante-spinatus fossa, by two tendons, into the two tubercles of the head of the shoulder-bone.</td>
<td>To move the fore-leg outwards, and away from its fellow.</td>
</tr>
<tr>
<td>Triangular</td>
<td>From a fossa, so called, into the outer side of the shoulder-bone.</td>
<td>To prevent the ligament from being pinched between the bones.</td>
</tr>
<tr>
<td>Anterior serrated</td>
<td>From the coracoid process of the blade-bone, into the whole of the capsular ligament.</td>
<td>To draw the fore-leg backwards, and towards the chest.</td>
</tr>
<tr>
<td>Serratus anticus</td>
<td>From all the dorsal vertebrae connected with the muscles of the back, and with the fleshy pannicule, into the inner tuberosity of the shoulder-bone, below the blade-bone.</td>
<td>To raise the arm, and when that is fixed, to draw the head and neck downwards.</td>
</tr>
<tr>
<td>Ante-spinatus</td>
<td>From the tuberosity of the temporal bone, and from the four, first cervical vertebrae, into the upper and outward part of the arm.</td>
<td>To move the arm towards its fellow.</td>
</tr>
<tr>
<td>Post-spinatus</td>
<td>From the hollow of the blade-bone, into the inner side of the shoulder-bone.</td>
<td>Larger.</td>
</tr>
</tbody>
</table>
FA R R I E R Y.

From the side of the breast-bone, and the cartilages of the six last true ribs, into the inner side of the shoulder-bone.

From the inner side of the shoulder-bone, into the inner and lower part of the shoulder-bone, and connected by expansion with the radius.

From the coracoid process of the blade-bone into the lower and back part of the shoulder-bone.

From the upper part of the posterior edge of the blade-bone, into the inside of the shoulder-bone.

From the posterior edge of the blade-bone into the outer tuberosity of the shoulder-bone.

Below the last muscle, between the last and the subscapula.

From the tuberosity of the blade-bone, above the glenoid cavity, into the inner tuberosity of the radius.

From the neck of the shoulder-bone into the inner tuberosity of the radius.

From the posterior edge of the blade-bone into the olecranon, or elbow.

From the whole length of the posterior edge of the blade-bone into the olecranon.

Below the inner side of the head of the shoulder-bone, into the inner and upper part of the olecranon.

From the neck and some part of the shoulder-bone, into the olecranon.

From the outer condyle, and tuberosity of the shoulder-bone, into the anterior tuberosity of the canon-bone.

From the side of the radius downwards from the middle into the small inner metacarpal bone.

From the outer condyle of the shoulder-bone, at its back part, into the pisiform, and small outer metacarpal bones.

From the inner condyle of the shoulder-bone, into the back past of the canon.

From the inner condyle of the shoulder-bone, at its back part, into the pisiform bone.

From the lower and outer head of the shoulder-bone, and upper part of the radius, into the anterior protuberance of the coffin-bone.

From the outer head of the radius, passing over the knee through an annular ligament, into the upper and back part of the bone down to the foot.

From the inner condyle of the shoulder-bone passing behind the knee, into the arch of the coffin-bone.

From the olecranon and the shoulder-bone at the back part, into the arch of the coffin-bone.

To draw the fore-leg downwards and backwards.

To draw the fore-legs together, and to assist the last in respiration, when the fore-leg is fixed.

To draw the arm forwards and outwards.

When the blade-bone is fixed, to draw the fore-leg upwards and inwards, and vice versa.

To draw the shoulder-bone upwards and outwards.

To turn the arm.

To bend the arm.

To turn the fore-arm, and assist the former in bending it.

To bind down the muscles, and assist in extending the arm.

To extend the arm.

To oppose the oblique flexor.

To assist in extending the arm.

To extend the canon.

To assist the former, and turn the foot outwards.

To bend the canon.

To assist the former.

To bend the carpus, and extricate the ligament.

To extend the foot.

To assist the former.

To bend the foot.

To assist the former.
2. Muscles of the Hind Leg or Foot.

<table>
<thead>
<tr>
<th>Name, &amp;c.</th>
<th>Origin and Insertion</th>
<th>Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Posterior gluteus. m, n, o, p, fig. 9.</td>
<td>From the interior and posterior angles of the ilium, into the little trochanter of the thigh-bone.</td>
<td>To extend the thigh, and draw it outwards.</td>
</tr>
<tr>
<td>Tensor vaginae femoris.</td>
<td>From the anterior angle of the ilium, into a tendinous expansion over the thigh.</td>
<td>To stretch the fascia of the thigh, and draw it inwards.</td>
</tr>
<tr>
<td>Fascia lata. a, b, c, d, e, f, g, h, fig. 9.</td>
<td>From the tuberosity and lower angle of the ischium, into the fore part of the thigh-bone, and into the tibia.</td>
<td>To draw the thigh outwards.</td>
</tr>
<tr>
<td>Semimembranosus. 17, 18, 19, fig. 9.</td>
<td>From the tuberosity of the ischium, and beginning of the tail, into the inner side of the spine of the tibia.</td>
<td>To bend the leg, and draw it inwards.</td>
</tr>
<tr>
<td>Biceps flexor cruris. 3, 4, 5 — 17, fig. 9.</td>
<td>Like the former, into the inner condyle of the thigh-bone and upper end of the tibia.</td>
<td>To bend the leg.</td>
</tr>
<tr>
<td>Posterior flexor of the leg.</td>
<td>From the vertebrae of the loins, and from the sacrum, into the great trochanter of the thigh-bone.</td>
<td>To extend the thigh, and draw it backwards and outwards.</td>
</tr>
<tr>
<td>The large gluteus. q, Q, r, s, t, fig. 9.</td>
<td>Rises from the brim of the acetabulum, into the outer side of the thigh-bone.</td>
<td>To extricate the capsular ligament.</td>
</tr>
<tr>
<td>Capsular. a, b, c, fig. 12.</td>
<td>From the pubis and ischium, into the fascia of the thigh and the inner side of the head of the tibia.</td>
<td>To make one thigh approach its fellow.</td>
</tr>
<tr>
<td>Gracilis. e, f, fig. 9. w, w, fig. 11.</td>
<td>From the inner edge of the brim of the pelvis, into the inner head of the tibia.</td>
<td>To assist the former.</td>
</tr>
<tr>
<td>Sartorius.</td>
<td>From the three last dorsal, and four first lumbar vertebrae, and from the two last false ribs, into the inner trochanter of the thigh-bone.</td>
<td>To bend the thigh.</td>
</tr>
<tr>
<td>Adductor longus. p, q, r, s, t, fig. 21. w, fig. 12.</td>
<td>From the inner surface of the ilium, into the lesser trochanter of the thigh-bone.</td>
<td>To assist the former.</td>
</tr>
<tr>
<td>Large psoas.</td>
<td>From the inner surface of the ilium, into the lesser trochanter of the thigh-bone.</td>
<td>To assist the former.</td>
</tr>
<tr>
<td>Largier internal iliacs. e, fig. 10.</td>
<td>From the symphysis pubis, inserted below the last.</td>
<td>To bend the thigh.</td>
</tr>
<tr>
<td>Lesser internal iliac.</td>
<td>From the inner edge of the pubis, from the anterior branch of the ischium, and from its tuberosity, into the back of the thigh-bone, the upper and inner part of the tibia, and the tuberosity of the thigh-bone.</td>
<td>To draw one thigh towards its fellow.</td>
</tr>
<tr>
<td>Pectineus. e, fig. 12.</td>
<td>From the great trochanter, and the outer side of the thigh-bone, into the side of the knee-pan.</td>
<td>To extend the leg.</td>
</tr>
<tr>
<td>Triceps adductor femoris.</td>
<td>From the ilium above the socket, and from the upper part of the thigh-bone, into the upper part of the knee-pan.</td>
<td>To extend the leg strongly.</td>
</tr>
<tr>
<td>Vastus externus. s, o, p, r, s, t, fig. 10.</td>
<td>From the neck, inner tuberosity, and whole inner part of the thigh-bone, into the inner side of the knee-pan.</td>
<td>To assist the vastus externus, and last muscle.</td>
</tr>
<tr>
<td>Straight muscle of the leg.</td>
<td>From the fore part of the thigh-bone, into the inner side of the knee-pan.</td>
<td>Ditto.</td>
</tr>
<tr>
<td>Rectus cruris. g, h, i, k, fig. 10.</td>
<td>From the inner part of the ischium, into the hollow of the great trochanter.</td>
<td>To roll the thigh-bone.</td>
</tr>
<tr>
<td>Vastus internus. b, c, fig. 10.</td>
<td>From the lower part of the tuberosity of the ischium, into the thigh-bone below the great trochanter.</td>
<td>Assists the former.</td>
</tr>
<tr>
<td>Crucial. 1, 2, 3, 4, 5, 6, fig. 11.</td>
<td>From the ischium and pubis, one above the other, inserted into the thigh with the last.</td>
<td>Oppose the last.</td>
</tr>
</tbody>
</table>

Inner
FARRIERY.

**Origin and Insertion.**

- From the edge of the thyroid hole, into the thigh with the preceding.
- From the sacrum within the pelvis, inserted as the last.
- From the external condyle of the thigh bone, into the tibia.
- From the fore part of the external condyle of the thigh-bone, into both canons by two portions.
- From each condyle of the thigh-bone, into the hook.
- From the upper part of the spine of the tibia, inserted as the former.
- From the hollow between the condyles of the thigh-bone, into each side of the pastern-bone.
- From the back and outer part of the head of the tibia, into the arch of the coffin-bone.
- From the back part of the head of the tibia, inserted with the preceding.
- From the tendon of the extensor of the canon, in the anterior protuberance of the coffin-bone.
- From the outer head of the thigh-bone, and from the head of the fibula, inserted with the last.
- From the tendon of the long extensor to the lateral extensor.

- To assist the gemini.
- Ditto.
- To draw the leg inwards.
- To bend the leg strongly.
- To extend the canon.
- To bend the pastern and foot.
- To assist the foot.
- To bend the foot.
- To assist the former.
- To extend the foot.
- Ditto.
- To draw the tendons of the long and lateral extensors together.

**InThe Hind Extremity.**

- Vena saphena; 21, 6g. 9.
- Capsular ligament of the knee; 3, 4, 6g. 10.
- Sciatic artery; 6g. 11.
- Gluteal artery; 35, 35, 6g. 11.
- Crural vein; 38, 6g. 11.
- Popliteal artery; 39, 52, 6g. 11.
- vein; 35, 6g. 11.
- Crural nerve; 35, 6g. 12.

**Chap. III. Of the Stomach and Bowels.**

In the horse there is but one stomach, which is very structure small in proportion to his general bulk; and is partly of the membranous, partly cuticular, and partly muscular. It is situated immediately behind the diaphragm, in the left hypochondrium, and in part of the epigastrium, with its expetent orifice extending across the spine to the right, which is the reason that lying on that side is judged more wholesome than sleeping on the left. It has two surfaces, which may be called its sides, though one is posterior, and the other anterior; and two extremities, a large and a small; the superior surface of which receives the gullet, and is called its cardiac orifice; while the former ends in the duodenum, and is termed the pyloric orifice; this extremity, when the stomach is distended, is the most posterior of the two. The hollow part situated superiorly, only forms its lesser curvature, as the lower portion forms its great curvature.

Thus when the stomach is moderately distended, it lies in an obliquely transverse direction, with its great extremity a little forwards, and its two orifices superi-
or, but the cardiac the most so, with the lesser extremity rather posterior to the other, and the great curvature inferior. It is evident that the situation of the stomach must vary much with its distension: the foregoing description answers to it when moderately distended only; but where it is very much filled, the left extremity will press upon the diaphragm, and the right will be carried more posteriorly. In oxen and sheep, where the first stomach is large, it is found, when distended, to have its left extremity carried quite into the left iliac region; in which part it is usually punctured, when they are bled; but such an idea of the stomach of the horse would prove very erroneous; for this animal has a very small one, and therefore its situation can never be such.

From a distended stomach pressing upon the diaphragm, we are at no loss to understand, why breathing is impeded after a full meal, when a horse appears to labour for breath; for he is forced to use the intercostal muscles, and the muscles of the shoulder and fore extremities, to open the chest, the posterior enlargement being prevented from the diaphragm being fixed by the pressure of the stomach; hence we see the great improwery of galloping horses after watering, to warm it in their bellies, as it is foolishly termed. Horses, when grazing, if they drink, are never observed to do this; if it was necessary, nature would dictate it to them. How hurtful it is likewise to ride hard, after a horse has been fully fed, is equally evinced. The stomach has externally a covering from the peritoneum, which adheres closely to it, by means of its cellular portion; and which portion is dipping in between the muscular fibres. Its middle portion is made up of muscular fibres, which are more numerous in this animal, than in the ruminant; making this kind of stomach a medium between the membranous one of some animals, and the true muscular stomach of others. The direction of these fibres is various; but they may principally be referred to a longitudinal and a transverse order, though neither of them are regularly so, and are intermixed with others, whose direction is very oblique, and interspersed with each other. The longitudinal fibres are in the most external of the two, and appears a continuation of the external plane of the oesophagus, with some original fibres, which spread over the lesser curvature, being carried obliquely round, and likewise over the great extremity, forming themselves into a kind of vortex, whose centre is in the middle of that extremity. The inner plane is by much the larger, and is not quite circular, but slightly oblique, crossing the obliquity of the longitudinal plane. This circular plane is very thick and strong round the cardia, or that extremity into which the oesophagus terminates. They are here so very thick as to form a true sphincter; and to this it is in some measure owing, that a horse cannot vomit; for when the circular and longitudinal fibres are acting from the pylorus to the cardia, by any irritation that reverses the usual motion, producing an effort to vomit, the circular and longitudinal fibres of the cardia being infinitely stronger and more numerous, are contracting this orifice (especially the circular), as the others are contracting the other parts; for as the muscular fibres exist equally throughout the stomach, by which the motions are effected, it cannot be simply from the existence of the circular covering to

Vol. VIII. Part II.
Anatomy of the Horse.

in a small degree upon the food, and perform a slight constricting action on it. This ciliated coat is spread over the first portion of the stomach, taking in all the great extremity, and forming between a third and half of its extent. It is formed into folds at the cardia in the same manner as at the internal part of the oesophagus; but as soon as it has passed this orifice, these folds take an irregular direction, but are less than those formed on the villous surface.

The villous or sensitive portion of the stomach, though it occupies more of the length of the stomach, yet perhaps in real extent is little more than half of its surface. It unites with it connected to the ciliated. Its external surface is firm, and appears as it were a distinct portion, but is only dense cellular substance, which has given rise to the description of four tenia to the stomach. The tenia villosa is so called from its resemblance to the pile of velvet; its fine villi are probably the extreme fine ends of vessels infiltrating the gastric tissue. The villous coat being much larger than the muscular, is thrown into folds which are more considerable than those of the ciliated coat.

These are largest at the portion toward the great extremity, and are irregularly waving; towards the duodenum they become less, and when at the pylorus they form a fold that makes a kind of valve to this part of the stomach, preventing the return of the food, and its too speedy passage out. The folds not only hinder the too speedy passage of the food, but by this means apply the gastric juice more certainly to all the parts; but the principal end is to increase the secreting surface, which is here more extensive than those of the human.

The remainder of the alimentary canal is continued from the lower orifice of the stomach, to the anus, or end of the passage, forming a long canal of different dimensions, called intestines. They are usually divided into small and large. In some animals they hardly merit this distinction, those being but little different in point of size; but in the horse, the proportion is very different; the small intestines being not much larger than the human, but the large of an immense bulk. This canal is connected through its whole extent to membrane productions of the peritoneum, especially to those called mesenteric and mesocolon. The whole canal varies in point of length in different subjects; but is seldom less than 24 yards, and often more. The intestines are contained within a prolongation of the peritoneum, which arises in most instances from the mesentery: the two folds of this membrane separate and surround the intestines, forming their external coat. The next coat is muscular, and formed of two layers of fibres, a longitudinal and a circular; the latter are in greater proportion, and by the contraction of these the vermicular motion, called peristaltic, is performed, from the longitudinal fibres slightly shortening them, and the circular diminishing their size. Within this muscular coat there is a quantity of cellular membrane rather more dense than in some other parts; and this used to be regarded as a coat, and was called the nervus, but is only a layer of cellular membrane. The third and inner coat of the intestines is the villous, which is very vascular and sensible. There are no considerable folds of the inner skin of the intestines, as in the human. In this animal these are rendered unnecessary by the great length of his intestines, and the slow passage of the aliment through them by this length and his position.

The first portion of the bowels, which answers to the duodenum in man, though in the horse it is nearly one inch in length, is attached to the stomach, having the pyloric orifice ending in it; its course in the horse is rather different from that in the human, and by this it acquires a more complete covering from the peritoneum. It bends oblique and pendulous, being attached to the concave surface of the liver, where making a turn, it is fixed to the vertebrae; it then takes the name of jejunum. It appears rather longer in circumference than the other small intestines, and is remarkable for having the pancreatic and biliary ducts penetrating it, sometimes entering it obliquely close together, and sometimes at a distance from each other.

The jejunum and ilium differ very little from the same bowels in the human species.

The great intestines are very properly so called in the horse; and as they have very little resemblance to the human large intestines, they require a particular description.

The cecum is situated in the back part of the belly, and is a very large canal, which is entered simply by the ilium. The fore part of this canal projects inward, or towards the cord of the colon; but the back part terminates in a small opening called a blind end. The cecum and its appendages form a very large mass, especially in the horse, but the lower part is the same bowels, while the upper is more constricted. The cecum is connected with the colon by its mesentery, especially in the horse, and the appendages are formed by the formation of villi, and are disposed in a manner like the appendix vermiformis, but terminate by a simple blind end.

Through the peritoneal covering are four muscular longitudinal bands, extending from the extremity along the muscular coat, and dividing it into four longitudinal portions. One or two of these are usually covered with fat, and are not so regularly longitudinal as the others. The internal membrane is folded up between the longitudinal bands, and by intersecting them forms numerous cavities called the cells.

On the slightest inspection we see a great peculiarity in the form of the cecum of the horse; and in an accurate view, are struck with the importance of the structure to this animal, and are led to consider the cecum as little less than a second stomach. This is in the case; for the food coming in a masticated mass into the small intestines, is mixed in the cecum, with its bile and pancreatic juice, and here undergoes a further change, to which the structure of the cecum is highly favourable, as it is fitted to retain the mass for a considerable time without it, and to circulate it through all its parts. It has two blind ends, one forming its base, and near this enters the ilium; the other forming its end, and extending up towards the diaphragm. From one part of the base the colon commences by a very contracted portion, for the purpose of preventing the escape of the contents of the ilium, till they have passed through the cecum. In many animals the cecum is a very small part; in some it has two or more appendages; in others it is almost entirely wanting.
The bones which compose the foot of the horse are six in number, considering the foot as commencing at the fetlock joint. Of these six bones two are included within the hoof, viz. the coffin-bone, and the navicular-bone; and four are situated above the hoof, viz. the large pastern-bone, the small pastern-bone, and the two sesamoid bones.

We shall begin from above, with the large pastern-bone, as this contributes to form what is called the large pastern joint.

The large pastern-bone, (1, fig. 13, 14, and 15.) is of an oblong cylindrical form, and, as is the case with all such bones, is smaller in the middle than at either extremity. It articulates above with the lower head of the canon-bone, and below with the upper head of the small pastern-bone. At its upper extremity there are three depressions, one on each side, large and superficial (a, e, fig. 15.) to receive the outer and inner convexity of the lower head of the canon-bone, and one in the middle, b, for receiving the middle part of convexity of the same bone. The fore part of this bone is slightly rounded, and rough towards its upper extremity, as at d, d, for the firmer attachment of ligaments. Behind, at its back part, it is flatter; and here there is a rough depression (C, fig. 14.) also for the attachment of a ligament that is deep seated, and is fixed to the two sesamoid bones. At the lower extremity the large pastern-bone is convex on each side (D, E, fig. 14.) for entering into two concavities of the small pastern-bone; and there is a depression (f, fig. 13.) for the attachment of a tendon. At the lower extremity there is also a roughness on each side at e, for the insertion of ligaments. Both extremities are covered with very smooth elastic gristle, which is kept constantly moist by the synovia or joint oil.

At the upper end of the large pastern-bone, towards the sesamoid the back part, are placed the two sesamoid bones, A, A. (fig. 14.) These are of an irregular wedge-like form, and are covered with cartilage, articulating both with the canon-bone, and on the back part they are very smooth to admit of a tendon readily gliding over them. The upper edges of these bones on each side have a rough irregular surface, into which is inserted a strong ligament that comes from the upper and back parts of the canon-bone, is fastened separately to each of the sesamoid bones, from which it proceeds downwards and obliquely forward to be inserted into the tendon of the large extensor muscles, (see a a, a, fig. 16.) a little below the large pastern-joint. These sesamoid bones are of considerable use in the mechanism of the large pastern-joint. "In consequence of their forming the back part of the large pastern-joint, and articulating with the lower and posterior part of the canon, they contribute very essentially, by always receding whenever the foot comes in contact with the ground, to act as a spring to the animal, and to prevent concussion. All the weight received by the upper head of the large pastern-bone is conveyed to bones below; but a considerable portion of the burden is received by the sesamoid bones. While the animal is at rest, and also during motion, these bones sustain part of the weight; and where the pastern-bones are long and oblique, the sesamoids often receive so much of the weight as to put the ligaments violently on the stretch, and occasion lameness."

3 K 2

The anatomy of the horse's foot.
FARriery.

Part II.

Anatomy of the Horse.

The small pastern-bone (2, fig. 13, 14, 15.) is about half the length of the large one, and is as broad as it is long. Besides the two concave depressions, (h, h, fig. 13.) mentioned before, there is a ridge between them, r, that enters a corresponding depression, q, in the lower head of the large pastern-bone. The small pastern-bone has at the back and upper part (F, fig. 14.) a slight projection, for the insertion of a long ligament, that comes from the sesamoid bones. The lower articulating surface is more extensive than the upper, as it is connected with the upper surface of two considerable bones, viz., the navicular and coffin-bone. It is of great consequence to understand the mechanism of the joints that are formed by this connection, as it is on this part that the principal stress of the animal falls. The union of the small pastern-bone with the navicular and coffin-bones, forming what is called the coffin-joint, is one of the principal methods provided by nature to prevent concussion.

Navicular-bone.

The navicular-bone (3, fig. 13, 14, 15.) is connected above with the back part of the small pastern-bone, and the lower edge of this bone is attached by a large ligament to the back part of the coffin-bone. The navicular-bone is slightly concave, to receive the back part of the lower head of the small pastern-bone. The upper edge of the navicular-bone behind is rough (g, fig. 14.) and thick, for the attachment of the upper ligament; and the lower edge of the navicular-bone receives at the back part a strong flat ligament from the coffin-bone, immediately above the insertion of the flexor tendon. The lower surface of the navicular-bone is covered by cartilage, and has a small ridge in its centre, (f, fig. 13.) to be received into a corresponding depression in the long flexor-tendon. This bone may be considered as forming two distinct joints, one of which is composed by the connection of one part of the bone with the tendon of the flexor-muscle, and the other is formed by the connection of another surface of the navicular-bone.

The whole weight of the animal, supported by the small pastern-bone, is thrown upon the coffin and navicular bones. Of this weight the coffin-bone receives the greater share; but the navicular-bone receives a considerable portion of it, though this bone does not contribute to prevent concussion so much as Mr Freeman has endeavoured to prove. The navicular-bone, when the hoof touches the ground, descends a little, and thus prevents that concussion which the horse's body would have received if this bone had been immovably fixed; and when the hoof is again raised from the ground, the elasticity of the parts below the navicular-bone lifts up this bone into its former position, thus acting as a spring in facilitating the motion of the animal. As the weight supported by the navicular-bone of the hind feet is less than that supported by the same bone of the fore feet, their descent in the former is less than in the latter. The organs connected with the navicular-bone of the hind feet are also less subject to disease.

Coffin-bone.

The coffin-bone (4, fig. 13, 14, 15.) is so named from its being concealed, or as it were buried within the hoof. It is also sometimes called the foot-bone. On its fore part it is rounded, having very nearly the shape of the external hoof. Its upper surface is slightly hollowed (m, m, fig. 13.) to receive the lower end of the small pastern-bone, with the fore part of which it articulates, as it does behind with the fore edge of the navicular-bone. At the back part the coffin-bone ends in two processes on each side, the upper of which are tipped with cartilage. At the upper part of the front of the coffin-bone there is a small protuberance, (w, fig. 13.) extending upwards above the joint, and serving for the insertion of the tendon of the muscles that extend the foot. Below this the coffin-bone is extremely porous, for the passage of nerves and blood-vessels; and towards the lower part in particular there are about 13 holes, for the transmission of considerable arteries, which go to supply the dense sole. At the heels and quarters the coffin-bone is still more porous, and is supplied with a greater number of arteries, but these are proportionately smaller. The lower surface of the heels of this bone is also very porous, where it unites with the dense sole, but the rest of the lower surface is generally smooth. There are here two hollow surfaces, which receive two corresponding rounded parts of the dense sole. They are unequal, the foremost being the larger. Into the hollow on the back part, the tendon of the flexor-muscle is inserted. (A, fig. 16.)

There are seven ligaments belonging to the coffin-ligament joint, of which there are three pairs, and one single. The first pair of ligaments take their origin from the heels of the coffin-bone on each side, and pass obliquely upwards as high as the middle, to which they are attached, and at which part of the small pastern-bone (B, fig. 16.) they are blended with the fibres of the lateral ligaments of the small pastern-joint. The second pair of ligaments on each side arise from the edge of the coffin-bone, near the heels, and pass obliquely forward to be inserted into the middle of the small pastern-bone (C, fig. 16.) near the attachment of the extensor-tendon. The third pair take their origin from the lateral edges of the anterior process of the coffin-bone, and are inserted into the edges of the cartilages. The use of these ligaments is to unite the cartilages more firmly to the coffin-bone. The extensor-tendon being inserted into the upper edge of the anterior process of the coffin-bone, prevents the necessity of a ligament at this part. The single ligament of the coffin-bone is connected with the posterior and inferior concave surface of the coffin-bone, immediately above the insertion of the flexor-tendon, and also with the lower edge of the navicular-bone. Besides this ligament there is another attached to the whole of the upper and back part of the navicular-bone, by which means that bone is enabled to support a greater share of the weight that rests upon it. By means of these ligaments this important joint is rendered very strong, while by the elasticity of the cartilages, and the constant supply of lubricating fluid within the joint, all the motions of the animal are rendered safe and easy.

The small pastern-joint is also well secured by means of ligaments, and by the sheath of the flexor-tendon. There are also ligaments proceeding from the sesamoid bones, which enter the sheath of the flexor-tendon, and are attached to the small pastern-joint (a, a, a, fig. 16.).

"The weight which the sesamoid bones, by means of ligaments sustain, is very different in different horses; and bears no proportion to the bulk and weight of the animal. The pastern-joints of large horses destined for slow motion, are constructed very differently from those of..."
of blood horses. Their pastern bones are short, and the joints nearly straight; but thorough-bred horses of light weight have long and very oblique pastern joints; and, as in proportion to the obliquity of the large pasterns, or fetlock joint, the cannon conveys more of the weight to the sesamoid bones, the ligaments that support the sesamoids are necessarily put into motion, and more on the stretch, as the weight presses down the lower and back part of the cannon on the sesamoid bones. Short pastern joints are as much adapted to the frame of heavy horses as longer joints are to that of lighter horses. The ligaments that support the sesamoids above also contribute to assist the flexor muscles and tendons in preserving when at rest, and in motion, the large pastern joint in its proper place.*

Before we proceed in describing the structure of the foot, it will be proper to shew how the hoof is formed, and how it is connected with the parts within.

The hoof of the horse forms a sort of organized shoe, which is adapted to the foot with the greatest nicety; so that every part of the cavity is completely filled, without the foot's being subjected to any unequal pressure.

A correct knowledge of the natural form and structure of this part of the horse's foot, and of the deformities produced in it by improper treatment, is of the utmost importance; as on this must depend the most advantageous method of shoeing, and the only rational means of correcting the unnatural deviations. It will be obvious, in order to form a just idea of the original shape of the hoof, we must examine it before any shoe has been applied to it; for, unless this shoe has been so constructed and fitted to the foot, as to preserve unaltered the original form of the hoof, this will be so changed, that we cannot recognise from it what was the original shape. That the methods of shoeing usually employed are calculated rather to deform the hoof, than to preserve its original figure, will appear presently.

A vertical section of the hoof shows it to be nearly conical; the broadest part of the cone being next the ground. This inferior surface, in a hoof that has not been shod, especially in the fore foot, appears nearly circular; or the diameter, from side to side, is nearly equal to the diameter from toe to heel (see fig. 17).

The hoof is composed of a horny substance that is entirely without sensation. It is divided into crust, sole, frog, and bars.

The crust surrounds the foot on the fore part, and on the sides, like a wall (A, A, fig. 17). It grows obliquely downwards from the coronet, and becomes broader as it approaches the ground. It is thicker at the toe than at the quarter; and the outer quarter is thicker than the inner. On the outside it is smooth and rounded, but within hollow and laminated (B, B, fig. 17,) to unite with the coffin-bone. The crust is the only part into which nails can with safety be driven in shoeing.

The horny sole (B, B, fig. 17,) unites with the lower part of the crust, and is situated below the coffin-bone; but between it and the coffin-bone, there is a vascular substance, to be presently described, called the sensible sole, from the blood-vessels of which the horny sole is formed. On the outside next the ground, the horny sole is hollow, but rounded within next the coffin-bone. The

horsy sole protects the sensible sole from injury, and in the horse's motions it embraces the ground, acting as a stop. When the laminated substances of the hoof lengthen, the horny sole descends, and thus assists in preventing concussion.

The bars, or binders (CC, fig. 17,) are two horny bars, substances placed between the sole and the frog, and forming at the heels a close solid union with the crust. The small part of the bars called the toe, sometimes reaches almost as far as the toe of the frog. Within the frog, the bars are laminated like the inner part of the crust, and are closely united to the horny sole. The bars on the outside keep the horse's foot extended, and within, they tend to prevent the separation of the sensible sole from the horny sole. In the natural state of the horse, there is a considerable cavity between the bars and the frog on each side.

The frog (DD, fig. 17,) is that hard rounded pro-frog,
tubercle, which we observe in the middle of the lower part of the hoof, pointed towards the toes, and expanded towards the heel like a wedge. In the middle of this broad part, there is a fissure (E, fig. 17). The external frog is united within the hoof to a narrow sub stance of a similar shape, but of a more delicate nature, and possessing sensation, and therefore called the sensible frog. This substance is connected above with the navicular bone, towards the back part; and at the extremity of the heels, it is united with cartilages on each side. The toe of the sensible frog is united to the coffin-bone, but by far the greater part is behind this bone. The back part of the frogs being united with elastic and moveable substances, admit of considerable motion, the frog rising when the hoof touches the ground, and descending when the foot is raised. By the ascent of the frog, the heels are prevented from contracting, and the cartilages are expanded, so as to afford the horse a considerable spring, whilst the form of this part fits it for embracing the ground, and thus prevents the horse from slipping. The convex form of the frog clearly shows that it was always intended to touch the ground, and experience has fully proved, that, unless this contact takes place, the healthy state of this organ cannot be preserved. It has been supposed that the frog is intended to defend the principal tendon or back sinew; but Mr Coleman has shown that this is a mistake.

The weight of the horse is chiefly supported by the weight of crust, and not by the sole or frog; for when these parts the horse have been removed, or by being diseased, become soft and supponed by and fungous, and thus incapable of resistance, it is found that the sole and the crust is still competent to bear the whole of the weight. If the sole and frog really supported the weight, it is evident that when these parts are removed or diseased, the foot would slip through the crust.

The union of the sensible frog with the horny frog, importance and the connection thus formed between the sides of the frog's sensible frog and the lower cartilages, effectually prevents dislocation. When the horny frog touches the ground, both that and the sensible frog ascend; but when by any means the horny frog is prevented from pressing on the ground, its proper functions are suspended. The cartilages partake of the motion of the frog; and, in proportion as this receives pressure, they recede from each other, and allow the sensible frog to ascend between them. But when the cartilages are rendered immoveable by becoming bony, or by contraction of the
the foot, the sensible frog is much confined in its motion. By this immobility of the cartilages, the horse is deprived of a powerful spring. When the frog does not press on the ground, and consequently the cartilages are deprived of motion, the moisture of the crust evaporates; and hence the quarters and heels of the hoof become contracted much more than the fore part of the crust, and this contraction is increased by the frog not being allowed to rise between the cartilages. Thus, the natural circular shape of the hoof is destroyed by the frog not receiving pressure.

Fig. 18 represents the lower part of a horse's hoof, as it is usually lengthened or contracted by improper shoeing.

We have not yet described the sensible sole. This is situated between the horny sole and the coffin-bone, and is united to the lower cartilages immediately behind the latter (CC, fig. 15.). Its lower edge is firmly connected with the sensible lamina, at the lower edge of the coffin-bone; but at the extremity of the heels, the laminae are continued for about an inch, forming what are called the sensible bars. The sensible sole is well supplied with blood-vessels, but when these are emptied, it appears of a ligamentous texture. From the vessels of this part, the horny matter of the horn sole and bars is formed and renewed.

The only other part of the foot that we shall describe, is an important ligament, which surrounds the junction of the coffin-bone with the hoof, and is called the coronary ligament (DD, fig. 16). This ligament is attached at its upper part, to the anterior protuberance of the coffin-bone, and to the lateral cartilages; and extends a little above the coffin-joint, being united on its outside to the skin. Below it is united to the sensible lamina, at their origin. On its outside it is convex, and is received into a correspondent hollow in the crust, called the coronary ring. It is ultimately inserted into the heels of the sensible frog. The uses of this ligament are very important. By its union with the sensible lamina, lateral cartilages, sensible frog, and coffin-bone, it assists the action of all these parts, increasing their strength and connection; and in particular, preserves the proper situation of the cartilages, and prevents their being dislocated, to which they would otherwise be liable, by being separated by the rising of the sensible frog between them, when the horse frog touches the ground.

We have thus described the structure and functions of the foot and hoof, as far as appeared to us to be absolutely necessary for understanding the principles and practice of shoeing. The names, insertions, and uses of the muscles of the foot, have been already concisely given in the table of the muscles of the extremities (see page 437.). The blood-vessels, nerves, and absorbents are well described, and most beautifully figured in Mr. Coleman's elegant work on the structure, economy, and diseases of the foot of the horse; to which, and to Mr. Freeman's work on the same subject, we refer such of our readers as wish for a complete and accurate account of that curious and important piece of mechanism, the foot of the horse.

We shall conclude this chapter with a summary recapitulation of the more important circumstances that have been mentioned, as we shall immediately apply them in describing the most approved method of shoeing; and they will be better understood, and the more easily remembered, by being brought together in a comprehensive point of view. It appears then,

"That the natural form of the hoof of the fore feet is a circle; and,

"That the internal cavity of the hoof, when circular, is completely filled by the sensible parts of the foot.

"That the hoof is composed of horny insensible fibres, that take the names of crust, sole, bars, and frog.

"That the crust is united with the last bone of the foot, by a number of laminated elastic substances.

"That the uses of the laminae are to support the weight of the animal, and from their elasticity to prevent concussion.

"That the horny sole is internally concave, internally convex, and united by its edge with the inferior part of the crust.

"That the uses of the horny sole are to act as a spring, by descending at the heels; to preserve the sensible sole from pressure, and (with its concavity) to form a convexity of the earth.

"That the external bars are nothing more than a continuation of the crust, forming angles at the heels.

"That the internal bars are a continuation of the laminae of the crust, attached to the horny sole at the heels within the hoof; and that these insensible laminae are intimately united with sensible laminated bars, connected with the sensible sole.

"That the use of the external bars, is to preserve the heels expanded; and the use of the internal horny bars, to prevent separation and dislocation of the horny sole from the sensible sole.

"That the external frog is convex, and of an insensible horny elastic nature.

"That the internal sensible frog is of the same form, very highly elastic, and united with two elastic cartilages.

"That the frogs are not made to protect the tendon, as Mr. St. Bel and other writers have supposed.

"That the use of the frog is to prevent the horse from slipping, by its convexity embracing the ground; and from the elasticity of the sensible and horny frogs, they act as a spring to the animal, and keep expanded; no length of time can render them short."
PART III. OF THE OPERATIONS USUALLY PERFORMED ON DOMESTIC ANIMALS.

CHAP. I. Of Shoeing.

131 The principles and practice of shoeing are usually explained at the end of treatises on the veterinary art, immediately after describing the usual surgical operations. We think it better, however, to treat on the subject of shoeing in this part of our article, immediately after having described the anatomy of the horse's foot; the necessity of understanding which has been fully explained in the last chapter.

132 It is very uncertain at what period mankind first began to shoe their horses with iron; but it is probable that this practice commenced as soon as they were sufficiently civilized, to have such roads as were composed of solid, hard materials, fitted for the purposes of constant traffic. In many countries where such kind of roads are not required, as in the deserts of Arabia, and in many eastern countries, we know that to this day the horses are not shod; and we have been assured, that some years ago, when the roads in most of the United Provinces of America were not so hard as they are at present, horses were shod only on the fore-feet (D).

We shall first briefly describe the mode of shoeing commonly practised by the smiths of this country, and shall then give a short account of the most important improvements that have been made in the art, from the time of Lafosse to the present method employed at the veterinary college.

In the common mode of shoeing, the bars are totally cut away, and the frog is considerably pared down, by means of a cutting instrument called a batta. The reason assigned for cutting away the bars, or opening the heels, as it is called, is, that the heels may not contract, and that the shoe may not press upon the sole, and occasion corns. The hoof being thus prepared, the shoe is to be applied. The common form of this shoe is nearly elliptical, being broader at the fore part, and growing narrower towards the heels, where it is thicker than at the toe. It is convex on its outer surface where it is to touch the ground, and concave on its inner part, which is applied next the hoof. It is fastened to the hoof by means of eight nails, four in each quarter; and the heads of these nails are nearly conical, standing out a little beyond the shoe. This shoe is commonly applied nearly red hot, in order, as we suppose,
Operations. Suppose, to adapt it better, and make it fit closer to the hoof.

134 Defects of the common mode.
The consequences of this method of shoeing must be:
1. That the function of the bars, whatever it may be, (and we have shewn that they are intended to prevent contraction of the feet), must be destroyed.
2. That cutting away the frog, exposes this part to injury, and is productive of many diseases.
3. That the heels of the shoe being higher than the toe, will prevent the frogs from embracing the ground, for which we have shewn they were naturally intended.
4. That by making the shoe concave at the quarters, and placing the nails near the heels, the growth of the crust in these parts is impeded, and thus the foot is contracted, and its proper shape destroyed.
5. That by fastening the shoe near the insensible frog at the heels, the proper division of the frogs and sole, as a spring to assist the motions of the animal, is destroyed.
6. That by putting on the shoe hot, the moisture of the crusts is dried up, and thus the contraction of the foot is still further increased.
7. That by making the shoes wound next the ground, the sure footing of the horse is greatly lessened, much to the danger of his rider.

The first modern writer who attempted to reform the common mode of shoeing, appears to have been La fosse. It is true that an excellent mode of shoeing was recommended about 300 years ago by Cesar Fiaschi, an Italian writer on horsemanship; but his plan never came into general use, and Laffosse appears to have all the merit of the improvement, as it is more than probable that he had never seen Fiaschi’s work. The shoe recommended by Laffosse was what he called the half-moon-shoe, being nearly semicircular, and reaching little further than to the middle of the foot; the nails being placed round the toe. Laffosse’s shoe was never very generally employed in this country, even though the improvement was rendered familiar by Bracken and Bartlet, who, as we have said, translated Laffosse’s treatise into English. It has been considered as useful in some cases of diseased feet, and for strong feet which have begun to contract, or appear likely to do so, provided such horses are not employed on very hard, rough roads; but it is by no means applicable to the majority of our horses. Its principal disadvantages appear to be, that the heels wear too fast, and that in running, horses are apt to slip with it.

Mr. William Osmer, whose work on shoeing we have mentioned in No. 65, improved considerably on the shoe of Laffosse. He forbade the frogs and bars to be cut away, except when they were ragged. He, however, remarks, that the feet of all horses should be pared according to their length; the crust being made perfectly smooth by paring or rasping. His shoe was everywhere of an equal thickness, rather narrower behind than before, of a flat surface next the ground, and bevelled away from about the middle of its breadth inwards, leaving a flat surface for the crust to rest on.

The next improver of shoes was Lord Pembroke. Though Mr. Blaine most unaccountably places him after Mr. Clark, Lord Pembroke’s remarks on shoeing are exceedingly ingenious. He observed that the weight of shoes must, in a great measure, depend on the quality and hardness of the iron. If the iron be very good it will not bend, and in this case the shoes cannot possibly be too light; care, however, must be taken, that they be made of a thickness so as not to bend, for operation, bending would tear out the nails, and ruin the hoof.

Part III.

That part of the shoe which is next the horse’s heel, must be narrower than anywhere else, that stones may be thereby prevented from getting under it, and sticking there, which otherwise would be the case, because the iron when it advances inwardly beyond the bearing of the foot, makes a cavity, wherein stones being lodged, would remain, and by pressing against the foot, lame the horse. The part of the shoe which the horse walks upon, should be quite flat, and the inside of it likewise; and only just room enough should be left next the foot, to put in a picker, (which ought to be used every time the horse comes into the stable, and often on marches), and also to prevent the shoe’s pressing upon the sole. Three, or at most four nails of a side, hold better than a greater number, and keep the hoof in a far better state. He advises that the toe of the horse be cut square and short, and that no nails be placed in that part. By these means narrow heels are prevented, and many good effects produced. His lordship advises the hinder feet to be shod in the same manner as the fore feet, except in hilly and slippery countries, where the shoes on the hinder feet may be a little turned up behind.

The utmost severity, (says Lord Pembroke), ought to be inflicted on all those who clap shoes on hot. This unpardonable laziness of farriers in making feet fit shoes, instead of making shoes fitting feet, dries up the hoofs and utterly destroys them. Frequent removals of shoes are detrimental, and tear the foot, but sometimes they are very necessary. This is an inconvenience which half-shoes are liable to (though excellent in several other respects), for the end of the shoe being very short, is apt to get soon into the foot, and consequently then must be moved.

The shoe recommended by Mr. Clark did not differ very much from that of Osmer. He does not, however, recommend the hollowing of the surface of the shoe next the foot. Mr. Clark recommended that the hoof and frog should not be pared or cut away without necessity, and was much against raising the heels with calkins; to the use of which he preferred that of an ice nail. He, however, admits, that sharp calkins may be necessary in hilly countries.

The shoe originally used at the veterinary college by the first professor, was very similar to that of Osmer but when Mr. Coleman succeeded to the professorship, he adopted the half-moon shoe introduced by Laffosse. This was, however, soon given up, as experience showed that it was not adapted to the generality of horses in this country. Within these few years, a method of shoeing has been introduced by Mr. Coleman, which appears in most instances preferable to any former method. We shall therefore consider it pretty much at large.

Mr. Coleman has laid down two general principles, by which the practice of shoeing for all horses, in every country, must be invariably followed. “So long as nails and iron are employed to protect the hoof, the crust is the part that should receive the nails, and the pressure of the shoe; and the sole of every horse employed for every purpose, is a part that should not be in contact with the shoe.” These are Mr. Coleman’s general rules, and to these it must be added, that the frog
farriery.

Once allowed to touch the frog, the sounds parts are generally destroyed. Where the frogs are not large and projecting, and the heels are higher than the frogs, then it is advisable to lower the heels, which may be done by a rasp, or the butteris; for in every case we are to endeavour to bring the frog in contact with the ground. We should never lose sight of this principle, that the frog must have pressure, or be diseased. If the frog does not touch the ground, it cannot perform its use; and no organ can be preserved in health, that does not perform the functions for which it was made.

Nevertheless, where the frog has been disqualified for its functions for a considerable period, and becomes soft, Horse's Foot, vol. 1. it must be accustomed to pressure by degrees." 745

When it is necessary for the horse to work, though his frogs are soft and diseased, it must be gradually accustomed to pressure, by cutting down the hoof about one-tenth of an inch at every fresh shoeing, that the frog may become hard, and equally protuberant with the heels. If the horse be not required to labour, much advantage will be derived from allowing him to stand in the stable without shoes.

The feet of most horses have been deformed by bad management. It will therefore be necessary to use a particular shoe to each particular form of hoof. Any one form employed indiscriminately for all feet, cannot be alike successful for all. It is from not having sufficiently attended to this simple fact, that the shoe recommended by the veterinary college has not been more generally adopted. It is therefore necessary to vary the length, breadth, and thickness of the shoe, according to the form of the hoof to which it is to be applied. If the heels or fore-feet are two inches and a half or more in depth; if the frog be sound and prominent, and the roads dry, the toe of the hoof only requires to be shortened, and afterwards covered by a short shoe, which may be made of the usual thickness at the toe, but must be thinner gradually towards the heel. The proportional thickness of a shoe of this kind for a common saddle horse, as recommended by Mr Coleman, is three-eighths of an inch at the toe, and one-eighth at the heel. By means of such a shoe the frog is completely brought in contact with the ground; the heels are expanded; and corns, thrushes, and canker are prevented. The horse may continue to wear such a shoe as long as the weather is warm, and the ground dry.

Race-horses, who generally have the heels high, and the crust thicker and stronger than heavy horses, may generally wear short shoes, at least on the fore-feet. But such as have weak legs, bent knees, long pasterns, or low heels, must not wear such a shoe.

A long shoe is necessary in wet weather, and even in summer, when the heels of the hooves are low. In winter, when the heels are too high, they should be lowered by means of a rasp, rather than suffered to wear down, by being exposed to the ground with a short shoe; for moisture is very destructive to the hoof; and thus as great a part of it may be removed as is necessary. Besides, when a horse has been accustomed to high-heeled shoes, if he was suddenly made to wear those with thin heels, the frog might be bruised or inflamed, and the muscles and tendons of the leg considerably strained. It is therefore necessary to bring the heels of the shoe to the proper degree of thickness gradually.

The bars and frog should never be removed. Where there are ragged and detached parts of the frog, it is better that they should be cut with any small knife, by the groom, than by the farrier; for if the latter is
FARRIERY.

Part III.

Operations. - Usually, observing that the heels of each succeeding shoe be made somewhat thinner than those of the last.

In general, as much as possible of the horn part of the hoof must the toe is to be removed, and as little iron employed near the heels every time of shoeing, till the feet be brought as nearly as may be to their natural shape.

In horses that have been accustomed to wear shoes of an equal thickness all round, and where the frog is healthy, we may in general apply a shoe, much thicker at the toe than the heel, by parting down the toe, and taking nothing from the heel; and if a horse appear to suffer no inconvenience from a thin-bottomed shoe, during the first month after it is applied, it may be continued with safety, and will greatly improve the hoof. In young horses, however, that have never been shod, and in horses just taken up from grass, the toe seldom admits of being pared down, and a thin-bottomed shoe cannot be applied at once.

In all cases where the frogs do not embrace the ground with a thin shoe, the heels must be lowered; and if the horse has been accustomed to wear high-bottomed shoes, both the shoe and the hoof must be gradually lowered, till the frog can safely and easily perform its proper function.

A few horses require to be shod in a manner different from that which we have described, but still dependent on the same principles.

Weight of shoes.

Different weights of shoes are required for different horses. Mr. Coleman gives the following proportions, for horses of various descriptions.

A moderate-sized coach-horse will require a weight of shoes and nails, from eighteen to twenty ounces; an inch wide, and half an inch thick at the toe, and three-fourths of an inch wide, and one-sixth of an inch thick at the heels.

An ordinary saddle-horse will require only from 12 to 14 ounces; and the shoe may be three-fourths of an inch wide at the toe, and half an inch at the heel, and three-eighths of an inch thick on the outside of the toe, but only one-eighth at the inside of the toe, and at the heel.

The shoe most recommended by Mr. Coleman, is constructed on its upper surface, where the sole is flat or convex, but it is flat on the rest of the upper surface, but if the sole admits of being hollowed, the whole upper surface may be flat. It is regularly concave on its lower surface next the ground; and it is fastened to the crust by means of eight nails placed round from the toe backwards, so as to leave a part of the shoe above an inch and a half from the heel. Hunting-horses usually require an additional nail on each side, next the quarter. The nail-holes are made with a punch of a wedge-like form, and to correspond to this the heads of the nails are made conical, so that as long as any part of the head of the nail remains in the hole, the shoe cannot easily come off.

For hunters, and other horses that run in shafts, it is recommended by Mr. Coleman to turn up the outer heel; but, as in this way there is often some inequality of position, the outer heel of the foot is to be lowered, while the inner heel of the shoe is somewhat thickened. By these means cutting is avoided.

In such horses as have weak, low heels, Mr. Coleman recommends the use of the bar-shoe, as the bar affords a support to the frogs, without wearing out the heels. When the bar-shoe has been employed long enough to admit of the heels growing to the proper size, the ordinary thin-bottomed shoe may be adopted.

The method recommended by Mr. Coleman, as described above, has been for some time followed with considerable success by the board of ordnance, whose horses, as well as those of the British cavalry in general, are now shod after this manner. The method, however, met with considerable opposition, partly from such as do not understand the principles on which it is founded, and partly from its having been too hastily adopted, in cases to which, as Mr. Coleman himself allows, it is not generally applicable.

Fig. 19, and 20, illustrate Mr. Coleman's method of shoeing.

Fig. 19, represents the hoof turned upwards, to show the manner in which the shoe is applied. It may be seen from this figure that the web of the shoe is hollow; that the heels at a are narrower than the other parts of the shoe, and that the nails are placed all round from the toe backwards. Fig. 20, shows that the heels of the shoe are much thinner than the point, and also shows the manner in which the nails are riveted or clinched on the outside of the hoof round the toe and crust.

The only remaining method of shoeing that we shall here mention, is that of the ingenious Mr. Morecroft's method. This gentleman has acquired much celebrity by his invention of casting shoes, by sinking them in a die, by which means horses may be fitted with any shoes best adapted to their hoofs. Mr. Morecroft's shoe differs from Queens's, in being concave within for more than half its width. He condemns the use of calkins, on the principle that the public roads are now much more solid than when calkins were in general use; and, consequently, that instead of sinking them into the ground, they rather tend to raise the heels above it, and thus the frog is prevented from receiving the necessary pressure. Mr. Morecroft, however, allows calkins to heavy draught-horses, for whom he recommends two on each shoe; but in lighter horses of the same description, one on the outer side of each shoe. The latter is also recommended for hunters, but for other riding horses he forbids the use of calkins. The number of nails in Mr. Morecroft's shoe is usually eight, but in heavy draught horses they are not to be placed on the sides of the shoe, but all round at equal distance, leaving a space at the heels of about two inches or two and a half. At frosty weather, Mr. Morecroft recommends nails with a longer head, or a double counterparts, terminating in an edge instead of coming to a point, which greater breadth of surface prevents its being rubbed away so fast as a point. The thickness in the middle gives it strength, and the regular taper to the shank causes it to apply exactly to the sides of the hole in the shoe, by which it is equally supported, and prevented from bending or breaking.

Mr. Coleman considering pressure as necessary to the Coleman's healthy action of the frog, has contrived a method of artificial affording this pressure in those cases in which, from diseased feet, or bad management in shoeing, it cannot naturally receive it; and where, if the heels were lowered, in order to bring the frog in contact with the ground, there would be danger of straining the tendons. Mr. Coleman's patent artificial frogs are intended to produce
Part III.

Operations.

Shoes for oxen.

Where oxen are worked in farming business like horses, it is generally thought necessary to defend their hoofs in a similar manner by means of iron shoes. The form and manner of fitting these do not appear to be universally the same in all places; nor are we acquainted with the methods usually practised. We know that M. St Bel recommended the following methods; either to shoe the ox with a flat plate of iron, having six or seven nail holes on the outer edge, accompanied with a projection of four or five inches of iron at the toe, which passing the cleft of the foot, is bent over the hoof; or with eight shoes, one under each nail; otherwise with four, one under each internal nail; or only two, one under the external nail of each fore-foot.

CHAP. II. Of Casting.

There are several tedious and painful operations that we are sometimes obliged to perform, and which it would be difficult or impossible to execute, were the animal left at full liberty to resist us. It is, therefore, necessary to render ourselves completely masters of him, by throwing him down on the ground, and in a convenient situation, so as not to expose him or ourselves to injury. This operation is called casting, and is usually thus performed.

The first object is to prepare a thick bed of straw or litter, not less than eight feet square, to prevent the animal from being hurt in the fall. If the stable be sufficiently large to admit of the bed being made there, it is to be preferred, as during the operation, to prepare for which casting is necessary, the parts operated on will suffer less from exposure to the air in the stable, than without doors.

But, if there is not room in the stable, the bed must be made in the stable-yard, or rather, if possible, in some field or park adjoining.

The animal is now to be brought to one side of the bed; a strong leather strap, with a buckle at one end, and having an iron ring fixed to it, at a convenient distance from the buckle, is to be fixed round the pastern of each of the four legs, in such a way, that the rings of the straps that are round the fore-feet shall be directed backwards, and those of the straps on the hind-feet shall be opposite to these; while the buckles point outwards, to prevent hurting the animal. A pretty strong cord, ten or twelve feet long, is to be fastened to the ring of that strap that has been placed on the fore-foot on that side of the animal which is farthest from the bed: from this ring it is to pass through the ring on the hind foot, on the same side, from which it passes through the ring on the other hind-foot, then through the ring on the other fore-foot, and lastly, through that to which it was first fastened. The animal being thus fastened, a number of men are to place themselves beside him, so that he may be between them and the bed, while others are to stand on the opposite side of the litter. Now, the men that are beside the animal, laying hold of the end of the rope, are to pull Operations gradually with considerable force, so as to bring the fore-feet of the animal as near as possible together. When this is done, the men on the other side, standing in a row, one at the head of the animal, another at his chest, a third at his haunches, a fourth at his tail, &c. pull the animal toward them and complete his fall.

It is necessary to observe that the men who pull the rope, and those who receive the animal on the bed, must not act at the same time; as in this case the shock would be so great and sudden, as probably to occasion some accident, either to the men or to the animal. It is also proper to remark, that the animal must be cast in such a manner, that the part to be operated on may be fully in the view and reach of the operator.

When the animal is once on the bed, his head must be held down by a man, and it will be proper to cover his eyes. Another assistant must stand by the cord, which, for greater security, should be fastened with a knot at the first ring.

There are some little niceties to be observed in casting an animal, according to the operation that is intended to be performed on him; but of these we shall speak, when we describe the operations themselves.

CHAP. III. Of Bleeding.

Bleeding is distinguished into general and local. Bleeding.

General bleeding is performed for the purpose of taking away a quantity of blood from the general mass, and consists in opening some large vein, or some considerable branch of an artery. The vein usually opened, in horses and cattle, is the vein that runs along the neck, and which is called the jugular vein. This vein may be easily felt, as it is generally considerably raised above the muscles.

The vein is usually opened by means of a flamm, which is forced into the vein, by striking it with a small wooden mallet, called by farriers a blood-stick. There are many objections to this mode of bleeding. In the first place, it is extremely clumsy; and, if the vein happens to roll, which is very commonly the case, a large wound may be made in the skin, without drawing blood. Again, these animals, especially horses, are easily frightened by any sudden motion of the hand; and some persons have a way of shaking the blood-stick before they give the stroke; and, in doing this, they often use more exertion than is necessary. The animal, alarmed at these strange motions, tosses up his head, and thus renders the stroke uncertain.

Many prefer the ordinary lancet used by surgeons; and, in several cases, particularly of local bleeding, this is the most convenient instrument. But in opening the jugular vein, we do not consider it as much superior to the common flamm. When this latter is employed, the back of it should be made of considerable thickness, so, when it is too narrow, as is commonly the case, when the instrument is struck with the stick, it sinks into the channel of the vein, which is often not opened, as the prominent muscles of the neck receive the stroke.

For most purposes of bleeding, we would recommend the spring-flamm, as being easily applied, and much more certain in its effect.

It is a common practice with grooms and farriers, either to tie a rope or other ligature about the neck of the animal, or to tie a rope or other ligature about the neck of the animal, and then to cut the neck, and then to cut the vein. This is a bad practice, as it is easy to cut too deeply, and the vein is apt to close, unless it is tied immediately. It is better, therefore, to make a ligature about the neck, and then to cut the vein, and to tie it immediately after. This is a much more certain way of bleeding, and is much more convenient than the other.
FARRIERY. Part III.

Operations, animal, previous to the bleeding in the jugular vein. They do this from a supposition that the vein will thus swell the more readily, and that it will be opened with greater certainty. But this ligature is in most cases unnecessary, and will at some times be highly dangerous.

Where exercise is not improper before bleeding, it will be sufficient that the animal be gently trotted previous to the operation, as thus the circulation will be promoted, and the superficial veins will be sufficiently filled with blood. Where general exercise is improper or inadmissible, the filling of the vein may easily be promoted by briskly rubbing the neck for some time with a wisp of straw or hay; and just before applying the fleam, it will be proper to press with one finger upon that part of the vein that is between the shoulder and the place where the fleam is applied.

The danger of a ligature will appear both from reason and experience. When the ligature is fastened round the neck, it produces a swelling of the vein on each side; and thus the circulation being in a great measure impeded, and the return of much of the blood from the head prevented, an accumulation of blood takes place in the vessels of the brain. If the ligature be continued round the neck, which must happen when, by want of dexterity of the operator, or by the horse being frightened, the vein has not been opened at the first attempt, the stagnation of the blood in the head goes on to an alarming degree, and the horse not unfrequently falls down in an apoplectic fit. "In such cases, (says Mr Clark), I have observed the operator greatly disconcerted, and desist from any further attempts to draw blood at that time, being prepossessed with the idea that the horse was vicious and unruly, although the very treatment the horse had just undergone rendered bleeding at this time the more necessary, in order to make a speedy removal from the vessels of the head; therefore a ligature or bandage ought never to be used till such time as the opening is made into the vein, and even then it will not be necessary at all times, if the horse can stand on his feet, as a moderate pressure with the finger on the vein will make the blood flow freely; but if the horse is lying on the ground, a ligature will be necessary."

But further, the concussion or shock the horse receives from his falling down, in the above situation, which will always happen if the ligature is too long continued, may cause a blood-vessel in the head to burst, and death may be the consequence.

The place where the vein is to be opened is of some consequence, as, when the opening is made too far from the head, where the vein lies deep among the muscles, both the vein is not so easily opened, and the wound is not so readily healed. The most proper place for opening the jugular vein is about an inch below the joining of the small branches that come from the lower jaw. This is generally about a hand-breadth from the head, but it may be easily seen by the swelling of the vein when pressure is made on its trunk.

Before opening the vein, it is usual to wet the hairs that lie above it, and to stroke them in the direction of the intended orifice. This is a good practice, as the instrument thus passes through the skin more readily, not having to overcome the resistance of the hair. In mentioning the direction of the orifice, it is worth while to remark, that this should neither be longitudinal nor directly across the vein, but rather oblique; as the flow of blood from an oblique orifice is most easily stopped.

When the vein is opened, it is highly proper in all cases to catch the blood in some convenient vessel. It is a very absurd practice, although it is commonly adopted, to allow the blood to flow at random on the ground or on a dunghill, by which means no precise estimate can be made of the quantity of blood taken away. This may either be so small, as to be of no advantage; or it may be so considerable as to produce fainting, before the operator thinks of stopping the orifice.

For the purpose of measuring the quantity of blood taken away, Mr White recommends a graduated tin vessel, capable of containing five quarts; every pint being marked on the inside of the vessel, so that the quantity of blood that is taken off may be exactly known. The blood should always be preserved, that we may judge from its appearance of the nature of the disease, and whether it is proper, or not, to repeat the operation. If the blood continues fluid for a considerable time, it shows that there is an inflammatory state of the body; and if a jelly-like substance, of a whitish or light buff colour, and rather firm consistence, appears on the surface after the blood has cooled, and especially if the surface is hollowed, we may be certain that the animal's complaint is of an inflammatory nature, that the bleeding has been proper, and must be repeated, if the symptoms continue or increase; but if the blood coagulates quickly, is uniformly a dark liver colour, loose, and easily broken, with a considerable quantity of water upon its surface, it denotes debility, and shows that the disease arises from a weakness of the system; that instead of bleeding, tonic and cordial medicines are to be employed, with every thing that may tend to restore the animal's strength.

When a sufficient quantity of blood has been taken away, it is for the most part necessary to secure the orifice, in order to prevent future accidental bleeding. This is usually done by thrusting a common pin through the lips of the wound, and twining about it a little horse hair. As in this way the wound often rankles, and becomes a sore difficult to heal, which we are disposed to attribute to the brass pin employed, as often as to any other cause; we would recommend a pin of silver, or at least of polished steel. The pin need not pass through more than the skin, and in some cases when the horse can conveniently be fastened to the rack after bleeding, the pin may be entirely dispensed with.

As it is often required to bleed on either side of the neck, or on both sides, it is proper that the operator should be able to bleed with either hand. This is indeed not quite so necessary in bleeding horses and cattle, as in the human subject; but it will be often found very convenient in both.

In some cases, especially in inflammation of the brain, where a sudden and copious loss of blood is required, it becomes necessary to open the temporal artery. This is easily effected, as the artery is situated very superficially, about an inch and a half backwards from the upper and outer corner of the eye. It is most conveniently opened with a lancet, and when a sufficient quantity of blood has been drawn, the flow is in general very easily stopped by making continued pressure upon the artery; or, if this should not succeed, and a dangerous effusion of
Topical bleeding is useful in several cases, as in inflammatory affections of the feet, which are often relieved by opening the coronary veins, or the vein that encircles the coffin-bone; in inflammations of the eyes, in which blood may be often drawn, from the angular veins, with considerable success; and in affections of the mouth, where it is sometimes useful to draw blood, by scarifying the bars of the mouth, or even, in some urgent cases, by opening the veins of the palate. Topical bleeding is best performed with a lancet.

Almost the only method that is practised for bleeding sheep, or dogs, is to cut off a joint or two of the tail; and this is certainly often productive of good consequences, as the flow of blood is sometimes pretty considerable. Unfortunately, however, we can seldom have recourse to this mode of bleeding more than once or twice, whereas cases often recur in which it is necessary to repeat the bleeding. It is also a cruel method, and we see no reason why the veins in these animals may not be opened like those of horses and cattle. In the sheep, indeed, the thickness of the kneel will commonly prevent bleeding in the neck, but the temporal artery and the veins of the foot may be opened without difficulty; and in most dogs we may bleed in the jugular, vein with nearly as much ease as in the horse or cow.

CHAP. IV. Of making Rowels and Setons.

Rowels in horses and cattle are much the same as swellings, issues in the human body. The operation consists in described, opening the skin, so as to insert between it and the cellular membrane some foreign body, which is kept there, in order to produce and keep up a suppuration or running of purulent matter. The operation is usually performed in the following manner. An incision is made through the skin by means of a very sharp pair of scissors, or, what appears better, a sharp knife. The finger is then introduced below the skin, so as to separate it from the flesh all around, as far as the finger will reach. A piece of leather about the size of a crown-piece, and of a circular form, with a hole cut in the middle, is then inserted between the skin and the muscles, having been first anointed with some stimulating ointment. A small piece of tow or caddice spread with the same ointment, is put over the hole in the centre of the leather; the skin is laid down over all, and the part is covered with a pledget, also covered with ointment, to keep out the external air.

The leather is left in this situation for two or three days, during which the parts adjoining the rowel swell, and at the end of the time there appears a discharge of a yellowish matter, which gradually becomes thicker and whiter. In three days at the earliest, the part must be examined, and the plug removed from the centre hole, to allow the matter to flow out. The rowel is now complete, and may be continued as long as shall be found necessary. The action of the rowel is easily explained; the leather introduced excites a degree of inflammation between the skin and the flesh, and no means being taken to check this, it goes on, like most other inflammations of fleshly parts, to suppuration. Thus a discharge is produced from the part, which is found to have considerable effect in checking inflammation of some more important organ near which the rowel.
FARBIERY.

Part III.

Operations of rowel has been inserted. Thus, in inflammation of the lungs, after copious bleeding, a rowel in the chest, like a blister in the human body, is found to have considerable effect in checking the progress of the disease.

Rowels may be placed in most of the fleshly parts of the body; but they are most commonly inserted in the belly, the breast, the inside of the thighs, the outside of the shoulders, and the hips. They are sometimes placed between the jawbones, below the tongue; but this is very improper, as a good suppuration can seldom be brought on in this place.

It is sometimes found necessary to make several rows at the same time; but they should always be placed as nearly as possible, to the seat of the affection which they are intended to relieve.

Besides dangerous inflammations, rows are found serviceable in large swellings of the hind legs, in obstinate cases of gnoises, and in strains of the shoulder.

Though rows are thus found extremely useful in many cases, they are, like many other operations performed on brute animals, sometimes made where they are unnecessary or improper. Where there is considerable debility, the insertion of a rowel would be very injudicious, as it would not suppurate kindly, and as the discharge produced would tend still farther to increase the debility. The discharge in these cases is usually thin and ichorous; sometimes they are perfectly dry, and not unfrequently a mortification is produced. When a rowel is found to be attended with any of these effects, it must be immediately removed, and the parts must be fomented with a warm decoction of the chamomile-flowers, and some stimulating herbs; or must be bathed with spirit of wine or oil of turpentine. If gangrene should have come on, it will besides be necessary to administer cordial and strengthening remedies.

Setons are inserted through an opening made in two opposite parts of the skin, and the extraneous body introduced is a cord.

The opening is made by means of a sharp-pointed instrument, with an eye at the other end for receiving the cord. The sides of the instrument must be proportioned to the opening to be made, and the size of the cord to be inserted.

Setons are particularly useful for the purpose of gradually draining off matter from abscesses or suppurating tumours, that are either so deeply seated as not to be easily opened in any other way, or so large that the sudden discharge of matter from them while opened by the knife, would be attended with bad consequences. They are best employed in large abscesses of the back withers, and the upper part of the neck behind the ears. Setons are also attended with the advantage of draining off the matter without exposing the inside of the abscess to the air.

The method of inserting the seton for the purpose of opening an abscess is this. When it is found that there is a considerable accumulation of matter, the needle, furnished with a cord of the proper size, is to be introduced at the highest part of the tumour, and brought out towards its lowest part, so that the matter may more easily drain off. The cord, which must previously be rubbed with stimulating ointment, is soon to be cut from the eye of the needle, and then fastened together at both ends, to prevent its being pulled out; but if the cord should not admit of being thus tied, a small operation button of wood may be fastened on each end. It is better, however, if possible, to tie the ends together, as every time the sree is dressed, the seton requires to be drawn a little round. When the discharge appears to be nearly stopped, except what evidently arises from the presence of the cord, this may be gradually removed, by drawing out a single thread of it at every dressing.

In introducing the needle, great care must be taken to avoid large blood-vessels and nerves; and where there is a danger in encountering these, it is better to pass the needle through a sheath. This may easily be done, by first making a small opening with a lancet at the upper part of the tumour; and through this introducing the sheath, which is to be pushed down till it reaches the part at which the needle is intended to come out. The needle in this way will pass through the sheath without danger of wounding any important nerve or vessel.

CHAP. V. Of Firing.

This operation consists in applying to the skin, or firing, other parts of the body, a metallic instrument heated to a greater or lesser degree of redness. The instrument is called a cautery, and the operation was well known among the ancient surgeons, by the name of the actual cautery.

The instruments employed for firing are usually made of iron, sometimes of copper; but iron is to be preferred. They are of various forms, according to the part to which they are to be applied, and the purpose for which the operation is to be performed. These will be considered in describing the cases to which firing is applicable.

The operation is found of use on several occasions: its use.

1st. In order to oppose the progress of mortification. With this view a cautery shaped like a knife, with a blunt edge and a thick back, is to be employed. This form will also answer for many other cases. There should be several instruments of the same kind, that when one becomes too cool, another may be ready of the proper degree of heat. The heat of the iron intended for the present case should be that of a charred.

In applying the iron, the parts adjoining to the mortified place are to be passed over with the edge of the instrument in successive parallel lines, so as the heat may penetrate to the living parts, and thus produce such a degree of healthy action as may enable them to throw off the mortified slough. When the iron has been applied for a sufficient time, which must be regulated by the nature of the part, and the extent of mortification, the wound is to be covered with a pledget spread with some stimulating ointment.

2d. Firing is employed to brace the skin, and to strengthen the sinews. The instrument above described is used on this occasion, but its heat must be somewhat greater. The mode of applying it is to pass the edge lightly and quickly over the skin, describing parallel lines from one end of the part of the other. When one iron has been used in this way, a fresh one is to be taken, and made to retrace the lines first formed, beginning where the last iron left off; and this is to be repeated as often as appears necessary, taking care not to destroy the texture of the skin. It is recommended by
FARRIERY.

By some to apply the hot iron, as to burn away the
hair, for some time previously to firing the skin; as
much time is otherwise lost before the proper impression
by the iron. After firing, a blister is sometimes applied, as this is thought to increase the good
effect produced by the iron. When firing is employed
on the hind legs, or on any part where the operator
would be exposed to danger from the horse’s kicking,
it is necessary to confine the legs by means of fetters.
This operation has been found useful in shaving, ring-bones, old callous swellings of the back sinews,and
in wind-galls. For this purpose the irons are used
as already directed. It is the custom with some farri
er’s to apply a blister in these cases before firing, in
order to reduce the swelling; as they suppose that fir
ing employed without this precaution would tend to fix
the swelling, and render it ineradicable. There is prob
ably little foundation for such an idea.

4th. Firing is very frequently had recourse to by
way of a styptic in stopping or checking profuse bleedings, from accidental wounds, or surgical operations.
The iron employed with this view has generally a
rounded extremity, except in the operation of docking,
where an iron in the form of a ring is generally em
ployed.

5th. Another use of firing is in wounds of the joints,
or other circumcised cavities, where it is employed
to produce a kindly circulation, and consequent granula
tion of healthy flesh. It has been employed in these
cases by Mr. Coleman, with considerable success.

6th. Firing has been found one of the most effectual
remedies in those superficial ulcers that accompany
farrow or gladders in the horse; and,

Lastly, the use of the hot iron has been found the
daly certain means of preventing the dreadful effects
arising from the bite of a rod animal, when properly
applied after cutting out the bitten part.

CHAP. VI. Of Docking.

The honour of having introduced this most useful
and humane practice, belongs, we believe, solely to this
country. It appears that it was in use in England, so
long ago as the end of the eight century; for at a
council held there about that time (concilium Calca
tense, or council of Calchate), there was a canon enset
ed, expressly forbidding this practice as inoend and
abominable.

It does not appear that this operation is performed
among the Arabsians, or other eastern nations; or at
least, if it be, it is not intended as an ornament to the
animal, but either from necessity when the tail is dis
cessed, or by way of mark, to distinguish some particu
lar horse.

Docking has been practised in Germany for about
300 years; and probably much longer in France. It
was certainly unknown to the Italians at the latter end
of the fifteenth century; for we are told, that when the
army of the emperor Maximilian was in Italy in 1497,
the Italians were much surprised to see his cavalry
mounted on docked horses.

It is strange that prejudice and false taste should lead
mankind to deprive their horses of a part, which, to the
eye of sense and unselected nature, must appear
not only an ornament to the animal, but as designed by

the Creator as a protection against flies, gnats, and in
numerable other winged enemies, which harass them in
the summer months. It is true, indeed, that in Britain,
where the summer heats are in general not so lasting, or
so violent, as in the more southern countries of Europe,
these insects are not always so troublesome as they are
found in those climates. But even here they are suffi
ciently so, to render the protection of the tail neces
sary; and when our cavalry are unhappily sent to the
continent, the loss of the horses tails proves a very se
rious obstacle to the success of the troops. More than
one instance of this has occurred. At the battle of
Dätheingen in 1743, great part of the British cavalry
were absolutely dismounted, from the death of the
horses, occasioned in a great measure by the torrent
which they experienced from the bite of gad-flies, and
other insects; and at the battle of Minden, in the seven
years war, the cavalry of the allies were thrown into so
much disorder by these petty enemies, that they had
nearly lost the battle. Lord Pembroke declares, that
he had seen the cavalry horses belonging to our army,
sweating, rushing against each other, refusing their food,
and absolutely devoured by flies for want of their tails
to brush them off; while those of the horses of the for
eign cavalry that had not been deprived of this neces
sary defence, were cool, tranquil, fed well, and were in
good condition. From the inconveniences which our
cavalry have suffered from the want of the horses tails,
it has been for some years the custom to employ long
tailed horses.

The principal reasons that have been assigned for
this absurd practice, are, that a long tail is extremely
inconvenient to both horse and rider, when travelling
through dirty roads and bushy forests; and that when
the tail is of its ordinary length, the animal cannot car
ry it in that fine, arched, cocked-tail direction, which
seems to form one of the chief beauties of the modern
race.

We apprehend that few horses enjoy such an ample
length of tail as that of the redoubtable Hodophilus; of
whose horse we read, that

“His dragging tail hung in the dirt,
Which on his rider he would flit,
Still as his tender side he pricket
With arm’d heel, or with unarm’d kick’t.”

As to the beauty of a cocked-tailed horse, we pro
fess ourselves not competent to judge; but with due de
ference to the gentlemen of the turf, and the respectable
fraternity of jockeys, we should humbly conceive (we
speak with submission) that a horse with a long tail is a
much finer object than one that is perpetually perking
and wiggling his tail in the air, and exposing his bare
breech to the broad stare of open day.

Docking is usually performed on horses, by laying the Mode of
tail upon a block, and chopping off the part by means performing
of a cleaver or hatchet stroke with a mallet. Perhaps the opera
tion would be rather less hanging to perform the opera
tion by means of a knife, and it would not take up
much more time. When this is done, the hair must be
previously clipped away, that the knife may cut more
easily; and previous to making the incision, the skin
should be drawn up forcibly towards the ump. The
division may be made by beginning on one side, and
cutting round from below upwards, so as to perform the
FARRIERY.

Part III.

Operations whole as nearly as possible at one stroke. When the skin and muscles have been completely divided, the part of the tail is to be cut off at the joining of two of the bones as nearly as possible to the edges of the wound, still keeping the skin drawn up. When the part has been removed, the flesh is to be seared all round with a hot iron, to stop the effusion of blood. The iron employed in France for this purpose is formed like a ring, so that it is easily applied to the flesh without injuring the bone. The wound must be covered from the air, and the animal must live rather low to prevent inflammation.

The practice of nicking, or cutting across the muscles that draw down the tail, so that those which pull it upwards may exert their full power, is still more inhuman and absurd than that of docking; and as we will contribute nothing towards extending this abominable practice, we shall omit the operation altogether.

CHAP. VII. Of Cropping.

TASTE and fashion have introduced another operation, by which the ears of horses and dogs are changed from their natural shape and size, to those which are considered by their owners as more handsome or agreeable. The ears of the horse and dog are seldom of such a shape or size, as to render them inconvenient to the animals, or to unfit them for the purposes for which nature has designed them. This may, however, sometimes happen; and there are some cases of wounds or diseases that may render cropping necessary: but in performing this operation, it should always be kept in mind that no part of the animal is made in vain, no more of the ears should be taken away than is absolutely necessary. We not unfrequently see horses and dogs cropped close to their head, a practice which is cruel and absurd, and which is always followed by more or less deafness, and exposes the animals to much inconvenience from the weather. In those dogs that are employed in rabbit Warrens, or for similar purposes, where they are required to enter burrows, cropping is attended with the worst effects, as the ears of the dog are unavoidably exposed to the particles of sand and earth that he brushes away in his passage through the burrow.

The operation of cropping scarcely requires description. In the dog it is usually performed by means of a pair of scissors, but these should be very sharp. In the horse, more nicety is required; and a particular instrument, called the cropping iron, is required, and a shape of the size of which it is intended the ear shall be, is applied to the ear, to mark the line of section. After the ear is cut, the skin and muscles recede considerably from the gristly part; but this seems of little consequence, and the wound heals in a few days without any other attention, than confining the animal within doors, and keeping him on a moderate, cooling diet. Horses ears are sometimes trimmed, as the grooms call it; that is, they are deprived of the fine soft hair that lines the inside of the cavity. This practice is equally absurd with cropping, as will appear from the following observations of Mr. Clark.

Absurdity of trimming horses ears.

"The ears of horses, as of other animals, (says Mr Clark), are covered on the inside with a short down, intermixed with long hairs, which line the external cavity of the ear, which seems designed by nature to prevent harsh sounds from making too great an impression upon the brain, and likewise to prevent the cold air, rain, dust, flies, &c. from annoying the internal ear. The means commonly used to remove this down, &c. is by the scissors, the flame of a candle, or that of a burning torch. Both the latter are cruel and barbarous, and cause a deal of pain to the animal, not only from the blisters that sometimes rise on the ears after this manner of singing them, but likewise from the means that are used to make horses stand with patience to undergo the operation, that is a twitch on the nose; and perhaps, if he is troublesome to the operator, one put on the ear. It is to be observed, that horses are very much guided or directed by the sense of hearing. This is obvious in those that hear distinctly, from the motion of their ears, and the direction they give them to whatever quarter any sound comes from, the attention they pay to what passes around them, or to what is spoke to them. Many of them, particularly the finest kind, as they only are liable to this kind of treatment, have the sense of hearing considerably blunted, if not rendered quite deaf from the above operation.

As this operation is generally first performed on young horses at the time they are breaking, it is the more hurtful; as the uncommon sounds, as the rattling of carriages, drums, &c. which are entirely new to them, and to which they are then more exposed on the roads or in streets, must make the greater impression on the sense of hearing; and perhaps it may be owing to the above cause only that many horses are timorous to pass carriages, and remain so ever afterwards.

Another disadvantage which attends this operation upon the ears of horses, is, that they will not go on cheerfully when travelling in opposition to the wind, more especially if it rains; for as the wind and rain get free access into the ears, they are continually shaking their heads and endeavouring to turn from it; and those who are of a more impatient temper will wheel suddenly round, in order to avoid what gives them so much uneasiness. They are then said to be restive; the whip and spurs are applied by way of chastisement for a supposed fault only.

From what has been said, it will be obvious, from the practice of taking away the natural covering from the inside of the ears, that the internal ear must be exposed to be considerably injured, particularly from cold, dust, &c. which blunts the sense of hearing, and perhaps causes deafness; for it is observed in those horses who have been much used to this treatment, that they lose that lively, active motion of the ears, and appear dull and inattentive to what passes around them, and even to the voice of their keeper.

CHAP. VIII. Of Castration.

Castration.

It is found of use to deprive the males of several of the domestic animals, especially of horses and cattle, of the means of propagation, either to render them more mild and tractable, or, in the case of cattle, to promote their fattening, and render their flesh less rank. It has been disputed whether the castration of the stallion is productive of such advantages as are not counterbalanced by the loss of strength and spirit, which the animals
FARRIERY.

Some of the Yorkshire breeders, however, think that operations for castration of an adult or young horse, appear to be the following. Let him be placed on some convenient spot, on the one side, and when down, let the off hind leg be drawn towards the neck, by which the scrotum will be fairly exposed. Holding the scrotum firmly, make a cut at once through it, not of too great length, but sufficient to admit the testicle being pressed out; this being done, apply the clamp or pair of nippers on the cord within an inch of the testicle, and hold the clamp sufficiently tight to stop the flow of blood, but not to bruise the cord; the stone may then be cut off with a scalpel, or it may be severed off with a burning knife. If it is cut off with a scalpel, immediately before the clamp let go their hold, near the end of the cord. Some apply a little powdered resin on it before searing, after which the clamps may be loosened. When this is finished, proceed to remove the other in the same manner.

After both are removed, a pledget of lint, wetted in warm water, may be introduced just within the edges of each wound; but no salt should by any means be introduced, as is the practice of some farriers; nor will any kind of bandage be easily retained, and if any thing of this kind is used, it should be very loosely applied, so as not to irritate.

When this operation is performed on a full grown horse, if he be at all fat, he should be previously bled, and kept rather low; and it will be prudent to choose mild weather for the operation; and the place likewise be in a part after the operation, should be of a moderate temperature.

Sometimes there is a considerable degree of inflammation, and when this happens, it is by no means proper to trot the horse about as is commonly done, but to bleed and purge, and apply a solution of sugar of lead to the parts. It will also be of advantage to insert a seton smeared with blistering ointment in the inside of the thigh.

Some operators separate the epididymis from the testicle and suffer it to remain, by which means they think that a portion of the animal's spirit is retained. A similar custom is said to prevail in France; but the French operators object to it, on the idea that it produces fistulous sores in the part. The fact is, that when any portion of the testicle is suffered to remain, though it cannot secrete semen, yet it has some action going on within, by which it produces some influence both on the mind and form; and as such, the future growth of the animal may perhaps be slightly affected by it, and perhaps his temper too, but the addition to the latter may probably not be a very favourable one.

Where the operation is to be performed; the best time is probably when the foal is about three months old, though some prefer a much more advanced age, as six, or even 12 months, and more in some cases. In all animals there is, however, the least danger of inflammation while they are young, in performing such operations. Besides, it is better to cut colts before they have any propensity to bank after mares, and get bad habits. When the foals are early, and the weather is not too hot, the latter end of May or beginning of June may be a good and proper season.

CHAP. IX. Of Spaying.

Spaying is an operation performed on the females. Spaying, chiefly on cattle and dogs, to prevent their producing young. It consists in taking away the ovaries, or those appendages to the womb in which are formed the rudiments of the young. It is supposed that it is attended with considerable advantage, in cows or heifers, as it greatly promotes their fattening. In hens, it is generally employed to prevent the unpleasant circumstances that often occur in the time they are in heat.

Spaying is usually performed after the animal has been newly impregnated, as at that time the ovaries are larger than before impregnation, and are of course more easily discovered. In performing the operation, a cut is made through the integuments of the belly, between the haunch-bone and the last rib, and through this opening the fingers are to be introduced. If the animal has not been impregnated, a roundish hard substance will be felt attached to the loins. This is to be drawn out and cut off, and that on the other side is now to be felt for, drawn out, and cut away. The ovaries, as has been said, will be much more readily found, especially the immost one, when the animal is impregnated, as the young within the horns of the womb afford a good direction to the finger. It is sometimes necessary, when the animal is not in a state of impregnation, to make an opening on each side of the belly, one for the extraction of each ovary; but when this is found requisite, it will be better to delay the second operation till the animal is in some measure recovered from the first.

When the ovaries have been cut away, the openings must be closed by means of a stitch through the integuments of the belly, and must be carefully covered with sticking plaster, to prevent the admission of the external air.

Mr Daniel remarks, that this operation does not always succeed in bitches, unless done by a skilful person, who can be relied upon. If it be ill done, although the bitches can have no puppies, they will notwithstanding go to heat, which defeats the purpose. There is a difference of opinion, whether a bitch should be spayed...
Operations, spayed before or after she has had a litter of whelps; Mr. Daniel, however, has tried, and found both periods to answer. The best time is 14 or 15 days after she has taken the dog, and when the puppies just begin to be knotted within her. All the roots of the veins should not be taken away; but strength and swiftness will be injured by so doing. They should be kept low for several days before the operation is performed, and fed on thin meat for some time after.

**Chapter X. Of Delivery in Difficult Labours.**

In general, Nature is all-sufficient for bringing forth the young of domestic animals, and man has little to do, except to take care that the females be not in such a situation as may expose themselves or their young to injury. It is proper always to watch a mare, or a cow, that is near the time of bringing forth; and to be at hand, to afford assistance where necessary. Mares do not often require assistance, as with them, difficult labour is uncommon. Where this does occur, the directions we are about to give for the cow, will in general answer for the mare.

Cows, particularly the short-bermed species, often need the assistance of the accouchers. The natural presentation of the calf, is with its head and fore-feet, the nose between the feet, and the back upwards. Downing enumerates seven preternatural positions: namely, 1st, Reverse presentation, or tail first. 2d, Fore-feet, no head appearing. 3d, Side-belly upwards, head reversed over one shoulder, legs appearing. 4th, Fore-feet, with head under the brisket. 5th, Head alone, or one fore-leg only with it. 6th, Head and one leg, or head alone. 7th, Calf lying on its back, its four legs folded nearly together, and close up to the cow's back; the head appearing, or doubled back, even with the ribs, on one side or other; one hind-leg, perhaps, appearing.

The following general rules are given by Mr. Lawrence:—Timely assistance before the cow is exhausted. Extraction never to be attempted in an improper position. Sop the hand and arm with warm water and fresh lard. Examination best made, the cow standing, and in the interval of pain. In pulling at the feet, in representation of the head, that the horn may bruise the cow. Navicular string bursting, and the usual flux of blood, of no consequence. Instruments to be used only in the last resort, and by experienced and steady persons only. The proper book is of hard iron, four inches long, with a loop for the cord at the straight end.

In a natural position, if the cow should want help, the position of the calf may be ascertained after the waters have been seen. A cord ought to be in readiness, to attach to the fore-legs of the calf, in order to assist each natural exertion. The head to be kept clear of obstruction.

**Preternatural position. No. 1.** as above. No attempt to turn the calf (this position being favourable for extraction), but use expedition, for fear it be suffocated. Press the haunches back with the palm of the hand, take hold of the bend of the hough of one leg, pull at it, and reach the foot; both feet may then be brought forth. No. 2. Reduce the head to its proper situation, between the fore-legs, either by hold of the nose, or the face-bone. A long arm is useful, which must be kept to the full extent in the body, that instant advantage may be taken of every three, the fingers being properly fixed. No. 3. Gently move the calf back, and bring the head forth to the legs. No. 4. Push the calf to find the head; pull at the nose: this requires address, but it is useless to employ force, for the head is in its proper place. No. 5, and 6. Push the calf against the shoulders and brisket; the feet will be folded under the belly; bring the feet forward, at the same time, the head being gently placed on the back of the knees. Should the head be too much swollen at bruised, to be returned, it must be skinned and repaired. Disconnect in a straight line from the poll to the nose, force the skin back over the first joint of the neck, divide the head from the body, pushing the latter to obtain hold of the knees. The loose skin must previously wrapped over the ragged bone, and is should have been fast held, in order to guide it clear to the brachial bones of the cow; should it hitch then, it back instantly. No. 7. If one hind-leg appears, put back; the calf cannot be brought forth with a hind and fore-leg together, and the difference between a knee and hough will be immediately discovered. In head being delayed back, most of course be recumbent in its proper place. The cow being strong and quiet, it is business may be affected with care and patience; it should the hook be positively necessary, hold and take either in the sockets of the eyes, cavity of the ears, or in the jaw. The case of draggy is the cal'll be sufficiently apparent by its preternatural six; wth the knife carefully, should that be necessary, to push the belly of the calf.

There is a very material obstruction which frequently happens to the calving of cows. It is called a breaking of the eye or calf-head, when the passage of it is obstructed into a very small circumference, insomuch that at the full time of gestation, it will not admit and the smallest head, and grows so sinewy or bent, renders it utterly impossible for the cow to come about assistance, and many cattle have died either a dreadful inconvenience, when it might have been prevented; but so little has been known of this disease peculiar to black cattle, that many cannot have been victims to untimely death, that might remedy or operation might have saved.

In the case before observed, it must take a considerable length of time, before it is contrived, as it is found; but no suspicion or dread can reasonably the place, unless the time when the beast has arrived at the end of nine months, her full time of being young; when they generally make a regular proportion, or falling of the parts of generation, for a few days or weeks before calving; but in case of the homeliness of the calf-head, is in observed that they are awkward in making those necessary admissions, preparatory to the approaching change; and when this noticed, more than usual observation ought to be used, for when they do not proceed in a regular manner, they马上就 have the effects of a new in due course, in the delivery of their brood. But when the head is observed sick for calf-head, and has reached the end of its time, and every demand of this is apprehended, there is danger or impropriety in attempting with the beast, in order to be satisfied, whether that part is open, or...
PART IV. HYGEIOLOGY; OR, THE MEANS OF PRESERVING THE HEALTH OF DOMESTIC ANIMALS.

Before we enter on the consideration of the diseases, that affect domestic animals, whose medical treatment is to form the subject of the remaining part of this article; it will be proper to lay down some instructions for the management of these animals in a state of health, with a view to that most important object, the avoiding of the causes of disease. The preservation of health must ever be considered as one of the principal objects of the medical practitioner, and has exercised the pens of some of the most eminent physicians in all ages. But the consideration of this subject is still more necessary in the treatment of the inferior animals, than in that of man. In the former the cure of disease is rendered much more difficult and precarious, on account of the obscurity in which the symptoms are often hid, and the difficulty which we frequently experience in investigating the causes of morbid affections.

The management of domestic animals is a state of health, chiefly respects the habits in which they are placed, when taken from their native fields; their food and drink; cleanliness, and exercise.

Chapter I. Of Stables, Cow-houses and Kennels.

In a state of nature, all the animals at present under our consideration, are constantly exposed to the open air, and only seek for shelter from the inclemencies of the weather under woods and thickets. The young of all these animals when domesticated, except the dog, are for a long time left in a similar state, till, for the convenience of their masters, it is found necessary to place them in habitations. The structure of these, that is of stables, cow-houses, and kennels, and the method of treating the animals confined in them, is of the utmost consequence; as on these the animals health and comfort must in a great measure depend.

1. Of Stables.

Stables should be built on a dry soil, that is some what elevated; or, at least, they must not be built in a soil of a bilious, or in the neighbourhood of boggy or marshy dry and land. The damp cold air, arising from moist, low situations, is extremely prejudicial to the health of all animals, particularly horses, and, as we shall see hereafter, to sheep. It renders them subject to colds, rheumatism, and not unfrequently to fevers. Stables built in these situations are therefore always dangerous; and more particularly so, when the animals return to them after having been heated by violent exercise or labour.

Stables should be roomy in proportion to the number of horses that it is proposed they should contain. Per roomey, no stable should be made to hold more than five or six horses, as many inconveniences arise from keeping too many of these animals in the same apartment. Not only is the air thereby much more vitiated, but the rest and sleep, so necessary to repair the fatigues of the day, are thus prevented or disturbed. Some horses will not sleep, or even lie down, if not perfectly at their ease; and hence, in large stables, that are made to contain a dozen or more horses, as is often the case in livery stables,
**Farrery.**

**Part IV.**

Bles, and such as are attached to large inns, the frequent entrance of grooms, outers, and other persons with lights, into the stable, and even the restless noise of some of the horses, who are more watchful, or have been less fatigued than others, must be a great disturbance to these latter. Where necessity requires a long range of stables, it is better to have them divided, by thick partition walls, into separate apartments, each made to contain not more than six horses. The additional expense of this would be trifling, compared to the greater ease and comfort of the animals.

It is usual in large stables, for the sake of keeping more horses conveniently under the same roof, to make them double headed, as it is termed; that is, to have a range of stalls along each wall, with a space between, for persons to pass to and fro. Stables of this kind are very improper; the space between the two ranges is often so narrow, that when the opposite stalls are occupied at the same time, the horses can reach each other with their hind feet, especially when standing, as they often do, at the full length of their halter. Hence, in the contests that often arise between quarrelsome or mettlesome horses, very severe bruises, and even lameness, are not unusually the consequences of the animals being within each other’s reach. The danger that threatens passengers in these narrow spaces is also not small; we have often trembled when obliged to pass between two rows of horses, kicking and wincing under the curry-combs, where the intermediate space did not exceed three or four feet. If double-headed stables must be used, the space between the ranges of stalls should be at least eight feet.

The roof of stables should not be low; for, as the foul and vitiated air, generated by respiration and the exhalations of animal bodies, naturally ascends to the highest parts, the horses, who usually carry their heads very high, are, when the ceiling of the stable is low, fully exposed to the noxious influence of this vitiated atmosphere. This is not the place to enlarge on the vitiation that the air undergoes from the action of the animals that are confined in it; this subject has been already fully considered in the article Chemistry when speaking of respiration; and, from what has been there delivered, the reader will see the necessity of pure air to horses and other animals as well as man, and will be able to judge of the propriety of the above maxim, and some others which we shall presently lay down.

The walls of the stable should be of stone or brick, and, by no means of wood; they should also be left bare, or at least only covered with plaster. The temperature of the air, in buildings of stone or brick, is much more equable than in those built of wood, they are not so easily penetrated by the heat of summer or the cold of winter, and they are also attended with another important advantage, that they resist the spreading of fire.

The stables in which the horses are to stand should be divided from each other by strong wooden partitions, that should rise sufficiently high to prevent the horse from stepping over, but not so high as to impede the free circulation of air, and admission of light from one stall to another. The breadth of each stall should be such as will freely admit of the horse turning himself, and stretching at his full length when he lies down; but they should not be so wide as to allow of his kicking against the partition. The floor of the stall should have a gentle declivity, from the manger backwards. This allows the urine and water to run easily off; it also relieves the fore quarters of the horse, and adds much to the grace of his appearance behind. Too great a slope, however, must be avoided, as when the declivity is too rapid, all the weight of the horse is thrown on his hind legs; and, as it is extremely uneasy for the animal to remain long in this position, he is obliged to press his body forward, which he cannot accomplish, without keeping the hind legs always on the stretch; the pastern-joint, from its situation, receives the whole additional weight, and the ligament which connects it is invariably strained in all horses which are kept in this sort of stall for any length of time.

A slope of one inch in six feet will be sufficient to answer every purpose.

This declivity should terminate in a hollow space a few inches from the end of the stall, forming a sort of gutter, extending the whole length of the stable, and passing out through the wall at each end, where iron bars should be placed, to admit of the water &c. passing out of the stable, which is the intention of this gutter, but preventing the intrusion of rats, and other noxious animals.

The floor of stables is commonly paved with stone, floor, or hard bricks made for that purpose. This kind of flooring has the advantage of being more durable than any other; but it is not without its inconveniences. The stones or bricks become smooth by wearing, and, when the stable is wet, the horse, especially if he be very frisky, is apt to slip, and endanger straining or otherwise injuring his limbs. Again, by the pawing, or stamping, to which these animals are often subject, the pavement may be loosened or broken. For these reasons, it would perhaps be better that at least the stalls should be floored with strong oakum planks well seasoned, and laid across the stall, with their extremities below the partitions, and having their joining edges accurately adapted to each other. A flooring of this kind has the advantage of being more elastic, and of preserving a more equable temperature than pavement; and it is not liable to the inconveniences which we have mentioned, as attending this latter. A wooden flooring is indeed expensive, but this is more than counterbalanced by the advantages to the horse. It is of little consequence how the rest of the stable is covered; some gentlemen floor their stables with a sort of cement, which in course of time becomes as hard as stone, and has the advantage of being perfectly smooth and even. The gutter should of course be well paved.

The manger for receiving the horses corn should be about a foot broad, and five or six inches deep. The manger is usually made of wood, and when this is the case, the boards composing it should be so closely joined, that the corn cannot get through between them. The front of the manger should rise about three feet, or a little more from the ground; should slope a little, and should terminate above by a strong rounded border. This, if the manger be made of wood, should be covered with tin plate, or white iron, as horses are very apt, when without food, or when allowed to remain long in the stall, to bite the front of the manger, and thus acquire a very bad habit, which farriers call cribbing. Some choose to make the manger of stone, which...
which has the advantage of wood in being more durable and cleanly, wood acquiring by use an unpleasant smell, and being soon rotted by the moisture of the food, which it often receives. The bottom of the manger should slope a little forwards.

The manger is sometimes made to extend the whole length of the stable, when it is in general divided into several cavities, one for each horse. It is of little consequence whether it be one continued cavity, or whether there be a separate manger for each stall; but the manger should by no means be supported on legs, so as to make it moveable, as is sometimes done: as this prevents the litter from being conveniently stowed below the manger, and exposes the horse or the manger to accidents. It should therefore be firmly fixed at the back to the wall of the stable, and to each partition of the stall. Sometimes a hollow is made at one end of the manger, or at one end of each division of it, for the purpose of holding water. When this is done, there should be a hole in the bottom of this cavity fitted with a plug, to draw off the water when the horse has done drinking, or when the manger has been washed.

In the middle of the front of the manger, in its thick edge, there is usually fixed an iron ring, turning easily in an eye bolt, for the purpose of passing through the halter, by which the horse is fastened. Sometimes, instead of this ring, a hole is made through the border of the manger for the halter to pass through; but as the halter does not slip backwards and forwards easily through such a hole, and wears very fast by rubbing against the wood, the iron ring is to be preferred. The horse should always be fastened in such a way, that as the halter shall slide backwards and forwards with every motion of the horse's head; and he shall be on no account be tied by the halter, as this exposes him to accidents, by twisting the halter about his neck or legs.

The rack should be placed at such a height above the manger, as that the horse can easily reach it, to pull out the hay; it should be very strong and firmly fixed, and should incline a little outwards from the wall of the stable. The bars of which it is composed, should not be above four or five inches asunder, that the hay may not fall out and be wasted.

One circumstance particularly to be attended to in the construction of stables is, to preserve a free circulation of air.

The generality of stables are by much too close and warm; not a chink is left for the free admission of air; the door and windows (if there are any), are made so close, as perfectly to exclude the air; or, if this is not the case, the crevices are frequently stopped with hay, under the idea that the horses cannot be kept too warm. This is a most absurd and mistaken notion; and is contradicted both by reason and daily experience. When we consider that horses in a state of nature, or even in their usual pastures, are perpetually exposed to the open air, and that, under these circumstances, they are more vigorous and active than under the most attentive care of their masters, we must be convinced of the impropriety of keeping them for hours together in the foul and heated atmosphere of the ordinary close stables. Whoever enters one of these stables when the door is first opened in the morning, after it has been closely shut up all night, will be able to judge from his own sensations, whether such an atmosphere can be wholesome to the animals that breathe it. Besides the great heat of the stable, which, if many horses have been shut up in it all night, is nearly intolerable, the air will be found highly impure from the continued respiration of so many animals, and the steams arising from the exhalations of their bodies, which have probably sweated profusely from having been so long confined in an atmosphere so foul and heated. Add to this the impregnation of the air by the effluvia arising from the litter, &c.; and it is not easy to conceive a more unhealthy situation for an animal, who, to perform the offices required of him with activity and vigour, should be in the full possession of all his strength. Now it may easily be supposed, that such an air as we have described, cannot be calculated to strengthen the body of the horses. On the contrary, it must be in a high degree weakening and relaxing. In this relaxed state, the horse is probably taken out immediately into the open air, whatever may be the season or weather, and made to enter on his daily task. The effect which such a sudden change must have on the constitution of the strongest horse, need not be described. The sudden action of the cold and probably moist air on a body that has been exposed for so many hours to the heated air of the stable, must be productive of the worst consequences to the health and vigour of the animal. Accordingly, fevers, colds, rheumatism, asthma, and a number of other formidable diseases, may be traced to this debilitating source.

We should think, that the analogy of nature would have taught men to avoid such absurdities. We learn from those authors who have written on the natural history of the horse, that the Arabsians, who live in tents, and are extremely careful in the management of their horses, allow them to stand all day, when not employed, at the door of the tent; and at night bring them within the tent, where they lie down in the same apartment with their master and family, sheltered indeed from the dews of the night, but freely exposed to the circulation of air that must constantly prevail in these temporary dwellings.

To avoid the inconveniences arising from confined Mode of air, the stable should be made high and roomy; the ventilator, door and windows should not be made too close; and the stable should be provided with proper ventilators. Perhaps a good method of preserving a free circulation of air in the stable at all times, would be to carry up a fine diagonally through the wall at each extremity, terminating above in a sort of chimney; and below, within the stable, in an opening sufficiently wide in any part of the wall that is not immediately within the stall.

The free admission of light into stables is nearly of the same consequence as that of air. It is a very erroneous opinion which is maintained by some grooms and stable-keepers, that horses feed best in the dark. These animals naturally love the light, and are much more cheerful and spirited in stables where this is freely admitted, than in the dark and dismal bowels that we sometimes find attached to inns and farm houses. There is one bad consequence that follows keeping horses in a dark stable, which does not appear to be sufficiently attended to. By being kept so long excluded from the light, the horses eyes become weak, and unable to support the full glare of open day. The pupils being so long...
long habituated to an unusual degree of dilatation, do not readily contract when the animal is brought out into the open air; hence, his eyes being offended with the strong light, to which he is so little accustomed, are perpetually winking and watering; the horse appears as if half blind, and starts and stumbles at almost every step.

The stable should, therefore, be furnished with glazed windows, in number proportioned to the size of the building. In general, no stables should have fewer than two windows; and they should be placed in such a situation, as that the horses may not receive the rays of light too directly on their eyes. Where the stable has only one range of stalls, this point can be easily effected, and in such stables, the windows should always be placed at the back of the horses. But in double stables, it is not easy to place the windows so as not to inconvenience some of the horses, since, on whichever side of the stable they are made, the horses on that side are exposed to the full glare of the light; another argument against double stables. The windows should by all means be sashed; and should be made to draw down from the top, as well as to be thrown up from below. They should not be made too small, and should be near the ceiling of the stable, as is compatible with the strength and symmetry of the building. Windows constructed in this way not only add much to the appearance of the stables and to the comfort of the horses; but they afford one of the best means of promoting a free circulation of fresh air through the stable. For by throwing one of them up, and drawing another down, the ventilation becomes nearly as complete as possible.

Nothing has astonished us more, when viewing the handsome offices attached to some of the gentleman's houses in this country, than to see the deficiency of the stables in the article of windows. When viewing them from without, we have congratulated the animals confined in them on the comfort of light and air, which they must enjoy from the fine sash-windows, which we saw on each side of the stable doors. How great has been our astonishment on entering the building, to find all gloomy and dark within; and that the sash-windows which we thought to have admitted a distance, were nothing but efforts of the painter to deceive our senses, and to present an appearance of what certainly ought to have been a reality!

We must be permitted here to draw what we hope will not be considered as an invidious comparison between the Scotch and English method of lodging their horses. In England we have rarely seen such miserable bovets as, in many parts of Scotland, are used to supply the place of stables. We have indeed in the former country seen the stables sometimes very small, or even consisting of a thatched building not very well defended from the weather; but they are for the most part tolerably well ventilated, and we believe scarcely ever without windows.

It is a common practice to build stables of two stories, the upper story forming a loft for the purpose of keeping the horse's hay and corn; and in gentlemen's stables, where the building is sufficiently large, it is usual to have apartments on the upper story for the grooms and other servants employed about the stables to sleep in.

The apartment employed as a hay loft has usually a vacancy in that part of the flooring which is immediately over the rack, for the purpose of more conveniently supplying the horses with hay. This mode of building stables has its convenience in an economical point of view, and these apartments in the upper story add much to the showy appearance of the buildings; but there are several material objections to this construction.

1. The hay and corn being kept immediately over the stable, are constantly exposed to the foul and heated air and putrid steams rising up from the stalls through the rack, and are thus rendered liable to be heated and mildewed; whilst the dust rising from the shaking of the hay into the rack is very prejudicial to the lungs of the horses. On this account, it is much better, where this can be conveniently done, to keep the hay and corn in some place distinct from the stable, and bring from time to time a sufficient quantity of hay nearly to fill the rack, into which it might be put while the horse is abroad.

2. Another serious objection to having lofts and chambers above the stable, is that the building is thus much more exposed to accidents from fire, owing to the combustibility of the corn and hay. And,

3. Those apartments above the stable render the latter much too close and warm.

Where, from convenience or fancy, a gentleman chooses to build his stables in the manner which we have just described, it will be advisable to have the flooring above the stable made as close as possible, and covered with thin bricks or stones for the purpose of checking the progress of fire; and for preserving the hay and corn as much as may be from the steams of the stable, a partition wall may be raised from the extremity of the flooring immediately over the rack all the way to the roof of the loft, with a door opening over the rack in each stall. The entrance to the hay loft or chambers above the stable should be without, and by no means, as generally the case, by a trap door and ladder within the stable. If, as we frequently see in gentlemen's offices, the stables are built on each side of the coach-house, the entrance to the rooms above may be conveniently made by stairs from the coach-house.

The building of which the stables form a part, should be as much as possible detached from other buildings, so as to admit of a free circulation of air all around.

It is a vile practice, which is common on many farms, to have the dung-hill or midden close to the stable. This nuisance should be removed as far as possible from the door and windows of the stable, as the heat and offensive vapours arising from the fermenting dung impregnate the air to a considerable extent.

It is of great consequence that the stable be kept swept and cleaned. It should therefore be regularly swept every morning, and every part of the litter that is wet and dirty should be removed to the dunghill, while what is clean and dry should be put up close below the manger, unless where the horses are lame, or has any affections of the feet or limbs, which renders it necessary for him to stand upon soft litter. Where the horse is perfectly healthy, no litter should be allowed in the day time, much less should the stall be crammed with litter, as is often done, and is suffered to remain in this situation for many days, for the purpose of increasing the quantity of manure. Nothing injures the feet
FEET of horses more, or more frequently produces softness of the hoof, canker, and greasy heels, than allowing them to stand night and day on hot fermenting dung. It is also impossible for the horse to lie down in comfort in such a hot bed; and if the poor animal is obliged to recline himself for a time, he is soon compelled to rise again, and repeatedly making the same attempt to rest, and finding it impracticable, he is forced at length to stand altogether, perhaps shifting his legs from one part of the stall to another, to avoid the heat of the dung.

Lord Pembroke is of opinion that after working, and at night of course, as also in lameness and sickness, it is good for horses to stand on litter; it also promotes walking. At other times it is a bad custom; the constant use of it heats and makes the feet tender, and causes swelled legs. Moreover it renders the animal delicate. Swelled legs may frequently be reduced to their proper natural size by taking away the litter only, which, in some stables, where ignorant grooms and farriers govern, would be a great saving of physic and bleeding, besides straw. "I have seen, (says he), by repeated experiments, legs swell and unswell, by leaving litter, or taking it away, like mercury in a weather-glass."

It is a very common practice to keep horses, while in the stable, covered up with warm clothing. This is in some cases necessary, especially when they are under a course of physic, or are otherwise so delicate, as that they would be liable to injury from too much exposure to the air. But its indiscriminate use is highly improper, as it tends to render the horse too delicate, and exposes him to the danger of catching cold whenever he goes out into the air. While a horse is in complete health, and stands idle, he requires very little, if any covering, unless the stable be extremely cold, or ill sheltered. When indeed he comes into the stable, much heated by violent exercise or hard labour, it may be proper to throw over him a single cloth, that he may cool gradually. Some grooms think it necessary, besides enveloping the horse with body clothes, to gird them fast round the belly with tight rollers; and this is done with the view of taking up the horse’s belly, as they term it. The practice is exceedingly absurd, for these tight rollers impede the circulation in the superficial veins, produce difficult breathing, and if they be applied, as is often the case, after eating, they greatly obstruct digestion.

To finish the subject of stable economy, we have only to make a few remarks on currying, or dressing horses.

Friction employed on the horse’s skin is not only necessary to keep him clean, and to promote the incensable perspiration, by freeing the skin and hair from impurities, but it is exceedingly useful when considered as a kind of exercise. It promotes the free circulation of the blood, which is much impeded by the horse standing long idle in the stable; and it much improves the appearance of the horse’s coat. Horses should therefore be regularly dressed, at least twice a day.

There are, however, some cases in which general friction ought not to be employed; such are cases of internal inflammation, especially of the bowels; or when there is a discharge of sharp ichorous matter from any part, especially the legs and heels. In these cases the affected parts should not be rubbed, as it would tend to increase the pain and distress arising from the inflammation.

2. Of Cow-houses, or Byres.

After what we have said on the construction of stables, we need not here enlarge on that of cow-houses or cattle byres, as these buildings, so far at least as respects their outsides, are constructed on similar principles. We shall take occasion, when treating on the manner of feeding cattle, to describe a byre that appears to us to afford a good model for buildings of this kind.

It is of material importance in the wintering of young stock, to keep them more warm, and sheltered from wet, than is usually done, as by means they thrive faster, with a less consumption of food, than in the contrary circumstances. This may be effected, either by tying them up in stalls, in houses for the purpose, or by keeping them in good sheds in well enclosed yards.

The question of feeding the cattle tied up, or loose property in the yards, in winter, has not been yet decided of tying. Each method has probably advantages. In the first, cattle thrive better than when left at liberty to run about the yards. Mr. Marshall found that in Yorkshire, cattle kept tied up, and regularly fed with straw in a moderate proportion, did better than in the southern parts of the island, where left loose in the midst of greater plenty. Whether this effect is to be ascribed to the greater warmth, the resting better, or the being fed more regularly, and eating with an appetite, he cannot determine. Some experiments of Mr. Young’s also lead to the conclusion that cattle stock thrive better when tied up. They likewise show that the practice of tying up is the only one that can be had recourse to, where straw is not in great plenty, and the quantity of the stock very inadequate to its consumption.

In the latter method there is the advantage of a large supply of manure, especially where the farmer has the convenience of litter. Where however the farmer has convenience, the former method is probably in general the most beneficial. In either mode of management much attention is necessary to keeping the stock constantly supplied in an evenly proportioned manner, as in this way there will be great advantage, both in the saving of food, and the condition of the animals.

The necessity of providing shelter for cattle in bad weather, is now we believe pretty well understood by every intelligent farmer; and experience has proved that proper buildings erected for winter feeding are attended with considerable advantages. The erection for this purpose at Hafod in Wales, the residence of Thomas Jones, Esq. M. P. for the county of Cardigan, and one of the most eminent improvers of the present time, seems to be calculated upon a moderate scale. The whole length of the building is fifty feet, the roof shelving, its chief height being fourteen feet, the lower extremities, one seven and a half, the other six feet. A stone wall running up to the summit, parts the feeding-house from the other and smaller apartment, which is a receptacle for dung. Width of the feeding-house, nineteen feet wide within. Stalls each twelve feet long by four feet two inches wide. Gangway three feet and a half, at the heels and tails of the cattle, leading from the doors, the first door being for the cattle, the other
for the attendants. Similar doors at the opposite ends of the building. Running water in troughs, with racks, and mangers. The cattle lie on wooden platforms, perforated for the passage of the urine. The urine runs, and the dung is pushed through apertures in the wall, each of which is two feet square, and one between every two stalls. There are 12 wooden flaps or windows to give light and air, to each stall. The dung pit is about twelve feet wide, sunk some feet deep in the earth, extending the whole length of the building. The walls are built partly with stone, and in part with wood, the roof with larch wood, as an experiment of its durability in that exposure.

According to Mr. Lawrence, the round or quadrangular form might perhaps, either of them, be more economical as to space and materials for a building to contain a considerable number. The oxen would most conveniently stand around with their tails toward the wall, contrary to the usual practice, for the more easy throwing out the dung from a gangway, through apertures purposely made in the wall, into a pit, under cover, sunk around the building. The area within would, of course, be for feeding, and every necessary purpose of attendance. A store-chamber above completes the building, the chief objection to the form of which is the greater expense attendant upon the reversed position of the cattle, which perhaps is compensated by the greater saving of labour, in the more easily getting rid of the dung. The gangway will in course be sufficient to admit the beasts to and from their stalls; the dung aperture in the wall may be closed in cold weather.

Of all domestic animals, sheep are the most exposed to the inclemencies of the weather. This arises chiefly from their numbers, which renders complete shelter very difficult; but even in the case of a small flock, the prejudices of many feeders have prevented their procuring proper shelter for their sheep, under the idea that it would render them too lazy to provide for themselves. These prejudices, however, are gradually wearing away, and few sheep-farms are at present unprovided with shelter, either of trees or buildings. Mr. Findlater, in his able survey of Peebles, strongly recommends shelter for sheep. "It would be (says this gentleman) for the interest of every proprietor of sheep-farms, to cause the farmer to rear shelter of trees, by allowing him the weodings of the plantation, and becoming bound to pay the farmer, at the rate of perhaps eight-pence or ten-pence a piece, for every tree left standing at specified distances, at the expiry of his lease; such interest communicated to the farmer, would give the most effectual security for the protection of the trees. Shelters are also procured by buildings, enclosing a square open area in the middle, furnished with sheds on every side. Stalls (that is circular spaces of area, proportioned to the size of the flock, enclosed by a five or six feet wall of stone, or sod, without any roof) were the primeval shelters invented by our forefathers. The circular figure of the building causes the drifting wind in snow storms to wheel round it, without rising over it, and depositing the snow in the calm region within. The sheep are fed, in winter storms, with such provision as can be procured, under the trees, in the sheds, and within the circles. Even where no feeding is administered, much advantage results to the animals, from mere defence against the weather; and they are much the more alert in searching for natural food, so soon as the storm ceases. The mode of acting of the sheep gives a pretty certain indication of the weather to be expected: Upon the near approach of a storm, those accustomed to shelters are observed to make for their shelters. Upon the near approach of thaw, their pre-sentiment leads them to be less industrious in digging the snow for food, as if conscious that such labors was no longer necessary."

According to Mordaunt, who wrote about the middle of last century, sheep pens and houses were then not uncommon in Essex and Gloucestershire. He directs the pens to be made at some convenient corner of a pasture, or where several fields, commons, or pastures meet, so as to be common to all them. They should also be erected on a dry spot of ground, and stones laid at the bottom to keep the sheep dry and clean, whilst under examination. The pens to be divided into partitions to hold about forty sheep.

"The sheep houses, for warmth in the winter season, are made low, and a third part longer than broad, and rather large, the sides lined with firze or boards, for warmth; the bottom laid with large stone slabs, and very level, that the urine run not away, but soak into the litter. It would be proper to have the sunny side well lined with moveable hurdles, that when the sun shines it may be laid open to give the sheep a refreshment, by letting them into some close or croft, where in the sheep-house stands: the house to be well covered."

3. Of Dog-kennels.

It is usually recommended to erect a particular building, for the sole purpose of a kennel; and certainly where the proprietor's fortune will admit of it, such an appropriate building is to be preferred. A common barn has, however, often been employed as a kennel: and Mr. Daniel says, that the excellence of the bounds kept in such a building has been rivalled by few that were lodged in the most sumptuous edifices.

Whatever may be the form or original intention of the building, cleanliness is absolutely necessary, both to the nose of the bound and the preservation of his health. The sense of smelling is so exquisite in a bound, that every stench must be supposed injurious to it; upon that faculty all our hopes depend, and nostrils clogged with the effluvia of a dirty kennel, are ill adapted to carry the scent over greasy fallows, or guide one through the soil of deer, or over ground tainted by sheep. Dogs are by nature cleanly; where they lie, if they can avoid it, they seldom dung. Air and fresh straw are essential to preserve them healthy. They are subject to the mange; nastiness very much contributes to this, and although at the first appearance it may be easily checked, the remedies that are used are in themselves strong in their operation, and will do no good to the bounds constitution. Let the cleanliness of the kennel, therefore, be carefully attended to; a resort to these remedies will then be unnecessary, and all injury to bounds from this source will be prevented.

On the presumption that a kennel is to be erected, its site is strongly pointed out by Somerville.
FARRIERY.

Upon some little eminence erect
And fronting to the ruddy dawn, its courts
Time waste not by; for the sun’s all-cheering beams, when mild he shines
And gilds the mountain tops.”

But this selection of a high situation is incompatible with a running brook; and as these two advantages cannot be united, water is to be preferred, with the aspect to the morning sun as much attended to as possible.

The number of its inmates must determine the size of the kennel; and the architecture should be neat, without being uselessly expensive. The most magnificent is the duke of Richmond’s at Goodwood, which cost 19,000l. and is sufficiently extensive for two packs of hounds.

The building comprises five kennels, two 30 by 15, three 30 by 15, and two feeding rooms 20 by 15 feet, with stoves to warm the air, when too cold. The huntsman and whipper-in have each a parlour, kitchen, and sleeping-room.

The nearer to the house the kennel is placed the better. There are reasons against its too close approach, but they yield to others which forbid a great distance. To mention one, derived indeed from a vulgar saying, “that the master’s eye makes the horse fat,” recollect that the inspection of the kennel is even more necessary than that of the stable; for in both, cleanliness is no less essential than food.

The kennel should be of sufficient dimensions at its first building room for two kennels should be under the same roof; when there is but one it is seldom sweet; and when washed out, the hounds, particularly in winter, not only suffer during the time of cleaning, but as long afterwards as it remains wet. The second kennel affords opportunity for drafting the hounds intended to hunt the next morning. In a few days they will be drafted with little trouble, will readily answer to their names; and with equal ease as a shepherd numbers his sheep, you may count your hounds into the hunting kennel.

In a morning, upon the feeder’s first entering the kennel, he should let the hounds into the outer court; the door of the hunting kennel, when not occupied by the drafted hounds for that day’s hunting, should be opened in bad weather to shelter them; the lodging-room should then be thoroughly cleaned, the windows and doors opened, the litter well shaken, and the kennel made sweet, before the hounds are again shut into it. Every omission prejudicial to the hounds should be immediately pointed out to the feeder, who must be made to remedy it; and also observe that the great court and the other kennels are equally objects of his attention.

The lodging-room should be bricked, and sloped on both sides to the centre, where should be a gutter to carry off the water, that when washed, the floor may be equally dried: but flag-stones, or large square bricks termed pommades, are far preferable; there are fewer interstices, and consequently less filth or water can there accumulate, and the surface is sooner dry. Let the floor be kept in thorough repair, that no water may remain in any cavity, until the mason can be had, when at any time wanted; let the stagnant water be carefully stopped up; for nothing is more hurtful to hounds than damp, or more refreshing than warmth after hard work.

The kennel should have three doors; two in front, and one behind; that in the back to have a lattice window in it, with a wooden shutter, which is to be kept always close, except in summer, when it should be left open the whole of the day. This door has a twofold utility, it serves to carry out the dirty straw, and being opposite to the window, will admit a thorough air, when the lodging room is cleaned, which will much contribute to render it sweet and wholesome. The front doors will be useful in drying the room when the hounds are out; and as one is to be shut and the other hooked back, so as to allow a single dog to pass, they are not liable to any objection. The large centre window should have a folding shutter, which at night, according to the weather, may be wholly or partially closed; and thus the warmth of the kennel may be regulated as is judged most salutary. The two great lodging rooms are exactly similar, and having a court belonging to each, are distinct kennels situated at the opposite ends of the building. In the centre of the boiling-house and feeding-yard, a lesser kennel, either for hounds that are drafted off, hounds that are sick and lame, or for any other required purpose; at the back of which, being but half the depth of the two larger kennels, are places for coals, &c. for the use of the kennel. There is also a small building in the rear for hot bitches.

The inner court floor should be bricked or flagged, and sloped towards the centre like those of the lodging-room; and water brought in by a leaden pipe, should run through the channel in the middle. In the centre of each court is a well sufficiently large to dip a bucket for the purpose of cleaning the kennel. To keep these from wanting repair, they should be faced with stone, and to that of the feeding-yard a wooden cover should be fixed. The benches, which must be open to let the urine through, should have hinges and hooks in them, all, that they may fold up when the kennel is washed. They should be made as low as possible, that when a bound is tired, he may have no difficulty in jumping up, and at no time be able to creep under them. Recollect that, owing to the smallness of the bound, as in beagles, it should be difficult to make the benches sufficiently low, it will be proper to nail a legging projecting downwards in the edge, or the benches may be faced with boards at the bottom, to prevent bounds from creeping under.

A large bricked court in front, having a grass court adjoining, and a brook running through the middle of it, completes the kennel. This court should be planted round, and also have some lime trees and some horse chestnuts near the centre for shade. Some posts bound round with straw, rubbed with galbanum, may be placed so as to prevent the bounds from making water against the trees. The brook may be used as a cold bath for hounds lamed, in the stile, in strains, or for other purposes for which the cold bath is required. A high paling should inclose the whole, and which, to the height of four feet, should be close, the remainder being open, with an interval of two inches between the palings. At the back of the kennel should be a thatched house, fenced at the sides, to contain at least a lead of straw,
FARRIERY.

The species of corn usually given to horses in many countries is barley, the bulky provender is straw, both of which, in warm climates, are said to be nearly equal in nutriment to our oats and hay. With us, barley is apt to scour horses, and make their urine red, especially at its first being given. Wheat is often given to horses of the great upon the continent. It is said when Philip of Spain was in this country, his jennets were fed upon wheat during the time of scarcity, and this gave great umbrage to the people.

There seems to exist no particular difference of quality between the white and the black oats, they being equal in weight and thinness of husk; these criteria, and their being short, are the best marks of their goodness. It is equally well known that they should be some months old when used, as new oats are apt to swell the belly and produce gripes.

New beans are improper for horses, for the same reason. The best remedy is to dry them in a kiln. Old beans should be split, and given either with bran or chaff; or the best way would be to break them in a mill. Mr Lawrence fed cart-horses with beans for nearly seven years, without experiencing any ill effect from such food; but the horses laboured very hard. Beans contain more solid nourishment than oats, but of a less salubrious nature.

Grains constantly loosen a horse, and impoverish his blood; bran scour and weakens the antrailes; both of them are good occasional dietetic alternates.

Carrots are said to purify and sweeten the blood, to amend the wind, and to replenish after the fastings occasioned by disease or inordinate labor. Mr Lawrence informs us that he has been accustomed to use them for years in all forms, and to all descriptions of horses. They are either given in spring or autumn to high fed horses, as a change of diet, at the rate of one feed per day, in lieu of a feed of corn, or as full subsistence to others. They ought to be washed clean, and, if large, cut into flat and n一体able pieces. The quantity of carrots for a feed is from half a peck to a peck.

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The usual periods of feeding with corn are in this country, morning, noon, and night. The quantities feeding each time either a quarter or half a peck, with or without about two handfuls of beans, according to the horse's state of body. Much greater care than is common ought to be taken in sifting the oats clean from dust, and the dung of mice. Water should be allowed without fail twice a day. There is an error not unfrequent among stable people, who suppose water to be at best but a kind of necessary evil to horses, and therefore think it a point gained whenever they can find an opportunity to abridge the quantity. But however a horse may shift with little or no water while in the field, and while feeding on succulent meat, much mischief may ensue from its being withheld; and this may produce constiveness, gripes, inflammation of the bowels, perpetual longing, and a danger of drinking to excess on every opportunity.

The well known use of hay is to dilate the body of the horse, to satisfy his appetite with bulk and quantity, as corn does with compact and solid nourishment. British hay, the best in the world, contains great nourishment.
nourishment, and will keep a horse and even fatten him; but he is unable to labour upon hay alone, and experience has shown that Bracken's observation of the constant use of hay injuring the sight of horses, particularly if suddenly put on such food after good keeping, is very just. Hard upland hay is the best for race and coach horses; and it should be of a fine greenish colour, fragrant scent, and full of flower. It is said that horses and cattle prefer such hay as has been sweated, or which has undergone a partial fermentation; and it is even thought that they grow much sooner fat on heated hay than on such as has been gotten up dry and cool. There can be no doubt that sweated hay contains a considerable quantity of sugar, formed during its state of fermentation; this may render the hay more palatable to the beasts, but we have some doubt whether it be so wholesome as fresh well-coloured hay. Clover-hay, and hay of artificial grasses, from its grossness, is appropriated to cart-horses. Without attempting to ascertain the precise quantity, it may be said that hay should be given as often as a horse has a keen appetite for it; but great care should be taken that so much be never allowed at once, as that he shall leave it, and blow upon it. At night a considerable quantity of hay is usually left in the rack, and this is no doubt absolutely necessary for horses who are hard worked during the day, as night is their most leisure time for feeding; but it admits of doubt whether horses who live in a state of luxury, and are but little worked, should be indulged in much hay at night. 

It will obviously occur to most people, that the quantity and quality of a horse's food should be proportioned to his labour: that horses who are lightly worked, will not in general require so much or so nourishing food, as those who are constantly kept to hard labour. It is evident that when horses stand idle, and are at the same time high fed, they are exposed to many dangerous diseases, as inflammation, staggering, arising from a too full habit of body; and these diseases will be more likely to come on when a horse has been fed he suddenly put to hard labour, or obliged to make any unusual or violent exertion. But this must not be carried too far. Horses should not, because they have little work at the time, be entirely confined to grass, or grass and hay, unless they are at pasture, and are never worked. For while a horse stands in the stable, and is liable to be called upon any emergency, his diet should be so regulated, as that he shall neither be so fat and full of blood, as not to perform occasional work without difficulty and danger, nor, on the other hand, so poor and weak as to be incapable of supporting exertion without injury to himself or rider. All horses that are fed on grass and hay alone, are too weak to perform a good day's journey without stumbling. A moderate quantity of corn or other hard food, should therefore be allowed to such horses as stand constantly in the stable, or who, while at pasture, are occasionally worked.

Mr Clark observes, that throwing great quantities of clean grain before horses at one time is very improper; as they eat it too greedily, and swallow whole mouthfuls of it almost dry. The moisture in the stomach, or water drunk immediately after eating, causes the grain to swell, and thus the stomach is greatly distended, and loses its contracting power on the food. By the pressure of the full stomach on the intestines, the passage of the food backwards is obstructed, and the confined air, arising from the digested food, not having a ready passage backwards, and horses not possessing the power of belching, the air becomes rarified to a great degree, the horse is seized with colic pains; as these increase he becomes convulsed, and in many cases the stomach bursts. Out of a number of cases where the above was discovered on dissecting the bodies, Mr Clark mentions the two following.

"A young draught-horse was fed in the morning with too great a quantity of barley mixed with pease, and had been allowed to drink water immediately thereafter. He was yoked to a two-wheeled chaise, in order to travel a few miles, and was observed about the middle of the day to be very uneasy, frequently attempting to lie down. As soon as he was unyoked he lay down and tumbled about, frequently lying on his back, starting up suddenly and turning his head towards his belly. He continued thus in great agony till towards next morning, when he died. Upon opening his body, the stomach was found burst, the barley and pease mostly entire, only greatly swelled, and the whole contents of the stomach spread through the abdomen.

"The other case was a horse who had been fed with too great a quantity of oats and barley, and had been allowed to drink water freely afterwards. He was seized with griping pains, so that he frequently lay down and tumbled, seemingly tortured with the most acute pains. He died next day. Upon opening his body, the stomach was found distended to a most enormous size, but was not burst. Its contents were so very thin, from the great distention it had undergone, that its cohesion was almost destroyed, and had more the appearance of a coat of mucus or slime, than the stomach. The oats and barley were for the most part entire as they were swallowed, only greatly swelled from the moisture they had imbibe.

From the cases now related, it will appear how necessary it is not to allow horses to eat too great a quantity of clean grain at a time, but to give it in small quantities, and repeated the more frequently. At the same time, it will show the propriety of mixing with it a little chopped straw, or hay, in order to make them chew it the more thoroughly before they swallow it. This process also prepares the food for being properly digested, and not a single grain of it is lost."

The method of feeding horses with bruised grain and oat straw is recommended by the earl of Pembroke, in his excellent treatise on horses, as exceedingly proper.

"Every grain (says he) goes to nourishment: none is to be found in the dung; and three seeds of it go further than four as commonly given which have not been in the mill. But wheaten straw, and a little hay sometimes mixed with it, is excellent food. To a quantity of corn, put the same quantity of straw. It obliges them to chew their meat, and is many other ways of use."

Mr Lawrence disapproves of the use of straw, as containing no nourishment. In this he probably goes too far, as both horses and cattle are in straw-yards often fed with little else. He prefers chaff, or cut clever hay, to mix with the corn, especially for cart-horses. Mr Lawrence, however, allows that cutting
up unthreshed oats for food is a good practice, particularly when hay is scarce; as threshing and dressing of the oats are thus saved, and it is an economical expenditure of the oats, which are moreover very fresh, and agreeable to the horse.

It has of late been recommended to bruise the corn in a mill, before giving it to the horse, and it is certainly a good practice, as there is thus little danger of its passing through the bawls undigested. It is usual to mix the corn, but Mr. Lawrence finds that it is better to grind them as fine as possible. Whole corn, with whatever it may be mixed, will, much of it, be swallowed in that state; a great deal only half masticated, which will eclude the digestive powers of the animal, and be ejected from his body crude and unbroken. This is particularly the case with the brood mares and young stock, the bellies of which are full of slippery grass; such should ever have ground corn, and masses should always be made with it. Ground buckwheat agrees well enough with horses, but that species of corn is the least substantial.

Mr. Lawson, a merchant of London, has lately published an essay, on the use of Mixed and Compressed Cattle Fodder, intended as food and fattening for horses, oxen, sheep, and hogs. His plan is, to grind, cut, mix, and compress, all the articles in present use, as food for cattle, with some additional ones of his own recommending; and to keep the mass stowed in casks, or other close storage. He gives a detailed account of all the instruments necessary in the process, the commodious methods according to his practice, and various tables of expense and quantities.

With respect to the drink of horses, we have little to remark. Their water should be as pure as possible, as muddy and hard water is not only very unpleasant to the horse, but probably lays the foundation of gravelly complaints. It is a very absurd custom, which is however very prevalent, to gallop the horse after watering, with the view, according to the groom's idea, of warming the water in his belly; for if the horse has drunk heartily, as he is very often improperly allowed to do, any violent exertion immediately after cannot but occasion great uneasiness. It is, however, a good practice to ride the horse moderately before watering; but care should be taken, not to throw him into a perspiration, as drinking cold water in this state is attended with considerable danger.

The feeding of cattle is of considerable importance to the farmer, and has of late been much improved. Both the food and the manner of administering it must be different according to the age of the cattle, the season of the year, and the purposes for which the cattle are fed. It has been well observed in a late useful practical work, that in the winter the yearlings should "be fed with hay and roots, either turnips, carrots, or potatoes; and they should be thoroughly well fed, and be kept perfectly clean by means of litter. At this age it is a matter of great consequence to keep such young cattle as well as possible; for the contrary practice will inevitably stop their growth, which cannot be recovered by the best summer food. If hay is not to be had, good straw must be substituted; but then the roots should be given in greater plenty, and with more attention. To steers and horses two years old, the proper food is hay, if cheap, or straw, with baits of turnips, cabbages, &c."

Mr. Donaldson thinks the advantages of green winter food for live stock, so great, that there is no way in which it can be applied with greater benefit than "by giving the young cattle a daily allowance during the first two or three winters." Whenever straw is employed as fodder for young stock, without the above sorts of food, if it be not very good, or slightly mixed with some grassy material, a little hay should always be blended with it, in order that it may be preserved in proper condition. It is also of consequence that the animals be served with this sort of fodder, in a regular manner, as where too much is given at a time, Mr. Marshall has remarked, that they do not thrive so well.

The following observations of Sir John Sinclair merit every attention.

"Some intelligent graziers recommend the following mode of feeding and fattening cattle. Suppose there are four inclosures of from six to ten acres each, one of them should be kept quite free from stock till the grass gets up; and then the prime or falling cattle, should be put into that, that they may get the best of the food: the second best should then follow; and the young store after all, making the whole feed over the four inclosures in succession, as follows.

1st Inclosure. Free from stock, till ready for the best cattle.
2d ditto. For the best cattle till sent to No. 1.
3d ditto. For the second best cattle till sent to No. 2.
4th ditto. For the young cattle till sent to No. 3.

No. 4. is then kept free from stock till the grass gets up, and it is ready for the prime cattle. The proper size of inclosures has never yet been ascertained by experiment; probably from 10 to 30 acres is the best; but the size should be various, as small ones are better calculated for grass, and large ones for corn. Probably the best plan to adopt is to feed cattle entirely in the house, or smilling them as it is technically called. In that case, small enclosures must be preferred, as the shelter they afford is extremely favourable to the growth of the herbage.

The larger a bullock is, he must take the more food to support him. It is desirable to change his food often, and to give him frequently, but little at a time, which makes him more eager to eat. After his kidneys are covered with fat, he will take less meat every week. It is better, therefore, to ascertain the quantity he eats, by the week, than by the day.

Fattening cattle, to be sold immediately from the farmer's house, and not sent to market, should be kept moderately warm. If kept too hot it makes them perspire, and their skins to itch: this vexes them, and they rub themselves against any wall or post within their reach, which is much against quick feeding. Carrying and combing them are useful practices; and washing them at least once a week, is of great service. Bleeding is now exploded as an old and unnecessary practice.

In some parts of the kingdom, the whole attention of the farmer is devoted to suckling, or, in other words, to feeding calves, for supplying the market with veal. In Essex, this plan is reckoned more profitable than the dairy, and next to grazing. But the profit there must depend much upon the immediate neighbourhood of
Farriery:

At the proper season when the turnips are completely ripened, and the turnip feeding commences, the turnips are gathered together on the field in large quantities, and two or three men with coarse turnip knives made from old scythes, cut off the whole of the root, carefully cleaning the turnips at the same time, from any earth which may adhere to them. The turnips are then carted to the turnip barn, the door of which is wide enough to allow the carts to back in, and throw them down. Here the men with their turnip knives are again ready immediately to cut off the whole green tops or shaws of the turnips; and these green tops are immediately given to cows, young winterling cattle, sheep, &c. who readily eat them when fresh. The turnips, now quite clean, are piled up in one end of the barn like cannon bales, and will keep in excellent order for months together. Should the winter storm set in, a small quantity of clean dry straw laid over them, will effectually preserve them from being injured by the frost. The other end of the barn receives the straw and litter for the use of the byre. The advantages proposed to be derived from this method of treating the turnips are: 1. The preservation of a great many of the best turnips, which, if allowed to remain on the field during winter, are unavoidably spoiled by the effects of the weather, and the alternate operations of snow, rain, and frost. 2. The green tops being cut off fresh and good, are immediately consumed, in place of being entirely lost if allowed to remain on the field. 3. It saves much labour and trouble, both to men and horses, to lay in a stock of turnips at once, in place of going to the field every day, whether good or bad, and when, as the fields are necessarily wet and soft, the horses, carts, and harness, are severely strained, and the fields poached and cut up.

Lastly, by having a couple of months supply of turnips in the barn, you are never under the necessity of using frosted turnips, which are often little better than lumps of ice. And even if you should not incline, or find it convenient, to lay in so large a stock of turnips at once, still you can take the advantage of any good fresh day, as it occurs, to add to your stock of turnips in the barn.

At right angles to the turnip barn, stands the feeding byre, constructed as follow. At the distance of about three feet and a half from the great side wall of the byre, there are constructed on the ground, in a straight line, ten troughs for feeding ten large cattle; these are of hewn pavement on all sides, and at the bottom; and they are divided from each other by divisions or bridges, likewise of hewn pavement. These troughs are so constructed, that there is a small and gradual declivity from the first or innermost, to the last and outermost one; and the bridges separating them, being made with a small arch at the bottom, a pail or bucket of water poured in at the uppermost, runs out at the undermost one, through a stone spout passing through the wall, and a sweep with a broom, carries off the whole remains of the turnips, &c. rendering the whole troughs quite clean and sweet. The whole food of the cattle is thus kept perfectly clean all times.

In a line with the feeding troughs, and immediately over
over them, runs a large strong beam of wood, from one end of the byre to the other, which is strengthened by two strong upright supports to the roof, placed at equal distances from the ends of the byre, and the main beam is again subdivided by the cattle stakes and chains, so as to keep each of the ten oxen opposite to his own feeding trough and stall.

The three and a half feet of space between the feeding troughs and outer wall of the byre, lighted at the further end by a glazed window, is the cattle-feeder's walk, who passes along it in front of the cattle; and, with a basket, deposits before each of the cattle the turnips into the feeding trough of each.

To prevent any of the cattle from choking on small turnips, or pieces of large ones, as they are very apt to do, the chains at the stakes are contrived of such a length, that no ox can raise his head too high when eating; for in this way, it is observed, cattle are generally choked. However, in case it should happen, that an ox chokes on a turnip, the cattle-man, or feeder, is provided with a ramrod, made of a piece of strong stiff rope, with a small round polished wooden head at the end of it; this he introduces into the mouth of the ox, and so gently knocks the turnip down his throat without either danger or difficulty to the animal. That the cattle-feeder may be always at hand to attend his cattle, a small apartment with a window in it, in which his bed is placed, is constructed immediately off the corner of the byre, so that he is ready, even in the night-time, in case of any accident happening, to render assistance.

At the distance of about six feet eight inches from the feeding troughs, and parallel to them, is the dung groop and urine gutter, neatly and substantially built with hewn stone. Here too, like the troughs, there is a gradual declivity from the inner and upper to the outer and lower end; so that the moment the urine passes from the cattle, it runs to the lowest end of the gutter, whence it is conveyed through the outer wall of the byre in a large stone spout, and deposited in the urinaium outside of the wall. At this place is a large inclosed space, occupied as a compost dung-court. Here, all sorts of stuff are collected for increasing the manure; such as, fat earth, cleanings of roads, ditches, ponds, &c. rotten vegetables, &c.; and the urine from the byre being caused to run over all these collected together, which is done very easily by a couple of wooden spouts moved backwards and forwards to the urinaarium at pleasure, renders the whole mass, in a short time, a rich compost dung-hill; and this is done by the urine alone, which in general is totally lost. The dung of the byre again is cleaned out several times each day, at the two front doors of the byre opposite to the groop, and deposited in the dung-court; so that in this way, too, the byre is kept in as good order as any stable, and the cattle as clean as horses. Along the edge of the dung-court, a few low sheds are constructed, in which young beasts, sheep, or swine, &c. are kept; and these consume the refuse and remains of the turnips from the great feeding byre.

In the side wall of the byre, and opposite to the heads of the cattle, there are constructed three vents, or ventilators; these are placed at the distance of about two feet four inches from the ground in the inside of the byre, and come out immediately under the easing of the slates on the outside. The inside openings of these are about 12 inches in length, seven in breadth, and nine in depth in the wall; and they serve two good purposes. x. The breath of cattle being specifically lighter than atmospheric air; the consequence is, that in some byres, the cattle are kept in a constant heat and sweat, because their breath and heat have no way to escape; whereas, by means of the ventilators, the air of the byre is kept in propercirculation, which conduces as much to the health of the cattle as to the preservation of the walls and timber of the byre, by drying up the moisture produced from the breath and sweat of the cattle, which is found to injure those parts of the building.

The method of giving cows their food by the milk-feeders of London farmers in the vicinity of the metropolis, where this business is carried on upon the most extensive scale, is thus stated in the valuable Agricultural Survey of that district. "During the night, the cows are confined in stalls; about three o'clock in the morning, each cow has a half-bushel basket of grains; when the milking is finished, a bushel basket of turnips is given to each cow; and very soon afterwards they have an allotment, in the proportion of one bess to ten cows, of the most grassy and soft meadow hay, which had been the most early mown, and cured of the greenest colour. These several feedings are generally made before eight o'clock in the morning, at which time the cows are turned into the cow-yard. About twelve o'clock they are again confined to their stalls, and received the same quantity as they had in the morning. When the afternoon milking, which continues till near three, is finished, the cows are again served with the same quantity of turnips, and about an hour afterwards with the same distribution of hay, as before described. This mode of feeding generally continues during the turnip season, which is from the month of September to the month of May. During the other months of the year they are fed with grains, cabbages, tares, and the other foregoing proportion of second-cut meadow hay, and are continued to be fed with the same regularity until they are turned out to grass, when they continue in the field all night; and even during this season they are frequently fed with grains."

As the grains employed in feeding cattle cannot always be procured fresh as they are wanted, it becomes a desirable object to preserve them for a length of time. They are preserved in some places by putting them into pits dug in the earth, into which they are trodden down, and afterwards covered to a moderate depth with dry earth. In this way being defended from the action of the air, and thus prevented from fermenting, they may be kept for a considerable time during the months of summer, when brewing is not carrying on; they may also be kept by pressing them down into casks placed upon stands, so as to elevate them a little from the ground, and having their bottoms pierced with holes, to carry off the superabundant moisture.

Food of Dogs.

A good feeder is very essential. He should be food of young, active, industrious, and good tempered, for the sake of the animals entrusted to his care, who, however they may be treated by him, cannot complain. He must strictly obey any orders that his master may give, both...
We must however remark, that barley meal should never be given by itself to hunting hounds during the hunting season, as its heating quality renders them exceedingly thirsty; and when out, they take every opportunity to lap water.

The meat should never be given to the dogs too hot, and should be mixed up as thick a consistence as may be. The feeding troughs should be wide at the bottom, and have wooden covers, and they should not be made too long; five or six troughs that are easily moved, are better than two or three that are unwieldy.

The boiling for the hounds, mixing of the meal, and preparing it for them at proper hours, will of course be taken care of by the huntsman. He must constantly attend the feeding of the hounds, who should be draughted according to the state they are in at the time. Some hounds are better feeders than others, and some require less meat than others; a nice eye and great attention are required to keep them all in equal flesh. This is what constitutes the merit of the huntsman, and shews him to be well qualified for his office, but few are sufficiently attentive to this. The hounds are fed in a hurry, without examining them before they begin. To ascertain properly the condition of a pack of hounds requires no small circumspection.

The huntsman should call each hound by name, letting him in to his food as he is called; this uses them to their name, and teaches them obedience. A hound should always approach him who calls on him; and if he touches him with a stick, he should follow wherever he is led.

The thin and tender feeding hounds being first turned out to the feeding room, will have the opportunity of picking where they choose. Such hounds as are in low condition, had better be drafted off into a separate kennel. Thus selecting those that are poor, we proceed to the feeding of the rest with less trouble and more accuracy; but those that are drafted off, when more flesh is mixed with the meat, must be let in to feed one by one as they answer to their names; or they may be better fed than taught. Thus the hounds who want flesh, will all have a share of it; and if any of them be much poorer than the rest, they should be fed again, asick hounds cannot be fed too often. Unless peculiarly good, a soft, weasy constitutioned hound will scarcely ever be worth the attention that is given him; and after a hard day is frequently unserviceable for some time. It must be recollected, however, that such hounds as are tender, or lean feeders, cannot be fed too late, or with too rich meat. Should any hounds appear to get too fat, they must not be suffered to eat their fill, but the rest may eat as much of the meat as they please.

Once a week, or fortnight at most, during the hunting season, the hounds should have a pound of sulphar given them in their meal; and when the season is over, they should have half a pound of antimony added to the sulphar, and well mixed with the meat. On these days, the hounds should all be let in to feed together, and such as require flesh, have it given to them afterwards. Grease boiled in their meat once a week, is likewise proper. A horse killed and given to hounds whilst warm, after a very hard day's hunting, will make an excellent meal, but they should not hunt again till three days after it. The bones broken are good food for poor hounds, as there is considerable nourishment in them.
Sheep's trotters are also very sweet food, and in a scarcity of horse flesh, bullocks' paunches may be employed with advantage.

It is customary with some to shut up the hounds for two hours after they have returned from hunting, before they are fed, and the other hounds are shut up with them to lick them clean; but probably this practice does more harm than good, as the idle hounds will disturb the tired dogs more by their licking, than this will make amends for. Besides, hounds shut up on their return from hunting, will not afterwards readily quit their benches, as, if much fatigued, they will seek repose rather than food. It is therefore a better way when the hunt is nearly over, to send forward a servant to see the meat prepared, that the dogs may be fed immediately on their return. If they have had a severe day, they should be fed again afterwards. When hounds are fed twice, they should be kept separate from the hounds that were left at home, till after the second feeding, and it will be still better if they are not put together till the next morning. It is the best plan to feed the hounds that have been out twice. Some hounds will feed better the second time than the first, and besides, the turning them out from the lodging house refreshes them, and allows them to stretch their limbs; and if the kennel is cleaned out, and the litter well shaken up, they will afterwards settle themselves better on their benches.

It is at all times proper, after feeding, to turn out the dogs into the grass court, as this contributes very much to the cleanliness of the kennel.

**CHAP. III. Of Exercise.**

*Nature* dictates the necessity of exercise to almost every animal, and a greater or less proportion of it is necessary to enable them to perform their functions with health and activity. The proportion requisite for this purpose is, however, not the same in all animals. Sheep and cattle require but little exercise, much of which, indeed, appears to be incompatible with the manner of their eating; for, as they require a second mastication of their food by rumination, a considerable time is necessary for this process, which cannot be properly performed unless the animal be entirely at its ease. It is found, however, that such of these animals as are kept without exercise, or are wholly copped up in houses, for the purpose of fattening them more speedily, are neither so healthy, nor afford such fine and wholesome meat, as those which are permitted to rove at large in their native pastures. It is to the horse and dog that exercise seems the most essential. These animals require the greatest proportion, and are most injured by the want of it. The observations we are about to make will chiefly apply to the horse.

Such horses as are constantly employed in active labour have, of course, sufficient exercise; but it is often necessary that those which are kept by gentlemen, for their pleasure or convenience, are, when their labour is not required, permitted to stand whole days in the stable, without any other exercise than being ridden perhaps twice a-day to a neighbouring pond. In cities and large towns, even this exercise is often not permitted them. They are in the mean time plentifully fed with rich hard food, and thus pampered, they are rendered liable to the attacks of many acute diseases; and when their exertions are required, they cannot perform their usual labour with their usual ease. It is therefore necessary that such horses as are not regularly worked, should receive daily a moderate proportion of exercise, and should be accustomed to such a degree of labour as may counterbalance the effect of high feeding, and enable them to undergo occasional exertion. A horse who is kept in the state of regular labour, is said to be in *wind*. The exercise of a horse that is not constantly worked should not, however, be excessive, or be carried beyond the commencement of fatigue, as this would wear out the horse without necessity. It is an absurd practice which some people pursue, to send out their horses every day to be galloped and rattled along the roads, or perhaps over the streets, for the purpose of keeping them in wind. This is wrong, even where the horse is in good health and sound condition; but when it is practised with sinew-strained, or fonderered horses, as is not uncommon, it must be productive of considerable mischief.

In general, two hours a-day will be sufficient for the purpose of preserving the health of the horse, and this may be taken at once or twice in the day, as may be most convenient. If possible, the owner should ride his own horse on these exercising jaunts, for the groom will probably do the horse more injury than benefit.

Some horses require more exercise than others. Gentlemen's horses that are merely kept for light riding, will do with but little; but hunters and racers require a greater proportion, and should seldom have less than three hours a-day. This, however, must depend in a great measure on the quantity and quality of their food, as the food and exercise must in general be proportioned to each other; but in all cases care must be taken that the horse's labour do not exceed his strength. Young horses are not equal to much exertion, and should therefore be exercised but lightly. Many horses have been destroyed by the neglect of this precaution, especially in the army, where it is not unusual to receive horses as recruits of four or even three years of age. These horses, when they reach the regiment, to which they are probably brought from a considerable distance, are in general weak and in low condition, and are probably suffering from some acute disease, brought on them by exposure to cold and wet during their journey. They are of course very unfit for labour, and require at least three or four weeks rest, before they can with propriety be brought to go through their exercises in the riding school. According to Mr. White, however, they are seldom allowed the half of that time, but are brought too hastily into the school, without reflecting that, as they are unaccustomed to such exercises, or indeed at that early age to any kind of work, it must become exceedingly fatiguing to them; and to young horses in a state of debility, especially if they are not immediately attended to, when brought sweating from the riding school, such labour must often be followed by the worst consequences.

When a horse cannot be conveniently taken out to the fields or roads, for the purpose of exercise, expedients have been thought on to exercise them within the stable, or in a yard adjoining. The stable can answer for this purpose only when it is very large, and he may then be made to trot backwards and forwards till
FARRIERY.

A horse on a journey may travel five hours at a time, if not hurried onwards; a manceuvre two hours; a cavalry horse may manœuvre two hours; a coach horse, at a slow pace, six hours. But it is proper that saddle horses should not be overloaded, and that the load of a horse in harness should be in proportion to his strength, in order to perform those proportions of labour, to establish which is a difficult point; all depends on quickness. We will say generally, that a saddle horse, well formed, and muscular, may thus carry at a slow rate, two-thirds of his own weight, and run in a chase with double and one-half of his weight. It is easy to see from this, that the load of a saddle horse should be less if he is put on the trot, and less still if he is made to gallop. The draught horse, on the contrary, lightens his load by speed, which, however, he cannot long continue without tiring, and being out of breath.

The disorders which proceed from hard work are, founded, rest, and most inflammatory diseases. There are others that proceed from sudden transitions from heat to cold, or, on the contrary, such as inflammation of the lungs, colds, glanders, rheumatisms, and dropsy of the breast. These are particularly frequent and dangerous to cavalry horses. They have existed at all times; but the present system of manoeuvres renders them much more common than formerly; they are a species of endemic disorders, which alarm many regiments, and make them dread the consequences. But there can be no doubt they may be avoided in a great degree.

1. By taking no horse into a regiment under four years old, and those only which are well formed.
2. By giving them forage of good quality.
3. By airing them in the stable, and
4. By avoiding to put them in a sweat, which is a state contrary to nature. This forced perspiration dries up and impoverishes the blood, spoils the finer fibres, the vessels lose their reaction; hence the stagnation of the humours, which produce tumours and farcy. It would be advisable then to avoid accidents after a repetition of military exercises, by walking the horses quick, and afterwards slowly, until they have regained their natural warmth. By this means a repercussion of the humours may be avoided. For the same reason, a horse should neither be watered, fed, or dressed, while sweating; on the contrary, if he must be put into the stable, take off the saddle, rub him down with straw, and cover him with a cloth.\)

PART V. VETERINARY MATERIA MEDICA.

In treating of the substances employed in the cure of the diseases that affect domestic animals, we shall first describe the usual forms in which they are administered, with the most approved methods of exhibiting each, in the various cases to which they are applicable. We shall then enumerate the remedies themselves, arranged under certain heads or classes, as is usually done by writers on the materia medica; for the sake of bringing together under one view, those articles which are suited to the same purposes. We shall not at present, however, describe the articles made use of, as most of them are employed in general medicine, and a particular account will be given of them in the article MATERIA MEDICA. Our object here will be to point out the doses required for the animals of whose diseases we are about to treat; and the particular cases to which they are adapted. To each class we shall subjoin a number of receipts to which we shall have occasion to refer, when we come to the treatment of the diseases.
The most usual forms in which medicine is exhibited to horses and cattle, are those of powder, ball, drench, ointment, poultice, and somation.

**POWERS.**

There are not many substances which admit of being administered in form of powders; for as it is necessary to mix these with the food of the animal, they must of course be composed of such articles as do not impart to the food any very strong or disagreeable taste. These substances chiefly given in the form of powders are antimony, sulphur, nitre, and some of the aromatic seeds, &c. They should be reduced to the finest powder, and should be thoroughly mixed with the corn or bran that is placed before the animal. These powders which do not readily dissolve in water, such as antimony, sulphur, and the powder of seeds, should be moistened before mixing with the food, as in this way less of the medicine will be wasted. Emetic tartar, and all articles that require to be given in a small determinate dose, cannot properly be administered in this form.

In giving powders mixed with the food of horses, much will depend on the delicacy of the animal's taste, and on the state of his stomach at the time. Some horses will readily take their food mixed with medicinal powders, while others refuse every article offered to them in this form. When this is the case, or when the medicine thus administered appears to disagree with the animal's stomach, this mode of giving it must not be repeated; but the medicine must be administered in some other form.

Powders are also sometimes used externally either to sores and ulcers, or blown into the eyes.

**BALLS.**

The form of ball or bolus is one of the most common in which internal medicines are administered in farriery. It is extremely convenient, as there are very few articles that do not admit of being given when mixed up into a ball; as they are, from the peculiar composition of the animal's throat, more easily administered than any other form that can be given by the mouth. Some articles, however, especially such as easily evaporate at the usual temperature of the air, as ether and volatile alkalis, and such as speedily liquefy or deliquesce by exposure to a moist atmosphere, are not so properly given in the form of balls. Substances, too, which require a very large dose, do not easily admit of this form, and are best given in infusion, or mixed with water in the form of a drench.

It is best to prepare balls as they are required, or at least not many days before they are needed, as by exposure to the air they become hard, and do not easily dissolve in the stomach; they may even pass through the bowels nearly unchanged. But what is of still more consequence, giving a hard ball may endanger the animal's life, by its sticking in its throat. Mr. White says, that he has known several instances of horses being destroyed in this way. Sometimes the horses jaws are so narrow as not to admit of introducing the hand between them. In this case, the ball may be fixed lightly on the end of a stick or cane, moderately pointed; or what is still better, placed loosely in a kind of cup fixed on such a stick or cane; and thus thrust to the back of the throat.

The ball should be made not round, but nearly of the shape of an egg, and rather less in size. The mode of administering balls to horses requires some dexterity. To give a ball with ease, the operator should extend his fingers so as to surround one end of it, while the whole hand and the thumb opposite to the fingers that surround the ball must be contracted into as small a space as possible, as the smaller the hand the greater will be the ease with which the operation is performed, both to the farrier and the horse. The animal's mouth is usually kept open by means of an instrument called a balling iron, that is formed like a ring, with an opening sufficiently large to admit the hand, and which is covered with cloth, and placed between the horse's jaws; thus preventing him from shutting his mouth, or hurting the operator with his teeth. When the ball is held in this way, in the right hand, the tongue of the animal is to be drawn out with the left hand towards the left side, and the ball to be adroitly placed beyond the root of the tongue, and immediately on quitting the ball, the tongue is to be let go, and the horse allowed to raise his head. The ball is now in such a situation that it cannot be thrown back, and will be gradually swallowed. In holding the tongue it is proper to keep it pretty firmly against the lower jaw, as this position greatly facilitates the operation. Balls are usually wrapped up lightly in paper, to prevent their disagreeable taste, but the paper should be very thin and delicate, that it may easily give way when the ball enters the stomach. Water paper, which is employed for administering boluses in the human subject, would be an improvement in farriery, which may be easily adopted, as it is by no means expensive.

When the balls are composed of very hot or stimulating ingredients, it is proper to give the horse drink before administering them. It is best to give the drink first, as horses in particular will not readily drink after receiving a ball. If the ball has been composed of any medicine that possesses a corrosive quality, or is otherwise very irritating, as arsenic, corrosive sublimate, blue vitriol, or the like, it is necessary to give the animal, previous to the operation, a considerable quantity of some mucilaginous drink, as of water-gruel, or linseed tea.

When a ball is properly administered, it gives the animal very little fatigue, and may be repeated much more frequently than any other form of medicine. It is therefore extremely convenient.

The ingredients composing a ball should be mixed up with some sugary substance, as molasses, honey, or extract of liquorice softened in water, rather than with any gummy or mucilaginous substance, as these latter soon become hard by exposure to the air.

When a number of balls of the same kind are made at once, great care should be taken in mixing the ingredients in the most accurate manner, otherwise a much greater quantity of the active part of the medicine will be found in some of the balls than in others.

Though we have mentioned the use of the balling iron, in administering balls to horses, some grooms and farriers are very expert in giving the ball without this instrument.
DRENCHES.

This form is chiefly suited to those remedies that are easily soluble in water, or which readily mix with that fluid, and which have not any very disagreeable taste. Hence all mucilaginous substances, some resins, and many of the aromatics, may be given in this form. It is proper, in compounding a drench, that the substances composing it be thoroughly mixed with each other. If it not unfrequently happens, that oils or balsams are given by way of drench, without any pains having been taken to combine them folly with the watery part of the medicine; and when substances that would admit of being finely powdered, are administered in this way, the carelessness of grooms or farriers is too often such as to give them in a very coarse state. In the former case, or in administering a drench, the neck of the bottle may be broken, and occasion much mischief.

In giving a drench by means of the horn, the animal's tongue is to be held down with the left hand, as in giving a ball; and when his head is sufficiently raised, the drench is to be poured cautiously into his mouth. Every stable should be provided with a drenching horn.

In preparing drenches, farriers almost always make use of ale or beer, as the menstruums or diluent; but this is often very absurd, and can be proper only in the preparation of cordial drenches. Those of a cooling nature should be mixed, either with common water, or with some mucilaginous infusion.

Drenches are seldom given with dexterity, and thus a considerable quantity of the medicine is frequently spilt. This circumstance renders them often very inconvenient, particularly in cases where there is any swelling or painful affection either of the mouth or throat. Under such circumstances it is scarcely advisable to administer medicine in the form of a drench; as, independently of the resistance given by the horse, which will certainly waste much of the medicine, the forcing of a drench down his throat, when it is in an inflamed or irritable state, may be followed by very unpleasant consequences.

Mr. Clark says that he has frequently observed a simple solution of nitre in water, seasoned with honey or molasses, when given in cases such as we have described, to occasion violent coughing, trembling and panting, insomuch that the poor animal was like to drop down, merely from the acute pain he suffered, from a medicine being administered to him in the form of a drench at such a critical period.

Even the position in which the horse's head is placed to receive a drench may, in these cases, excite the most violent pain, from the distention which the muscles of the throat undergo, when the head and tongue are held in so awkward a situation.

The great advantage of a drench is, that remedies exhibited in this form produce their effect much more speedily than when given in the form of a ball, which may take a considerable time to be dissolved in the juices of the stomach. Drenches are therefore particularly suited to urgent cases, in which it is necessary to give immediate relief.

CLYSTERS.

This form is suited to a great variety of purposes, and is not administered so often as with propriety it might be given. Not only purges, which are very commonly administered in this way, but also every class of remedies, may be exhibited in the form of a clyster. The clyster should be composed of no substances that are not entirely soluble in water, or may be so thoroughly mixed with any watery fluid, as to pass readily through a slender tube.

The instrument employed for administering a clyster is, as in the human subject, a pipe and bladder, but the bladder should be that of an ox, and of the largest size; to the extremity of which must be fitted a pewter pipe about a foot long, and about half an inch in diameter, having the extremity which is to enter the gut made completely smooth, that it may not injure the internal coat of the bowel.

Preceding to administering a clyster, it is often necessary to free the great gut from a quantity of hardened excrement which it may contain. This is best performed by means of the hand, and the operation is called roking, or back-roking. The hand is easily introduced, as the diameter of the great gut is in the horse very large. Care must be taken before introducing the hand, to grease it well with oil or hog's lard, and to have the nails cut perfectly close, for fear of injuring the gut. This mode of extracting the hardened excrement is frequently required, and will succeed when medicine would probably only serve to increase the animal's distress.

Large syringes are frequently employed for the purpose of administering clysters; but such instruments are exceedingly improper, as their tubes are very short, and they are very difficult to manage, especially if the animal should prove restless from pain, as frequently happens in cases of colic; where, as we shall see, clysters are very frequently required.

Clysters are peculiarly requisite in those cases where medicine cannot be conveniently given by the mouth; as in locked jaw, or when there is any obstruction in the throat, or wound of the tongue. In such circumstances horses may frequently be kept alive for many weeks, by the frequent exhibition of nourishing clysters.

OINTMENTS.

Ointments are employed in farriery, merely as an application to sores, or in some cases of eruptions of the skin. They cannot be employed as in the human body, to introduce remedies into the system; as on account of the hair that covers the body of quadrupeds.
Poultries.

Poultries are frequently employed, either for the purpose of maintaining a long-continued heat and moisture about a part in which we are desirous to produce suppuration, or for correcting the unpleasant smell that sometimes arises from foul ill-conditioned ulcers; or, lastly, they are applied to check inflammation. In the first case they are always applied warm, and should be renewed repeatedly, till the proper effect is produced; as if old poultries are suffered to remain long on a suppurating part, they tend to check the suppuration instead of assisting it. In the two latter cases poultries are usually applied cold.

Poultries should always be composed of such substances, as admit of being reduced to a soft mass, either by boiling or pounding, as otherwise they would fret and irritate the parts to which they are applied. This must be particularly attended to in such poultries as are laid over large open ulcers, or any part that is highly sensible.

Fomentations.

These are intended to relax and soften the parts to which they are applied, and in this circumstance they nearly resemble the first kind of poultries, only that fomentations are always in a liquid form, being composed of some infusion or decoction of herbs. The mode of applying a fomentation is, by wetting a large flannel cloth in the warm liquor, wringing it slightly, and then applying it as warm as can easily be borne over the part to be fomented.

In the following list of the articles of the veterinary materia medica, we shall call the substances by those names by which they are usually known to the common people; but we shall add by way of synonyms the scientific names, as derived from the modern systems of natural history and chemistry. In fixing the doses of each article, we shall, unless particularly mentioned to the contrary, only specify the dose proper for horses and cattle; but it would be proper for the reader to keep in remembrance, that the dose for a sheep or a dog will be about one-half or one-third of that for a horse or cow.

In classing the remedies we shall adapt the arrangement given in a late compendium of the materia medica. Most writers on the materia medica of horses, have arranged their articles in alphabetical order. Mr. White has done this, in his excellent veterinary materia medica and pharmacopeia. Such an arrangement does very well, if intended to answer the purpose of a dictionary; but for practice, it is better to have the articles classed according to the sensible effects which they appear to produce in the system; as in this way the practitioner has before him all those remedies that are of the same nature, and may select from among them such as he thinks will best suit the particular case that he has in hand.

It may be necessary to observe, that the weight intended in this part is Troy weight divided according to the apothecaries, and the measure English wine measure.

2. Emetics.

It will have appeared from our description of the stomach of the horse, that this animal is in general incapable of vomiting. Emetics, therefore, as calculated for him, form no part of the veterinary materia medica. We do not know that emetics are given either to sheep or cattle, but to dogs they may be often given with advantage. A few substances, however, will answer this purpose, as in general a little grass, or a little mustard mixed with warm water, will be sufficient to vomit a dog. The following substances may be ranked in this class for dogs.


Emetic Tartar. Tartar of Antimony and Potash.

Dose from two to four grains.


Said to have been given with success in the distemper.

Dose from eight to ten grains, repeated every three or four hours, according to the evacuation produced.

c. Mercury.

Turbith Mineral. Yellow Sulphate of Mercury.

Used also for the distemper, and in cases of recent poisoning.

Dose about half a dram. Also recommended in canine madness.

Receipt.

1. Take of turbith mineral, five grains;
   And emetic tartar, one grain.
   Give in a little milk after bleeding.

2. Expectorants.

These are remedies that are calculated to produce a
drainage of phlegm from the lungs, or windpipe,
and are thus suited to relieve coughs and thickness
of wind or asthma.

g. Ammoniac. Gum Ammoniac.

A gum-resin. Dose from three to five drachms, in
the form of a ball. Commonly combined with squill, or
some other powerful expectorant, preceded by a purging medicine. Particularly suited to chronic coughs.

h. Asefoetida. Ferula Asefoetida. Lin.

A gum resin; dose about half a dram, in a ball.


Dose from one to two drachms in combination in
a ball, assisted with other expectorants. In chronic coughs.


Dose about an ounce, in the same form and cases as
the last.

e. Balsam of Sulphur.

Dose from half an ounce to an ounce.
FARRIERY.

477

Materia Medica.


Employed sometimes in chronic cough; but not so good as other expectorants.

The cloves of the root beaten to a paste; dose from one to two ounces; made into a ball with liquorice powder, or boiled in water into a drench. In similar cases.

A. Squill. Scilla maritima. Lin.
Dried root powdered; dose about a drachm, in a ball, with other mild expectorants.

Strained storax, in a ball. As a substitute for balsam of Tolu, in obstinate coughs.

Receipts for Expectorants.

1. Take of gum ammoniac, three drachms; Castile soap, two drachms; Powdered squill, a drachm.
Mix with honey or molasses into a ball.

2. Take of camphor, powdered squill, each a drachm;
Balsam of copaiva, half an ounce;
Aromatic powder, two drachms.
With honey, mix into a ball.

3. Take of balsam of sulphur, 4 ounces;
Barbadoes tar, two ounces; Oil of aniseed, two drachms;
Powdered liquorice root, enough to make a mass, to be divided into balls, each weighing about an ounce and a half, for a dose.

4. Take of asafoetida, half an ounce;
Powdered ginger, a drachm and a half;
Prepared ammonia, half a drachm;
Honey, &c. enough to make a ball.

5. Take of nitre, half an ounce;
Camphor, a drachm and a half;
Calomel, powdered opium, a scruple;
Molasses, enough to make a ball. In fever.

6. Take of unwashed calx of antimony, two drachms;
Camphor, a drachm;
Opium, half a drachm;
Compound powder of tragacanth, two drachms;
Honey enough to make a ball.
In fever. To be repeated occasionally.

7. Take of emetic tartar, from one drachm to two;
Compound powder of tragacanth, three drachms;
Honey enough to make a ball.

8. Take of amonoxia, sulphuret of antimony.
Very commonly given to horses for the purpose of improving the fineness of their coat. Dose about an ounce, in powder, mixed with the food.

Dose from one to two drachms; in a ball or drench.

Antimonial Powder. Oxide of Antimony with Phosphatic of Lime.
Dose about two drachms.

c. Unwashed Calx or Oxide of Antimony.
Dose two or three drachms; in composition as below.

Dose about one ounce in a ball, with one or two drachms of camphor; or alone in a drench.

g. Opium. Papaver somniferum. Lin.
Seldom given alone, though it might probably be administered with great propriety, in doses of two scruples to a drench.

Receipts for Sudorifics.

1. Take of gum ammoniac, three drachms; Castile soap, two drachms; Powdered squill, a drachm.
Mix with honey or molasses into a ball.

2. Take of camphor, powdered squill, each a drachm;
Balsam of copia, half an ounce;
Aromatic powder, two drachms.
With honey, mix into a ball.

3. Take of balsam of sulphur, 4 ounces;
Barbadoes tar, two ounces; Oil of aniseed, two drachms;
Powdered liquorice root, enough to make a mass, to be divided into balls, each weighing about an ounce and a half, for a dose.

4. Take of asafoetida, half an ounce;
Powdered ginger, a drachm and a half;
Prepared ammonia, half a drachm;
Honey, &c. enough to make a ball.

5. Take of nitre, half an ounce;
Camphor, a drachm and a half;
Calomel, powdered opium, a scruple;
Molasses, enough to make a ball. In fever.

6. Take of unwashed calx of antimony, two drachms;
Camphor, a drachm;
Opium, half a drachm;
Compound powder of tragacanth, two drachms;
Honey enough to make a ball.
In fever. To be repeated occasionally.

7. Take of emetic tartar, from one drachm to two;
Compound powder of tragacanth, three drachms;
Honey enough to make a ball.

8. Take of emetic tartar, a drachm and a half;
Ginger, two drachms;
Camphor, half a drachm;
Opium, a scruple;
Oil of caraway, ten drops;
Molasses enough to make a ball.

For horses that are hide-bound, and have unhealthy-looking coats.

9. Take of antimonial powder, two drachms;
Caraway seeds, powdered, half an ounce;
Ginger, a drachm;
Oil of aniseed, twenty drops;
Honey enough to make a ball.

10. Take of unwashed calx or oxide of antimony, two drachms;
Prepared ammonia, ginger, of each a drachm;
Opium, half a drachm;
Powdered aniseed, half an ounce;
Molasses, enough to make a ball.

4. DIURETICS.

These are remedies that are intended to produce a diuretic more than ordinary discharge of urine. See Materia Medica.

Diuretics.
FARRIERY.

5. PURGES.

These medicines are well known. They are generally considered of two kinds; laxatives, or such as purges, gently move the bowels, and are intended merely to empty them of excrement; and purges, or such as, besides this effect, are intended to stimulate the exhalent vessels of the intestines, and produce a considerable discharge of liquid stools, (see Materia Medica). As either order may in general be given so as to produce either of these effects, according to the quantity in which it is administered, we shall consider them together.

Purgative medicines are given with considerable advantage to all the domestic animals, in many cases of disease, which will be pointed out hereafter. They are very commonly, however, given to horses, by grooms and ordinary farriers, by way of alternative or preventive of disease; or in order, as they think, the better to prepare them for some unusual exertion. The reason given for this practice is, that the horse is foul in the body, or full of humours, and the purgatives are given to expel this morbid accumulation of humours.

"This sort of evacuation (says Dr. Bracken, who is impertinently one of the first that pointed out the absurdity of this indiscreet practice), seems very much to quoadrate with the out ward sense, and makes the ignorant part of mankind, whose heads are fuller of humours than their horses, imagine that purging medicines carry off the offending matter in most disorders; never considering the general use, which ought still to be kept in mind, viz. that in proportion to any one evacuation being heightened or increased, most or all of the natural evacuations are proportionally diminished."

It must be remembered that the intestines of the horse are exceedingly long, and the large intestines are so constructed as in many cases to retain the food or excrement for a very considerable time. Purgative medicines given to a horse are often retained for 2, or 3, or 4 hours; and if these have been of an irritating quality, it is evident that the unnecessary exhibition of them may often produce considerable mischief. Mr. Blaine says, that when horses die after the exhibition of strong purges, which according to him is not unfrequently the case, he has always found the large intestines more or less inflamed.

It is found that after giving a horse a strong purge, he is often incapable of returning to his usual work for many days; it is even said for a month. Hence it will easily appear how absurd is the practice of those who physic their horses without necessity. Mr. John Lawrence is, however, still an advocate for purging horses now and then, and is of opinion that the mischief done by purges is to be attributed to the coarseness of the medicine, rather than to its purging effect. He declares, that after 30 years experience, he has never known purging do harm, if the doses employed was of the finer sort.

Veterinary practitioners differ with respect to the time of administering a purge. Mr. Blaine recommends it to be given in the morning, when the horse is to be allowed to fast from 9 or 10 o’clock to 12 or 1.
FARRIERY.

Chiefly used to combine aloe s and other purgatives into a ball.

A. MERCURY, or Quicksilver.
   i. CALOMEL. Sub-muriate or mild muriate of mercury.
   Dose from one to two drachms, usually mixed with other purgatives.
   In liver complaints, obstinate cases of grease, chronic inflammation of the eyes, and dropical swellings of the hind-legs.

B. GLAUBER’S SALT. Sulphate of Soda.
   Dose about a pound. Best given in the form of a oyster. In fevers, and inflammatory complaints.

C. EPSOM SALT. Sulphate of Magnesia.
   As the last.

Receipts for Purges.

14. Take of Socotorine aloe s, five drachms;
   Castile soap, half an ounce;
   Oil of caraway, ten drops;
   Molasses enough to make a ball.
   A moderate dose for young or delicate horses.

15. Take of Socotorine aloe s, an ounce;
   Castile soap, half an ounce;
   Calomel, a drachm and a half;
   Oil of mint, twenty drops;
   Molasses enough to make a ball.

16. Take of Barbados aloe s, half an ounce;
   Compound powder of tragacanth, two drachms;
   Salt of tartar, a drachm and a half;
   Syrup enough to make a ball.
   This is given as a laxative by Mr White, who declares that he never saw any ill result from giving Barbados aloe s, though Mr Blaine and Mr Lawrence are of opinion, that Socotorine aloe s is always to be preferred.

17. Take of water-gruel, a gallon;
   Glauber’s salt, half a pound;
   Oil of olives, or linseed oil, a pint.
   To be given warm by way of oyster. In fevers and inflammation of the bowels.

18. Take of powdered jalap, a drachm;
   Powdered ginger, half a drachm;
   Syrup of buckthorn, enough to make a ball.
   For dogs.

6. ERRHINES.

These remedies are suited to produce a considerable discharge from the nostrils, and with this view are sometimes prescribed to horses in cases of staggers or violent headaches. They must, however, be given with caution, and not till after bleeding and other evacuating means have been used. They are always administered in the form of powder, which is blown up the nostrils, usually through a quill.

A. ASARABACCA. Asarum Europaeum. Lin.
   The dried leaves in powder.
   The snuff, usually sold by the name of cephalic snuff, is chiefly composed of asarabacca mixed with some aromatic
7. SIALOGOGUES.

These remedies are given with a view of increasing the flow of saliva or salver. They are seldom employed in veterinary medicine, though it is probable that salivation might be productive of good effects in the locked jaw, so fatal to horses, and in the distemper in dogs.

a. GINGER. *Amomum singber.*
Sometimes tied about a horse's bit by way of a masticatory, as it is called.

b. MERCURY.
Calomel is the only mercurial that can properly be employed to excite salivation in the horse and dog; and it will scarcely produce this effect, if given by the mouth. It is best to rub the gums with it twice or thrice a day, till the proper effect is produced. See STIMULANTS.

8. EMOLLIENTS.

These are such remedies as are calculated either to relax the body, or to abate acrimony. The former are sometimes divided into diluents and relaxants; the latter are usually called demulcents, although diluents are also commonly given to obviate acrimony.

a. BARLEY. *Hordeum distichon.* Lin.
The use of barley as an article of food, has been already noticed. A decoction of it forms a part of most emollient drenches and clysters.

b. CHAMOMILE. *Anthemis nobilis.* Lin.
The dried flower. In infusion or decoction by way of fomentation.

c. GUM ARABIC. *Mimosa milotica.* Lin.
In powder. Dose two or three ounces or more, by way of a drench.

d. GUM DRAGANT. *Astragalus tragantha.*
In infusion, so as to form a mucilage. In inflammation affections of the lung, bowels, or bladder.

e. HOG’S LARD.
An ingredient in most ointments and liniments.

f. LINSEED. *Linum usitatissimum.* Lin.
In infusion, by way of drench or clyster. In purging or scouring.

g. LIQUORICE. *Glycyrrhiza glabra.* Lin.
The root in infusion, or powder. Seldom employed except to render drenches more palatable, or in powder to mix up balls.

h. MARSHMALLOWS. *Althea officinalis.* Lin.
The dried root in decoction, by way of drench or clyster. In internal inflammations, or irritation from strong purges.

- Olive Oil.
A principal ingredient in ointments and liniments, and also frequently given by way of drench or clyster.

k. STARCH.
Very serviceable by way of clyster dissolved in warm water, either to obviate acrimony in inflammation of the bowels, and scouring; or by way of nourishment, combined with a little opium, in cases where food cannot be given by the mouth.

l. WARM BATH.
Seldom employed, on account of its inconvenience, although it would be probably one of the best remedies in spasmatic complaints.

Receipts for Emollients.

19. Take of linseed, four ounces; Boiling water, three pints.
Infuse for some hours, and add to the strained liquor, of nitre an ounce, honey sufficient to make a palatable drench. For two doses.

20. Take of marshmallow root sliced, four ounces; Water three pints.
Boil together till the liquor be reduced to a quart, and to the strained decoction add of Powdered gum arabic, an ounce; Linseed oil, two ounces; Honey sufficient to make it palatable. For two doses.

The above decoction, before the other ingredients are added, forms a good emollient fomentation.

21. Take of starch, two ounces; Water-guel, two quarts;
Mix for a clyster.
To be given frequently in scouring or purging.
If they are not kept up for a sufficient time, two or three drachms of laudanum must be added.

9. COOLING REMEDIES.

These are called refrigerants by medical writers, and it is supposed that they act by diminishing the temperature of the body. See MATERIA MEDICA. They are peculiarly suited to cases of fever and inflammation.

a. NITRE.
Frequently employed in fevers and inflammations, except those of the kidneys, and in catarrh. Dose about an ounce, dissolved in water-guel, or some mucilaginous decoction, by way of a drench.

b. SAL AMMONIAC. *Muria of Ammonia.*
Externally, as a lotion, against inflammation.

c. SPIRIT OF SALT. *Muriatic Acid.*
May be employed as a refrigerant in fevers, when largely diluted with water or water-guel.

d. SUGAR OF LEAD. *Acetate of Lead.*
Employed externally, dissolved in soft water; by way of lotion or embrocation, for sores or bruises; and in the form of a poultice with oat-mel, to check inflammation.

e. GOULARD'S
Part V.

Materia Medica.

Goulard's Extract, or Vege-to-mineral water. Is merely another form of the same remedy.

Vinegar. Acetic acid. Employed externally in similar cases.

Vitriolic Acid. Sulphuric acid. Useful in similar cases with the muriatic acid, but requires to be largely diluted.

Receipts for Cooling Remedies.

22. Take of nitre, an ounce;
Emetic tartar, two drachms.
Dissolve it in a sufficient quantity of water-gruel, for a drench.

23. Take of sugar of lead, half an ounce;
Vinegar, two ounces;
Rain-water, a quart.
Dissolve for a lotion.

24. Take of sal ammoniac, an ounce;
Vinegar, four ounces;
Spirit of wine, two ounces;
Soft water, half a pint.
Dissolve for a lotion.

Both these lotions are employed in external inflammation.

25. Take of cream of tartar, two drachms;
Nitre, an ounce;
Water-gruel, a quart.
For a drench in fevers.

26. Take of emetic tartar, a drachm;
Glauber's salt, eight ounces;
Water-gruel, a quart.
In similar cases attended with obstinacy.
To be repeated every six hours.

27. Take of extract of lead, half an ounce;
Distilled vinegar,
Olive oil, of each two ounces.
Mix well together, into a liniment.
For sore backs.

28. Take of marshmallow ointment, half a pound;
Sugar of lead rubbed fine, an ounce.
Mix for an ointment.

Astringents

Astringents are such medicines as are supposed to produce a degree of rigidity in the muscular fibres, and thus to increase its power of action, or to prevent morbid discharges. Such as are intended to prevent unusual discharges of blood are called astringents. For the action of astringents, see Materia Medica.

Alum. Super sulphate of Alunina and Potash. In powder, from half an ounce to an ounce, in the form of drench or ball. In purging, diabetes, &c. Externally by way of lotion, or in a fine powder sprinkled on the part. In grease.


The root in powder, from half an ounce to an ounce; or in a larger dose, in the form of decoction, for a drench.

A powerful astringent in cases of purging, and recommended in hemorrhages.


Iron. Muriate of Iron. A powerful astringent, though rarely employed in veterinary practice. It may be given in cases of obstinate purging, or diabetes, in doses of a drachm or two, by way of drench.

Japan Earth. Mimoso catechus. Improperly called an earth, as it is a vegetable extract. Given in powder, from two drachms to four, in purging and diabetes.

Kino. An extract similar to the former, and adapted to similar purposes.


Pomegranate. Punica granatum. Lin. The dried fruit in powder. Dose from half an ounce to an ounce. Chiefly given in the scouring incident to horned cattle.

Tormentil. Thromentilla erecta. Lin. The root in the form of decoction, by way of a drench. An ounce or an ounce and a half in three pints of water, boiled to a quart. In similar cases with the last.

Vitriolic Acid. Sulphuric Acid. Diluted Vitriolic Acid. Used externally by way of lotion, in obstinate cases of grease, and to foul ulcers. Not given to the horse internally.

Zinc. White Vitriol. Sulphate of Zinc. Chiefly employed externally, in inflammations of the eye, and as a lotion to foul ulcers, and to check inflammation. Seems to have little effect on the horse, but may probably be given to cattle with some advantage in cases of debility.

Receipts for Astringents.

29. Take of powdered oak-bark, an ounce; Powdered ginger, two drachms; Opium, a drachm; Solution of gum, enough to make the mass into a ball.

In profuse staling, with a drench of oak-bark decoction after it.
30. Take of kino, two drachms; Atom, half an ounce; Ginger, a drachm; Castile soap, softened with water, two drachms; Powder of oak-bark, enough to make a ball. In scouring or purging.

31. Take of white vitriol, Sugar of lead, each one drachm; Soft water, half a pint. Mix. For eye-water, in inflammation of the eyes.

II. STRENGTHENING REMEDIES.

These are commonly called tonics by medical writers. Many of them are astringents, and have been already enumerated.

a. GALANGAL. Haruma galanga. Lin. The root in powder; dose about an ounce. In weakness of the stomach.

b. GENTIAN. Gentiana lutea. Lin. The root in powder; dose from half an ounce to six drachms. Extract of Gentian. Dose, a drachm or two, in a ball in composition. In indigestion and weakness of the stomach.

c. HORSE CHESTNUT. Esculus hippocastanum. Lin. The bark in powder, or its decoction. Dose of the powder about an ounce.

d. IRON.

SALT OF STEEL. Sulphate of Iron. Dose about half an ounce. Generally in composition. In similar cases.

e. MYRTH. A gum resin. Dose in powder, from two to four drachms, in a ball. In weakness of the stomach, and general debility.

f. OAK BARK. Quercus robur. Lin. Dose in powder about an ounce. In general debility, succeeding to violent diseases.

g. PERUVIAN BARK. Cinchona officinalis. Lin. Dose of the powder from one ounce to two. Seldom employed in veterinary practice on account of its expense. Said to be inferior to many other tonics in the horse.

h. QUASSIA. Quassia excelsa. Lin. The wood and the bark of the root. Dose in powder two or three drachms, in a ball, or infused in water by way of a drench.

i. BLUE VITRIOL. Sulphate of Copper. Recommended as a powerful tonic, but requires caution in its use. Dose about half a drachm, gradually increased according to its effects. A considerable quantity of drink should be given, either before or after it. In cases of debility that resist other tonics.

32. Take of powdered gentian, half an ounce; Ginger, two drachms; Honey or molasses, enough to make a ball.

33. Take of powdered horse chestnut bark, an ounce; Myrrh, in powder, Castile soap, each a drachm; Water, enough to make a ball.

34. Take of powdered cassia buds, a drachm; Extract of gentian, a drachm and a half; Honey, enough to make a ball.

35. Take of powdered oak bark, an ounce; Aromatic powder, two drachms; Salt of tartar, a drachm; Molasses, enough to form a ball.

36. Take of salt of steel, two drachms; Infusion of quassia, (two drachms to a quart of water) a quart; Dissolve for a drench.

II. STIMULANTS.

These are such remedies as are suited to increase the action, either of the whole circulating system, or of some particular part or organ. They are at present usually divided into diffusible and permanent, the former being such as produce a considerable stimulating effect, which is soon followed by a degree of quietness or torpor, proportioned to the quantity that had been administered; as wine, alcohol, ether, and probably opium; the other sort being such as produce no very considerable effect, unless repeatedly exhibited for some considerable time.

Most of the stimulants are called cordials or aromatics; and under this class, we rank those medicines which have been called carminatives, or which are calculated to expel wind from the stomach or bowels, epispastics or blistering substances; and under this class we may also reckon most of those remedies that are called alteratives, or such as are supposed to produce some change in the constitution or habit of body. The stimulating remedies employed in farriery, as in human medicine, are very numerous.

a. AMMONIA, or Volatile Alkali. Prepared Ammonia. Carbonate of Ammonia. Dose from half a drachm to two drachms, in a ball newly prepared. In the latter stages of fever, attended with great debility.


c. ANISESEED. Pimpinella anisum. Lin. The seed in powder. Dose about an ounce, in a ball. Essential oil of aniseed. Dose from half a drachm to a drachm, in the same form. In flatulence and indigestion.

d. BALSA
Part V.

FARRIERY.

483

Materia Media.

d. BALSAM OF COPAIVA. See Eucalyptus. In flatulent colic or gripes.

e. BARBADOS TAR.

Externally mixed with oil of turpentine or sweet oil into an emulsion. In strains and bruises.

f. CANTHARIDES, or Spanish fly. Lytta vesicatoria. Tincture of cantharides. Externally by way of emulsion in similar cases.

Blisters are well known to be those remedies that irritate the skin to which they are applied, so as to raise the scar skin into a bladder containing a watery fluid, which is the serous part of the blood. By abstracting this from the general circulation of the body, they produce an excretion, proportioned to the extent, from the part to which they are applied, and are thus extremely useful in producing a determination of blood from some neighbouring and more important part.

Blister are of considerable use in veterinary practice. According to Mr. White they are very efficacious in dispersing callous swellings, the effects of strains, bruises, &c. Their beneficial effects are very great in removing the inflammation of such parts as are remote from the surface. In inflammations of the internal parts of the foot, the practitioners give relief when applied to the pastern, especially if the auxiliary remedies are not neglected, such as morphine, purgative, &c., or, as they are called, the application of a poultice to it, and administering a purgative medicine. For carbuncles, wind-galls, spavin, &c., no remedy is more efficacious than blistering. It is also productive of salutary effects in inflammation of the internal organs. For instance, when the lungs are inflamed, the determination of blood to the diseased part is lessened by the extension of blistering of the sides, and considerable relief is afforded in this way.

By the unskilful treatment of broken knees, a callous swelling is often left in the part, for the removal of which it is always necessary to have recourse to blistering. If blisters are freed from all caustic ingredients, and properly made, no injury to the hair will result from their application; and if one should fail of producing the desired effect, the practice may be followed without danger till that object is attained.

g. BLUE VITRIOL. Sulphate of Copper.

Employed externally to form ulcers, either in solution, or by touching their edges with a crystal of it, to produce healthy granulations. Also in some inflammations of the eyes by way of lotion.

A. BURGUNDY Pitch.

As an ingredient in stimulating ointments and plasters.

f. CAPSICUM, or CAYENNE PEPPER. Capsicum annuum. Lin.

The dried pod in water.

Dose about a drachm, in a ball, with mild stimulants. In flatulence and indigestion.

k. CARAWAY. Carum carvi. Lin.

The seeds and their essential oil.

Dose of the oil from half a drachm to a drachm in a ball, as prescribed presently. In weakness of the stomach, flatulence, and indigestion.

l. CASSIA. Casia cassinia. Lin.

The bark and flowering buds in powder.

Dose, from one to three drachms. Used as an ingredient in many cordial medicines. Chiefly for affections of the stomach.

m. CLOVES. Eugenia caryophyllata. Lin.

The flowering buds.

n. OIL OF CLOVES.

Dose, 20 or 30 drops. In gripes and sickness of the stomach.

o. CUMIN. Cuminum cuminum. Lin.

The seeds and their essential oil.

In a dose of from half a drachm to a drachm, in similar cases.

p. OIL OF CUMIN.

Dose, from half a drachm to a drachm. In flatulent colic.

q. FENNEL. Foeniculum vulgare. Lin.

The seeds in powder.

Dose, an ounce or two.

r. GINGER. Zingiber officinale. Lin.

The root in powder. One of the most useful stimulants, and preferable to most others in veterinary practice.

Dose, a drachm or two. In weakness of the stomach, indigestion, and flatulent colic.

s. GRAINS OF PARADISE. Amomum granatum. Lin.

The seeds. Chiefly employed as a stimulant for cattle, as a cordial.

Dose from three to six drachms.

t. WHITE HELLEBORE. Veratrum album. Lin.

The root in powder. Chiefly used externally in blisters, and for diseases of the skin. Formally employed as a purge for horses, but now deservedly exploded, as by far too violent.

u. HORSE RADISH. Cochlearia armoracia. Lin.

The fresh root in infusion or distilled water. In flatulence and indigestion.

v. MERCURY.

Calomel. Dose, from 15 grains to half a drachm. In farcy, glanders, &c.

Wherever calomel or other mercurial preparations are given, the animals should be kept warm, should drink their water a little warmed, and should take regular exercise in dry weather.

w. CORROSIVE SUBLIMATE. Muria of Mercury.

Employed internally in solution, in doses of about 15 grains, gradually increased. In farcy and glanders. Externally by way of lotion, to foul ulcers and eruptions of the skin.

No preparation of mercury seems to produce so great a degree of weakness in the horse as this. Its effects must therefore be carefully watched; and besides the regulations laid down above, the horse must be kept on a more nourishing diet than usual.

x. RED PRECIPITATE. Nitrate Oxide of Mercury.

Externally to ulcers, either sprinkled on their surface,
or mixed into an ointment; in which latter form it is very useful in chronic inflammation of the eyes.

y. NITRATE OF MERCURY. See Receipts, No. 49.


a. MUSTARD. Sinapis nigra. Lin. The seed in powder. Externally mixed with water into a paste, or sinupsia, in cases of internal inflammation.

b. PEPPERMINT. Mentha Piperita. Lin. The essential oil. Dose, about half a drachm. In similar cases with mint.

c. PEPPER. Piper nigrum. Lin. Dose, from half an ounce to an ounce, in powder. In flatulent colic.

d. SPIRITS. Whiskey, Gin, or Brandy. Dose, from a gill to half a pint. To collect in the flatulence proceeding from eating too much green food.

e. SALT. Maurate of Soda. Given with good effect to sheep in the rot.

f. TAR. Commonly given by country farmers to cattle when broken from clover.

g. TURPENTINE. Oil of Turpentine. Dose, an ounce or two. In flatulent colic. Externally by way of embrocation. In cases of indurated swellings, strains, and bruises; and for cattle after the bite of the gad-fly.

Receipts for Stimulants.

Cordial Balls.

37. Take of caraway seeds powdered; six drachms; powdered ginger, two drachms; oil of cloves, 15 drops; treacle enough to make a ball.

38. Take of powdered aniises, half an ounce; Turmeric, an ounce; powdered cassia, two drachms; treacle enough to form the ball.

39. Take of caraway seeds, and grains of paradise, each in powder, three drachms; ginger, a drachm; oil of mint, 30 drops; honey enough to form the ball.

Stimulating Ointments and Liniments.

40. Take of yellow basilicon, half a pound; red precipitate finely ground, two ounces. Mix well together. For foul ulcers.

41. Take of hog's lard, four ounces; oil of turpentine, an ounce. Melt together on a slow fire. In similar cases.

42. Take of oil of turpentine.
   Oil of olives, each two ounces. Mix for a liniment. For strains and bruises.

43. Take of verdigris finely powdered, an ounce; Venice turpentine, half an ounce; olive oil, an ounce. Melt the turpentine and oil together, and when nearly cold, add the verdigris. For foul ulcers.

44. Take of hog's lard; four ounces. Bees wax, an ounce; Venice turpentine, three ounces; red precipitate finely ground, two ounces. Melt the three first together, and when nearly cold, sprinkle in the powder. This is Mr. White's receipt for the digestive ointment, commonly employed by farriers for dressing rowels and ulcers.

45. Take of camphor, an ounce; oil of turpentine, two ounces; rectified spirit, four ounces. Dissolve. For old strains.

Stimulating Lotions.

46. Take of blue vitriol, an ounce; water, four ounces; vitriolic acid, 10 drops. Mix. For similar cases, and for the mange.

47. Take of blue vitriol, half a drachm; water, half a pint. Dissolve for a lotion. In inflammation of the eyes.

48. Take of tincture of opium, two ounces; water, six ounces. Mix for an eye water. In similar cases.

49. Take of aquafortis, two ounces; quicksilver, one ounce. Dissolve in a gentle heat, taking care to avoid the fumes. This forms a nitrate of quicksilver, and when diluted with a proper quantity of water, is one of the best applications for the foot-rot in sheep.


These are such remedies as are calculated to remove spasmodic affections of the muscles, or convulsive affections, and are therefore frequently employed in cases of locked jaw, epilepsy, &c. Few remedies of this class are used in veterinary practice. Such as are more peculiarly of this nature are mentioned below. They generally consist of stimulants or of anodyne remedies.

a. CAMPHOR.
   Dose, about two drachms, in a ball combined with opium and stimulants. In locked jaw.

b. ETHER. Sulfuric Ether.
   One of the most powerful antispasmodics.
Part V.  

**FARRIERY.**

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485

**Materia Medica.**

**Dose,** about an ounce, mixed with a pint of water.

This should be given as expeditiously as possible, otherwise much of the ether will evaporate. In obstinate cases of flatulent colic.

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c. Opium.

Dose, a drachm or two. The latter quantity generally in clysters.

**Tincture of Opium.**

Dose, from half an ounce to an ounce, repeated occasionally. In most spasmodic complaints.

**Oil of Turpentine.**

Dose, about two ounces. In flatulent colic.

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**Receipts.**

50. Take of camphor, a drachm; Essence of peppermint, two drachms. Grind together, and add Of water, a pint; Ether, half an ounce. Mix. To be given immediately. In violent cramp of the stomach.

51. Take of tincture of opium, an ounce; Oil of juniper, two drachms; Dulcified spirit of nitre, a drachm. Water a pint. Mix. To be repeated frequently. In locked jaw.

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14. ANODYNES

Are those remedies which are given for the purpose of procuring sleep, or alleviating pain. They are commonly called narcotics, and many of them are by most medical writers denominated sedatives.

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e. Fox-Glove. Digitalis purpurea. Lin.

Leaves in powder.

Dose, half a drachm, increased gradually according to its effect. In violent internal inflammations and swelling of the legs.

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Leaves in powder.

Dose, about a drachm, gradually increased.

**Extract of Hemlock.**

Dose, about a drachm. In obstinate coughs attended with irritability.

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The leaves in powder, or the seeds.

Dose, about a drachm.

**Extract of Henbane.**

Dose, about a drachm.

A solution of this extract has been found useful, applied to the eye, in chronic inflammation.

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The dried cones in powder.

**Receipts.**

53. Take of opium, a drachm; Powdered aniseed, half an ounce; Castile soap, two drachms; Molasses, enough to make a ball.

54. Take of camphor, a drachm and a half; Opium, a drachm; Ginger, two drachms; Honey, enough to form the ball.

55. Take of tincture of opium, two drachms; Decoction of poppy heads, a quart. Mix for a clyster.

56. Take of extract of hemlock, two drachms; Peppermint water, half a pint; Ether, half an ounce. Dissolve the extract in the water, and add the other at the moment of exhibition. For a drench. In scarlatina, or gangrene.

57. Take of bruised poppy heads, four ounces; Hemlock leaves green, a large handful. Boil gently in a gallon of water for about an hour, and strain the decoction. In wounds and bruises attended with considerable irritability.

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F5. WORM MEDICINES.

There are few cases in which worm medicines are given in veterinary practice. In the horse they are seldom required, and do not often prove effectual. In the dog, indeed, they have been applied more frequently, and may be used with more probability of success. The remedies of this class are generally of two kinds, either such as are violent purgatives, and in this way expel the worms by the violence of their operation; or, they are such as act mechanically on these animals, irritating and tearing their tender bodies, and thus forcing them to relinquish their situations.

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a. Castor Oil.

Dose, about half a pound.

b. Gamboge.

Dose, two or three drachms in a ball.


Dose for a horse, two or three drachms; for a dog, about half a drachm, in a ball with purgatives.

d. Salt.

Dose,

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FARRIERY.

Given internally in powder, to correct the bad smell in violent purging; and when powdered fine, may be sprinkled on large stinking sores, with the same intention.

c. LIME.
Lime-water. Dose about a quart, in acidity of the stomach.

d. CHALK.
Carbonate of Lime.
Dose, an ounce or two.
In violent purging attended with acidity.

e. SILVER.
Lunar Caustic. Nitrate of Silver.
Employed to eat down proud flesh, or destroy horny excrescences.

A. SPIRIT OF SALT.
Dose about two drachms, mixed with a quart of water by way of drench.

i. VINEGAR.
Given internally as an antiseptic, diluted with an equal quantity of water, or used externally to wash foul ulcers.

k. VITRIOLIC ACID.
Dose, a drachm or two, as under spirit of salt.

l. YEAST or BARM.
Employed to make fermenting poultices in cases of stinking ulcers.

16. CHEMICAL REMEDIES.

Many remedies are given internally, or applied externally, which seem to act merely chemically, either by combining with an acid or alkali, and thus neutralizing it, by checking putrefaction, or correcting the ill smell that is produced by it; or, in external applications, by destroying or corroding the parts to which they are applied. This class will therefore comprehend:

1. All those medicines that have been called antacids or absorbents, which are given to correct acidity in the stomach and bowels.
2. Antalkohines, or those acid substances that are given more rarely to correct alkalescence.
3. Antiseptics, or those that are supposed capable of obviating putrefaction.
4. Caustics or escharotics, which are intended to corrode the skin, or to take down fungous or proud flesh in ulcers.

a. ALUM.
Burnt Alum.
Sometimes applied to ulcers, to wear down proud flesh.

b. AMMONIA.
Dose, a drachm or two, in a drench, for acidity in the stomach and bowels.

c. ANTIMONY.
Sometimes applied to foul ulcers. A violent caustic.

d. CHARCOAL.

Receipts.

58. Take of calomel, jalap, each half a drachm; Honey enough to make a ball.
For dogs.

59. Take of tin powder, Quicksilver, of each two drachms.
Grind together till they be thoroughly mixed; then add enough of sugar to form a powder, to be made up into a ball with castile soap, softened with water.

60. Take of sal indus, four ounces; Alum, half an ounce; Water, a pint.
Dissolve for a drench. For the bots in horses.

Receipts.

61. Take of prepared chalk, an ounce; Powdered ginger, two drachms; Honey enough to make a ball.
In purging attended with griping.

62. Take of purified soda in powder, Powdered gentian root, each two drachms; Powdered cassia, a drachm; Treacle enough to form a ball.
In indigestion, with acidity of the stomach and bowels.

63. Take of charcoal in powder, Powdered oak bark, each an ounce; Treacle enough to make a ball.
In violent purging, producing very fetid stools.

64. Take of oat meal, Powdered charcoal, of each four ounces; Thin yeast, a sufficient quantity to make a poultice.
To be applied to foul ulcers.

65. Take of aequoraria, an ounce, Filings of copper, half an ounce.
Dissolve in a gentle heat, half an ounce.
For a caustic, in cancer of the foot. It may be made into an ointment for the same purpose, by mixing with hog's lard.

66. Take of fresh burnt quicklime powdered, Soft soap, of each equal parts.
Mix at the time of using.
A mild caustic, useful in destroying parts of the skin where necessary.

67. Take
Part V.

Materia Medica.

67. Take of corrosive sublimate, half a drachm; Ardent spirits, two ounces.

Dissolve for a lotion. Useful as an application to the callous edges of ulcers.

17. MISCELLANEOUS REMEDIES.


Sometimes employed among the common farriers as a remedy for broken wind, but appear to be useful only for the purpose of combining oily substances with water.


The root in powder. In the form of ointment for the itch or mange.

c. Glass.

Powdered glass is sometimes blown into the eyes of horses, to remove specks on the cornea.

d. Lead.

White Lead. White Oxide of Lead.

Sometimes used by way of ointment in some diseases of the skin.

E. Diactylon Plaster. Litharge Plaster.

Employed in making charges or strengthening plasters.


Oil of Bay.

Sometimes used in ointments for the mange.

g. Stavesacre. Delphinium staphisagria. Lin.

The seeds in powder. Employed to destroy vermin, being sprinkled on the skin.

h. Zinc.

White flowers of Zinc. White Oxide of Zinc.

In ointment, to sores and ulcers.

Calamine. Impure Carbonate of Zinc.

Employed to make the common brown cerate.

Receipts.

68. Take of sulphur vivum finely powdered,

Powdered elecampane root, each two ounces;

Hogs lard, enough to form an ointment.

For the mange.

69. Take of sulphur vivum powdered, four ounces;

Salt butter, six ounces;

Train oil,

Oil of turpentine, each one ounce.

Mix well together into an ointment.

These two ointments are useful applications in the mange.

70. Take of hogs lard, four ounces;

Tar, two ounces.

Melt together into an ointment.

Employed to anoint the backs of sheep or cattle, when bitten by the gad-fly.

71. Take of Burgundy pitch, four ounces;

Barbados tar, six ounces;

Bees wax, two ounces;

Red lead, four ounces.

Melt the pitch, tar, and wax together, and when the mixture is nearly cold, stir in the red lead, and continue stirring till it is firm.

This is Mr. White's receipt for making charges, or strengthening plasters.

In cases of wind-galls and old strains.

Before concluding this part, it will be proper to make a few observations, on the custom that prevails so much among grooms and farriers, of administering medicines to horses, by way of preservatives of health, or preventives of disease. It is very common among these gentlemen to bleed or physic a horse at least twice a-year, viz. in the spring and fall, though he be in never such a good health, or good condition, to give him sulphur and antimony now and then. This practice is unecessary and unwise, and a dose of diaphoretic occasionally to improve his appetite. If he is to undergo any unusual exertion, as riding or hunting, it is judged necessary by these sagacious practitioners to prepare him for the work, by bleeding, purging, and sweating below a load of body clothes in a close, hot stable. In pursuing this custom, they indeed only imitate what they practise on themselves on similar occasions. As they deem it necessary to have themselves bled every spring and fall, or once a quarter, to take physic once a-month, and to sweat themselves to make them ride or run more lightly in a jockey match, they naturally conclude that their horses should be treated in the same manner, and should undergo the same preparation.

If an animal is in a perfect state of health, nothing more is required to render him capable of performing the functions for which he is intended. It is only when there appears some derangement of the system, or when the state of the body is such as to threaten the attack of some dangerous disease, that it is necessary to call in the assistance of medicine. We shall soon have occasion to mention cases of this kind, and to show how the threatened danger is to be avoided. It must be remembered that those substances that are called medicine, are such as produce some effect on the body, that is in general either unnatural, or is greater than what comonly takes place in a state of perfect health. If then we give medicines to an animal in this healthy state, to excite the organs to some unusual exertion, or to check those exertions that are natural and healthy; and in either case, we must do harm. Besides the custom of giving medicines when they are unnecessary, renders them less efficacious when they are absolutely required, to ward off or obviate any disease. It is found that most remedies, when employed habitually, require to be increased in quantity in order to produce the same effect, and if continued too long they sometimes cease to produce their effect at all. With respect to some remedies, it is found that their habitual use is attended with dangerous consequences. Frequent bleeding tends to produce fatness, and a plethoric state of the body; the frequent use of cordials and stimulants stimulates the circulation too much, and produces such a rigidity of the fibres, as lays the foundation of apoplexy, palsy, and other dangerous disorders. It is well known too, that when the action of the stomach is too much excited by the habitual use of stimulants, it in time loses its tone, and becomes incapable of healthy digestion, unless roused by a greater quantity of its accustomed stimulus. It is therefore obvious that when an animal is in perfect health, all that is required to keep him so, is the proper regulation of diet, exercise, cleanliness, and other circumstances that have been mentioned in the fourth part of this article.

We cannot better illustrate the absurdity of the usual methods
PART VI. OF THE DISEASES INCIDENTAL TO DOMESTIC ANIMALS.

301. Classification of symptoms.

3. Of Sensation.

He labours under too acute sensibility; or, he is affected with pain or itching.
His sensibility is unusually diminished.
His sense of smelling is more or less impaired.
He hears with difficulty, or not at all.
His vision is more or less impaired.
He is unusually watchful.
His sleep is disturbed; or, he is unusually heavy and drowsy.

2. Of Motion.

He is either affected with irregular, involuntary motions or spasms; or, his moving powers are impaired.

3. Of Digestion.

His digestive organs perform their functions too quickly.
His digestion is impaired; or, he does not digest at all.
He is affected with sickness, with flatulence, or wind in the stomach and bowels.

4. Of Absorption.

He is unusually fat; or, unusually lean.
He is affected with some watery swelling.

5. Of Circulation.

His circulation is too rapid; or, it is too slow; or, it is irregular.
He has some effusion of blood.

6. Of Respiration.

His breathing is hurried; or, it is difficult.
He is affected with cough, with sneezing, hiccup.
His breath is hot; or, it is cold.
His skin is unusually hot; or, it is unusually cold.

7. Of Secretion and Excretion.

His secretions and excretions are either unusually copious.
He states profusely.
He has a purging; or, his skin is unusually moist.
The secretions and excretions are morbidly diminished.
He states with difficulty, or not at all.
He is costive.
His skin is unusually dry.

8. Of...
Part VI.

FARRIERY.

8. Of Generation.

Of generation.

His venereal appetite is excessive; or,
It is morbidly impaired.
He is impotent.

When a practitioner comes to examine one of these animals whose health is deranged, he will naturally inquire into all or most of the above particulars, and they will in general apply to all the four animals of which we are treating. There are some other questions which particularly relate to horses, and which it more especially becomes a farrier to ask; as,

Whether his flanks work.
Whether his ears are cold, or are in constant motion.
In what manner he walks.
Whether he looks earnestly at his sides.
Whether his eyes appear drowsy.
In what manner he carries his head.
Whether he kicks his belly.
Whether he appears desirous to lie down, but afraid to do so.
Whether he sometimes lies down on one side, and then immediately turns to the other.
Whether he lies down and flies up again repeatedly.
Whether he leans upon the manger.
Whether he stands off from the manger.
Whether he paws his litter.
Whether his nose runs.
Whether or not he passes much wind.

It will also frequently be of consequence to ascertain the following particulars.

Whether the horse is usually in a poor condition.
How did the disorder begin?
How long it has continued.
How long it is since he ate or drank.
Has he ever had the disorder before?
If he has, What was usually given him on these occasions?
Does the disorder come on at any particular times?
Has he been observed to pass any worms?
How long has he been bought, and what price was paid for him.
Was he bought of a horse-dealer, or of a private person?
Of a friend, or at the public market?

Having ascertained the necessary particulars, it is proper to consider whether the disease is of such a nature as has in general been easily removed; or whether the expense and time of cure will be sufficiently compensated by the value of the horse; for it must be remarked, that in general a horse or other domestic animal is worth no more than the price he would fetch at the public market. Unless, therefore, the animal is a favourite, or has some particular good quality which greatly enhances his value, it may happen that the expense and trouble of cure may amount to more than the animal is worth. In such a case it would be both prudence and mercy to kill him, unless we wish to attempt his cure for the sake of experience. These observations of course equally apply to cases that are generally deemed incurable.

Having found that the disease is of such a nature as

Sect. I.

To give hopes of a speedy or perfect cure, it will next be proper for the practitioner to consider what is the speediest, safest, and cheapest method of treatment. In particular, he ought to consider whether any immediate remedy be necessary, in order to check the violence of the distemper; more especially whether any immediate evacuation is required, as bleeding, purging, blisters, rowels, &c.

He must also be particular in examining whether the disease be of a contagious or infectious nature, that the affected animals may be kept in a separate place from those which have not been attacked.

As the general nature and theory of disease will be considered at large under the medical department of this work, we have only in this article to detail the symptoms as they occur in the domestic animals; to point out the causes and seat of the disease, as far as they have been ascertained by observation and dissection; and to lay down the most approved methods of treatment adapted to these animals. Observations with respect to the theory of diseases would here be out of place, and we shall seldom hazard them, except in some of those specific complaints which appear to attack solely the animals of which we are treating.

It may not be improper to remark, that diseases, like the objects of natural history, have been arranged in the two methods. One of these is the natural method, in which they are classed according to their seat or causes. The causes of diseases are the foundation of Dr. Darwin's system. In the first section of this part we shall attempt to class the morbid symptoms according to their seat, or the functions which they attack. The other method of arrangement, or the artificial method, is that in which diseases are arranged according to some obvious and remarkable symptoms. This is best calculated for the purpose of recognizing the disease when seen, and is the method employed by some nosologists. The diseases in the second section of this part will be arranged in this way.

CHAP. I. Of Morbid Affections of Sensation.

Most animals are occasionally subject to a morbid increase of sensibility, either of the whole nervous system, or of some particular organ. This morbid sensibility is generally called by medical writers, irritability; but this name is improper, as it implies an affection of the muscular parts; whereas the symptom we are now considering is an affection of the nervous system.

Some horses naturally possess a morbid degree of sensibility, which appears by their starting on the sudden approach of any object, by the peculiar tenderness of their skin that makes them wince and tremble under the currycomb, and by the extreme sensibility that they evince at the least touch of the whip or spur. Such horses are in general very active and spirited: but they require a cautious and prudent rider, who must rather endeavor to soothe and encourage them, than use any harsh or violent means.

This increased sensibility is not easily removed by art, but
but generally decreases as the horse grows older. It is best counteracted by living in a large well-aired stable, by being kept on hard coarse food, and by lying with as little litter below him, as is sufficient to prevent him from injuring himself against the pavement of the stable. In dressing him, the currycomb should not be too sharp, and should not be employed too freely.

When excessive sensibility arises from a deficiency and weakness of habit, strengthening medicines will be of use, and cordials may occasionally be employed.

There is a symptom nearly allied to this, which sometimes appears. The animal affected gathers himself together, and brings his four legs as close as possible below him, and creeps as it were on a heap. This symptom often attends nervous diseases, and severe affections of the bowels. It is generally considered as a sign of great danger, and is not unfrequently the forerunner of mortification.

At the commencement of several acute diseases, especially those of the brain, animals betray an unusual sensibility to the effects of light and sound. When this happens, the place where they are kept should be darkened, and they should be as little as possible disturbed with noise.

There is a peculiar restlessness and anxiety with which animals are sometimes affected. This is not unfrequently their only complaint, or at least we cannot perceive that they are affected with any obvious or well-marked disease, but it is most commonly a symptom attending violent disorders, especially of the inflammatory kind; and generally preceding the fatal termination of dangerous chronic diseases. Animals thus affected are continually moving about, and often lie down; if they are at liberty, they seek out the most sequestered and gloomy parts of the pasture, and frequently change their place: if they are tied up, they appear to listen to, or observe, every thing that passes round them; they are restless and attentive to the various objects near them; but although their eyes appear fixed, and wide open, they do not steadfastly regard any object; they are perpetually turning from side to side, and if they feel pain in any part, they often turn their heads mournfully towards it, sometimes growling or panting. If this state has continued long, the animals become still more restless, are perpetually shifting about, scraping with their feet, or pawing the litter; their ears become cold, and their hairs bristle up.

These latter symptoms are considered as denoting great danger, especially when the animal looks steadfastly at his sides, or stares with his eyes without appearing to take particular notice of any object.

When anxiety appears to be the only symptom, without any signs of inflammation or convulsive affection, it is generally a mark of nervous weakness, and requires cordial and strengthening remedies, nourishing diet, and gentle exercise without labour: but if it is a symptom of some violent disease, it can only be removed by the general treatment of that disease; and in this view, will come to be considered hereafter.

Animals are sometimes affected with dejection or loss of spirit. This is not unfrequently the attendant of fatigue brought on by excessive labour or unusual exertion; and is therefore most commonly seen in horses. It appears by the animal’s leaning his head on the manger, standing still in the same place, and appearing to move with pain or difficulty. His limbs are stiff, his skin hard and dry, his eyes look sad, he has no appetite for meat; if he lies down, he remains immovable, or if obliged to rise, immediately falls again when left to himself.

In general, if the fatigue produced be not extreme, it gradually goes off with rest and quiet; especially if it has been found possible to employ the means that are presently to be recommended; but if the exergia to which the animal was exposed, has been too great for its strength, the consequent depression may prove highly dangerous, or even fatal. In this state his urine is crude and watery, and, if a male horse, he seems scarcely to have the power of drawing for the purpose of making water; and his excrements are dry and scanty. If taken out in this condition, he moves with pain and difficulty, trots slow, or lifts his feet very little above the ground, carries his head very low and his ears depressed over his forehead; he is often stumble, and not unfrequently falls on his knees, and appears very little sensible of the whip or spur. If a horse in this state has any sores or ulcers about him, they become hard, or flabby, assume a dull appearance, and the matter proceeding from them becomes thick and viscid. Rovels very frequently dry up; and if he is affected with any eruption of the skin, this commonly disappears.

To prevent the bad consequences that are likely to follow the state which we have now described, it is proper, as soon as we find a horse much fatigued, to spread a bed of litter for him to rest on: and as soon as possible give him a cordial ball, or draught. The strength of this must not, however, be in proportion to the degree of fatigue or depression, as experience has shown, that when a powerful cordial is given in a state of excessive weakness, it proves too much for the animal, and frequently excites fever or inflammation. The horse’s limbs should be bathed with warm water, and then rubbed thoroughly dry. After this he should be left to his repose, and if it be not too late at night, he may in a few hours have a warm bean mash. When a little recovered, he must be gently rubbed all over, but especially his limbs, without currying; he should be put upon a nourishing diet, and exercised but little. These means, varied according to circumstances, will in general bring the horse round, unless the symptoms are extremely violent; when they will commonly terminate in fever, or in some chronic disease, especially dropsy.

The train of symptoms which we have been describing, are most commonly the effect of fatigue; but they may arise from other causes. They are more or less the attendants of decay, and they are generally the forerunners of fever or inflammation of the brain.

Sometimes these animals are affected with a great degree of insensibility or torpor; they are heavy and listless, and much; are not easily disturbed; are insinuating to the objects around them; seem to be insensible to pain, and move heavily and unwillingly. These symptoms require particular attention, as in most cases they denote some dangerous affection of the brain, and are very commonly followed by apoplexy or staggerers; or by epilepsy; or they are the attendants (especially in sheep) of water in the head. Wherever they are observed to take place in an animal that has been full fed, with little exercise, especially if he appear fat and fall of
Disease of blood, and the pulse be found full and strong, the eyes red or heavy, there is danger of apoplexy; and the animal should immediately be bled and purged, be gradually put on a lower diet, and use gradually more exercise. These changes must be made by degrees, because too sudden changes may produce the very effects against which we are guarding.

A great degree of torpor and insensibility is often produced by excessive cold, or by being kept long in an impure atmosphere. Where they have taken place from either of these causes to a dangerous degree, the application of heat must not be too sudden, as it will tend to extinguish the small remaining spark of life, and produce apoplexy, or mortification, where any external part has suffered from cold.

The head may be affected with dizziness, or giddiness, commonly called turn-sick, from various causes. It may arise from great weakness, or it may be the consequence of gout, or fullness of blood. In the latter case, it is a pretty sure mark of approaching apoplexy or staggers; and the animal must immediately be bled, and put on a lower diet, with gentle exercise. In sheep, dizziness is a common symptom of scurvy, or water in the head, a complaint which will be considered hereafter. It will be evident that when this affection appears in animals that are lean, meagre, and in low condition, it shows the necessity of a more full and nourishing diet.

The only morbid affection of the external senses, that we shall here consider is blindness, a defect which is of most consequence in the horse, though it may occur in all the domestic animals.

The eyes of a horse, when perfectly sound, have the cornea or outer covering, and the humours that are seen through it, perfectly clear and transparent; there should be no specks, or druggs, as they are called, in either, neither greenness or glassy appearance of the pupil, and this should readily suggest to us that suddenly exposed to a clear light. After observing, that in a sound eye, two or three rounded spots appear through the cornea above the pupil.

When a horse has a defect in his vision, without being perfectly blind, he appears dull, fearful and restive, starts at suddenly approaching any object, carries his head high, or to one side; moves his ears alternately, or turns one forwards, while the other is turned backwards, and usually hangs back on his bridle or halter, and lifts his legs up very high.

Partial blindness is a symptom of several diseases in the horse: it usually attends great weakness, especially when this has been brought on by hard work and low feeding; it is a common attendant on locked jaw, and generally precedes the staggers. It of course is one of the effects of old age.

When proceeding from debility, it generally goes off in proportion as the strength is restored by rest and proper nourishment; when it is a symptom of other diseases, it goes off when they are removed. The blindness of old age is incurable, and in the horse we believe no method has yet been discovered of relieving the defect by art.

It is generally allowed, that it is better to have a horse totally, than partially blind; as when quite blind, he is not liable to start, or be shy; and when sure footed, well shod, and managed by a careful rider, there is little danger of his stumbling or falling.

Total blindness either proceeds from a defect in the optic nerve, by which this is rendered incapable of receiving the impression of light, or from an opacity or muddiness in the cornea or humour, by which the transmission of light through them is obstructed.

The first species of blindness, or that depending on a glass eye, defect in the optic nerve, is generally called by farriers glass eyes, and by medical writers, it is termed amniosia, or gutta serena.

It is known by the peculiar glassy appearance of the eye, which seems perfectly clear, so that an ordinary observer would not suppose that there was any defect in the horse's eye. On examining the eye more attentively, it will be found that the pupil is considerably dilated, and preserves the same size in every change of light; not contracting, as usual, when the light to which it is exposed becomes stronger. There is also a greenish appearance of the eye in this disease.

The causes of glass eyes are not well ascertained. It has followed a blow on the head, or inflammatory affections of the brain or its membranes; but it has come on sometimes imperceptibly, and where these diseases, or any other evident cause has not appeared.

This disease in the horse has hitherto proved incurable.

The most common cause of blindness in the horse, is cataract, an opacity of the lens, or crystalline humour of the eye.

This disease is known by the name of cataract, and is sometimes called by farriers, moon blindness, or a horse that has a cataract is said to be moon-eyed.

It is in general easily discovered that a horse labours under a cataract, as, when the disease is confirmed, an obscurity or muddiness may be seen in the centre of the pupil, occupying more or less, according as the cataract is more or less extended. The opaque spot is generally of a dull white or yellowish colour. Sometimes the crystalline humour is so fixed to the iris, or that moveable coloured part in the middle of the eye, as to obstruct its motion, and then the pupil retains the same size in every light; or if the adhesion is partial, the pupil of the eye assumes a regular shape. It must be observed, that in this disease, the iris is not always so invariable as in glass eyes; though when the cataract is fully formed, the pupil is generally enlarged, and contracts very little on the approach of a strong light. Sometimes the lens comes through the pupil altogether, and floats in the watery humour, in the fore part of the eye.

The cataract in horses is said to be always a consequence of inflammation in the eye, which will be considered in the second section of this part.

The only method that appears likely to remove the cataract, is an operation by which the whole lens may be thrust down below the pupil, and carefully extracted from the eye; but, neitherouching nor extraction can be recommended in the horse, as the removal of the lens would still be attended with a defect of vision that would render the animal of less use, than if he were totally blind.

Another cause of blindness, and also a consequence of inflammation of the cornea, is opacity of the cornea. There may the cornea be either a diffuse whiteness or muddiness in the cornea, that is more or less extensive; or, there may be specks
or warts growing on the outside of this coat, so as to obstruct the passage of the rays of light. Sometimes the opacity of the cornea is only slight, producing partial blindness; but frequently it is universal, and then the horse cannot see at all. This universal opacity of the cornea is sometimes, though improperly, called cataract. It sometimes disappears for a time, and the eye seems nearly as clear as ever; but it generally returns in no long time.

General opacity diffused through the substance of the cornea, does not readily yield to remedies. Attempts have been made, by scratching the vessels on the white of the eye, or by stimulating applications to the cornea, to rouse into action the absorbent vessels of the eye, and thus remove the opacity: but these attempts seem to have attended with little success. Specks or warts on the cornea, if they are not too large, may generally be removed by the knife, or by repeatedly blowing into the eye a powder composed of powdered glass and white vitriol. But, if these specks are attended with any general opacity of the cornea, little benefit is to be expected from these operations.

As the skin is so intimately connected with sensation, we shall here consider some of the more simple affections of that organ, that are not generally attended with fever. It is not uncommon for excrescences or warts to grow on the skins of domestic animals, particularly on horses and oxen. Sometimes they are hard and firm; at others they are soft and sprouting: in some their root is smaller than their head; in others the base is the largest part. The sprouting kind of warts are called by the farriers anger-berrics, ambury or amberly, and are not uncommon among oxen. As these are largest at the base, they can, like all of that description, be removed only by touching them daily with some caustic, as lunar caustic, or butter of antimony. Where the wart has a small root, it may be best removed by tying a strong waxed thread round the root, tightening it now and then as it gets loose till the wart drops off. It is in general not proper to remove warts by the knife, unless they are of such a firm consistence as not to bleed on being cut, and to admit of the application of caustic after cutting.

There sometimes appears on the skin of the horse, a severe eruption at the bending of the knee or the bending of the hock. The eruption generally appears in both places at once, and is called by farriers, the Mallenders and Stallenders; a term which they have borrowed from the French. When considered separately, the eruption of the knee is called the mallenders, and that of the hock the stallenders.

These eruptions may generally be traced to want of cleanliness, and are, in most cases, easily removed, by washing the parts with soap and water, and applying an ointment, composed of mercurial ointment and camphor; or either of the ointments marked No. 41. and No. 70. in the receipts.

When a horse's skin is hard, dry, and unusually tight about the body, the animal is said to be hide-bound: This tightness about the skin is usually the effect of hard work and improper food; and commonly attends lingering diseases, in which the fat is gradually wasted or absorbed. It must therefore be considered rather as a symptom of disease than as a disease itself; but, as in the case with most remarkable symptoms, it has often been regarded as a primary disease; to remove which, by Disease sweating and relaxing remedies, is the principal object of the practitioner.

The proper remedies for this affection, when it is not a symptom of some lingering disorder, are nourishing diet, with plenty of green food, particular attention to cleanliness, by frequent dressing, and the occasional use of boiled barley and warm water.

Horses that have a lean, unthrifty-like appearance, with their coats looking rough and rusty, are said by the grooms to labour under a surfeit. Whence has arisen the application of this strange term to an appearance that seems so opposite to what is generally understood by a surfeit, we are not aware; but an affection of the skin, under the name of surfeit, is thus described by Mr. Lawrence: "Its confirmed state is attended with eruptions, and sometimes with swellings of the legs and joints, and in the latter case is usually to be looked upon, as the termination of some chronic disease, or a consequence of the improper use of mercurial physic. Surfeits are styled dry or wet; in the former, the skin is covered with a thick dry scurf, with scabs, and small hard tumours like marble; in the latter, a sharp brassy ichor issues from the poll, neck, withers, quarters, and hinder legs, in the bend of the hock, causing great stiffness and inflammation of the joints; it is probably analogous with seborrhoea in the human body, and will often attend cart-horses, with foul and unwholesome blood, at stated periods. The too free use of beans will produce the wet surfeit."

"The cure of surfeits depends almost entirely upon internal alternatives, with a very small attention to external applications. As to the latter, perhaps, frequent cleansing, with a good strong lather of soap, is generally sufficient, but where the eruptions are hard and fixed, and the scabs do not peel off, I know of nothing better than to rub them frequently with the strong mercurial unctious, keeping the horse well clothed, and giving warm water in the interim. The warm bath if the animal is strong."

One of the most common diseases of the skin among domestic animals, is what is commonly called the mange. It is most commonly found in horses, cattle and dogs, and the scab or itch in sheep. Its symptoms differ but little in the different species of animals, and we do not remember to have seen the disorder well described by any writer. The following description of the mange in horses by Mr. Feroux, is perhaps among the best that have been published. "The mange is a contagious chronic disorder which manifest itself on the skin, on which sensible eminences of a roundish figure rise up; these being scratched, a fluid oozes out, of a hot and corrodìng quality, that excoriates the sound skin wherever it runs, in a little time forming a dry, scaly, crusty eruption, which in its progress spreads over the whole surface of the body: and the skin becomes unequally thick, thin, hard, and soft. If the disorder has been neglected, or ill-treated, the animal falls off from his food, grows lean, and the legs swell: in this state the patient has frequent fits of shivering and trembling, and a slight fever arises, terminating in favr or the glands, by which he is easily destroyed."

A disease similar to this, if not of the same kind, affects cattle, especially such as are ill-fed, and not kept clean. It is commonly called, by husbandmen, the scab or..."
or scurf; and is thus described in a popular treatise on cow-doctoring.

Skin stiff, and sits fast to every part of the carcass, as if too small for the body. It makes its first appearance about the head and jaws of the animal, with a scurfy, pale, and dry texture; and the beast begins to scratch against every thing that comes in its way; it then shews itself along the back, and behind the shoulders; and if timely aid be not procured, the animal will tear its skin till it bleeds violently, which ought to be prevented, if possible, as the scabs which are the consequence of bleeding, much retard the efficacy of the ointment, and the loss of time confirms the disorder.

This disease is incident to sheep in some particular pastures, situations, and seasons, more than to others. The predisposing cause seems to be a relaxed habit of body, produced by poverty or leanness, though some sheep are subject to it that are fat and otherwise in good condition. The disease seldom seems to originate with such sheep, but to be conveyed to them by infection.

Dogs are exceedingly subject to the mange, and readily catch it from each other. The appearance of the disease in dogs, is familiar to every one, as there are few more common and disgusting sights than a mangy dog. A dog in this state is very unfit for any active exertion, as the affection of the skin renders him stiff and sore even in his limbs. A friend of ours had a greyhound, that, when he was clean, was one of the swiftest runners in the country, and had gained the prize in many a courting match. This dog caught the mange, and while in this situation was several times sent in pursuit of a hare; but now, puts generally escaped him.

This disease has sometimes been attributed to animalculae, such as are found in the symptoms of the itch upon the human skin; and analogy seems to be in favour of this idea. It is, however, evidently connected with poor living, and want of cleanliness.

In the treatment of the mange, we are to rely chiefly on the use of external applications, such as ointments, composed of sulphur, of some preparation of mercury, or bellerobe roots. The receipts marked No. 68. and 69. are well adapted to the cure of this disease. Sometimes internal remedies, such as sulphur and gentle laxatives, are required; and the greatest attention must be paid to cleanliness, diet, and exercise. It may be necessary in some cases, especially where the animals that have caught the disease, are very full of blood, to bleed and give cooling physic previous to the application of ointment; and in all cases the skin should be thoroughly washed with soap and water, both before and after anointing. The animals should always be confined till they are quite free from the disease.

Mr. Feron, who considers the mange in horses as a general affection of the system, and not merely a local disease of the skin, strongly recommends the use of blisters, which he has seen act as a specific. The local treatment, and the only one to be depended upon (says this gentleman), consists in a judicious application of blisters, used after the following manner; viz. if the whole body is affected, the one half must be blistered one day, and the other in three days after. This must be done at different times, in order to prevent the cantharides from operating too violently upon the kidneys and bladder; but if this happens, let the animal be bled, and clysters frequently injected. But the best way to avoid this, is to leave off all kinds of internal medicines, during the action of the blisters. When they begin to operate, the skin must be fomented with warm water three times a-day, in order to wash out a quantity of yellow matter, discharged by the action of the blisters, and to encourage the growth of the scurf. He does not pretend to dispute the efficacy of Mr. Feron’s blistering practice in removing the mange, but we doubt whether the blistering one half of the body with cantharides may not be productive of more serious consequences than the disease which it is intended to remove. At any rate, the expense of the method, and the torment which it mustoccasion to the poor animal, must greatly prevent the general application of the remedy.

Mr. Findlater’s Survey, quoted above, are the following judicious observations on the treatment of sheep labouring under the scab.

Scoothing tarred, or smeared, are seldom infected with this disease. If the disease be partial, perhaps the best remedy would be to clip the affected parts as bare as possible, and rub them occasionally with the common smearing ointment, to which may be added a little Venice turpentine. They should also be washed, once or twice a week, with black soap and water. But if this prove ineffectual, or if the disease has gone to a great extremity, the animal should first be washed as clean as possible, in a pond, or rill of water, to purge away all the accumulated virus, or infecting matter, from the wool. A little black soap may be of great use in washing. Then the whole body may be smeared with juice of tobacco; and after the animal becomes dry, may be rubbed with butter mixed with powdered brimstone; or brimstone mixed with the smearing ointment would answer better. A little of the sulphur may meanwhile be blown down its throat. If this treatment, being twice or thrice repeated, after an interval of several days, should prove ineffectual, recourse must be had to the mercurial ointment, composed of three ounces of hog’s lard, well rubbed in a mortar, with half a dram of finely powdered corrosive sublimate; or the same proportion of corrosive sublimate, well mixed with three ounces of the common smearing ointment, will answer equally well. The animal being smeared with this ointment, will soon be effectually cured. Meanwhile the diseased animal should be invigorated or put upon substantial food. In a note Mr. Findlater mentions an observation of Mr. Loch’s of Racan, that the matter discharged in the scab mixing with the wool, and drying, forms a hard impenetrable crust, which he has observed of half an inch in thickness; that it is vain to think of curing it by any external application, till this is removed; and that you might as well attempt to cure a man of the itch, by rubbing butter and brimstone upon his coat, instead of his naked skin; that the scurf thus formed, must be removed by soaking and washing it with warm lime-water and soap, and scraping it clean to the quick with a blunt knife. It may then be successfully cured by the ointment; or, what is more cleanly and more easily prepared, by means of a lotion made by dissolving half a dram of corrosive sublimate in a quart (chopin) bottle of whiskey and water. Mr. Loch has always
Among the insects which prove most troublesome to horses, sheep, and cattle, are those of the genus Oestrus, some species of which are generally known by the name of gad-fly. The best account of these insects and their effects, that we have seen, is that of Mr Bracey Clark, published in the third volume of the Linnean Transactions, from which the following account is chiefly taken.

Mr Clark describes five species of Oestrus, viz. O. bovis, O. ruminantium, O. amniorrhinalis, O. veterinary, and O. ovis.

We shall at present describe the effects only of the first and last species.

The O. bovis, as its name imports, chiefly attacks cattle, through the skins of which it pierces, in order to deposit its eggs. The pain which it inflicts in depositing its eggs appears to be much more severe than what is excited by any of the other species. When one of the cattle is attacked by this fly, it is easily known by the extreme terror and agitation that seizes the whole herd. The unfortunate object of attack runs bellowing from among his fellows, to some distant part of the pasture, or to the nearest water, rubbing his tail, from the severity of the pain, extended straight from the body, in a line with his back, with a tremulous motion, and stretching out his head and neck to the utmost. The rest of the herd, infected with the like fear, though not attacked, by like the water, or dispersing to different parts of the pasture. "Such is the excitement and apprehension of the cattle for this fly," says Mr Clark, that I have seen one of them meet the herd when almost driven home, and turn them back, regardless of the stones, stooks, and noise of their drivers; nor could they be stopped till they reached their accustomed retreat in the water."

When one of these flies happens to attack them that are yoked in the plough, there is often considerable danger, as the animals become quite ungovernable, and will often run directly forwards with the plough, through hedges, or whatever opposes their career.

Heifers, steers, and the younger cattle, are in general most frequently attacked by this fly, the strongest and most healthy beasts seem constantly to be preferred by it; and this circumstance is said to be a criterion of goodness held in much esteem by the dealers in cattle. Farmers also have remarked, that their best and strongest hides have generally the greatest number of holes in them.

The hives of this species, as of most of those we have to mention, are generally termed both, but this name is most frequently applied to the larvae of the Oestrus.

The complaint produced by the puncture of this insect in the skins of cattle, is called pockit-skin, and is not unfrequently attributed to the bite of the goat-fly. For the destruction of the hives that deposit, it has been recommended to insert a red hot wire into each of the holes made in the skin; but this is a formidable remedy, and will probably do as much harm to the skin as the bots themselves. A more rational practice that is sometimes in use, is to press the parts, and rub them well with a little oil of turpentine, or some other stimulating application, or a little oil of turpentine may be injected into each hole.

The
Part VI.

**FARRIERY.**

The larvae of the Oe. ovis are commonly known to the country people by the names of scrumil or worm, or worms, or worties.

During the summer, sheep are often observed to gather together in clusters, endeavoring carefully to guard their heads. Mr. Blainie says that this is to protect themselves against the attacks of this insect, which attempts to lay its eggs on the inner margin of the nose, which when it has effected, these eggs become larvae, and creep up into the frontal and maxillary sinuses.

It is not easy to discover the manner in which this insect deposits its eggs, owing to its obscure colour and rapid motions, and to the great agitation into which the sheep are thrown by its attack; but the subsequent motion of the sheep, and the manner in which they attempt to defend themselves against their enemy, leave no room to doubt, that the eggs are deposited on the inner margin of the nostril.

The moment the fly touches this part of the sheep, they shake their heads, and strike the ground violently with their fore feet, at the same time holding their nose close to the earth; they run away, looking about them on every side, to see whether the fly pursues them; they also smell the ground where they go, lest one should be lying in wait for them. As they cannot, like horses, take refuge in the water, they have recourse to a rut, or dry dusty road, or gravel-pits, where they crowd together during the heat of the day, with their noses held close to the ground, which renders it difficult for the fly conveniently to get at the nostril.

Observations on these flies are best made in warm weather, and during the heat of the day, when, by driving the sheep from their retreats to the grass, the attack of the fly, and the emotions of the sheep, are easily observed.

The nostrils from repeated attacks, and the consequent rubbing against the ground, become highly inflamed and sore, which occasion their touch to be so much dreaded by the sheep.

It is said that this fly also deposits its eggs in the skin of the sheep, but we are not certain how far this has been proved by experience; although there is no doubt that there are some flies found in the sheep's skin, which must have been produced from eggs deposited by some insect. They prove extremely troublesome to the animal, eating into the skin, and producing ulcers. If not discovered in time they may even destroy the life of the sheep. The remedy is to clip the infected parts bare, wash them well with black soap and water, and apply the soothing ointment. If this does not succeed, recourse must be had to the method recommended in No. 337.

When sheep have lain about for a long time in wet and marshy pastures, or have been kept in woods or caves in a starving condition, their fleeces become so completely soaked with water, that the wool rots off from the skin. This is what is called the polt-cot. If sheep be suffered to continue long in this condition, they become heavy and low-spirited, and will sooner or later be destroyed. If, however, they be attended to in proper time, they may be saved by driving them to a good straw-yard, pulling off their ragged and rotten wool, and walking on a good coat of tan, greases, and tarpsins. Care must also be taken to provide them with plenty of good wholesome nourishment.

The skin of all animals, especially on the most delicate parts of it, is subject to excoriations or chapping. This is of most consequence in the backs of horses fretted with the saddle, and the udders of cows by rubbing against their thighs, when they are expensibly shap'd, and go close behind. Both the udders and thighs of the cow are sometimes quite raw, and ulcerated.

The best remedy in these cases, is to wash the parts well with warm soap and water, and afterwards bathe them frequently with a mixture of liquor, and compounded spirits.

The udders of cows are sometimes chapped, which is commonly owing to want of cleanliness in the milkers. When this happens, the treatment recommended above for chapping may be followed; or, if this does not succeed, the udders may be anointed with what is called unguitum pusillum. If the udders are very painful, the cracks may first be bathed with a little linseed oil, and afterwards filled up with fine powdered prepared chalk.

There are many other diseases that affect the skin of these animals; but some of them are so trifling as not to require particular notice, and others being intimately connected with some general derangement of the system, fall more properly to be considered in the next section of this part.

**CHAP. II. Morbid Affections of Motion.**

The function of motion may be morbidly affected in various ways, but all these tend more or less to impede or disturb the natural motions of the animal.

The muscles are often affected with irritable motions, producing violent involuntary contractions, called convulsions or spasms. These are often symptoms of some dangerous derangement of the brain or nervous system, as locked-jaw, epilepsy, palsy, &c. Convulsions of this nature, being intimately dependent on the primary disease, can only be removed by such means, as are calculated to carry off the disease, of which they are symptoms. Irregular action of the muscles commonly attends great debility, whether it be brought on by hard work and low diet, or by disease. In either case, it is a very dangerous symptom. We cannot properly consider the property of convulsions here; but it will be considered in the next section, when we come to treat of convulsion or spasmodic diseases.

The affection that we are chiefly called to consider in this chapter is lameness, a very comprehensive term, as it includes almost all the local afections of the extremities. Lameness is a complaint that is exceedingly common among horses and dogs, especially the former; in whom it is more particularly demanded attention, as it so materially affects the value of the animal. A knowledge of the nature of lameness, and the method of treating it, can only be acquired by an investigation of the cause by which it is produced.

The causes of lameness are extremely numerous and various. We shall endeavor to class them, so as to render our inquiry as little tedious and difficult, as may be.

Lameness may be produced by a stiffness of some Stiffness parts of the muscles, tendons, or ligaments, arising either from excessive labour, from bruises, wounds, or some diseased affection of the joints.
with respect to ulcers. If mortification takes place, the part must be frequently fomented with the fomentation directed in No. 57 of the receipts; and the animal's strength must be supported by nourishing food, and the occasional use of cordial and strengthening remedies. If the mortified part be very extensive, it may be necessary to make incisions towards the edges with a knife, to promote the separation of the slough; or firing may be employed, as directed for this purpose in No. 175.

It sometimes happens that after the inflammation which attended a bruise has subsided, a permanent hard tumour is left, that prevents the free motion of the muscles of the part. This may arise either from a thickening of some ligament, or the cellular texture, or it may proceed from an excrescence formed on the bone, in consequence of the bruise. The treatment in such cases will be presently described, when we come to consider splints, ring-bones, and other tumours that commonly produce lameness.

Horses are very liable to receive severe bruises in the tread, back part of the foot, either from the tread of another horse, as often happens in the army, by a horse in the same rank treading on the heels of one in the front rank; or, by a horse overreaching his hind foot, and thus bruising the heels of the fore foot. From the manner in which this accident is produced, it has received the names tread, and overreach. Sometimes the bruise is so slight as to be productive of no farther ill consequence than a temporary lameness; but if the tread has been very violent, the edges of the part trodden on may be so much bruised as to produce considerable inflammations, or even a mortification. In ordinary cases it is sufficient to wash the part carefully with warm water, to clear it of dirt and gravel, then apply a pledget dipped in spirits, and bind up the foot, so as to exclude the external air; when the bruise, if slight, will probably soon heal. But in some cases matter is formed, which makes its way downwards towards the sole, forming what is called a quitter. Quitter may also take place from a puncture in the foot, by a nail or other pointed body, the effects and treatment of which will be presently described.

In a newly-formed quitter, it is of consequence to ascertain, whether it has been made by a prick or a tread. In the former case the matter usually makes its way upwards from the punctured part towards the coronary, and here the practice generally followed by farriers is, to tear the upper office with a hot iron, which answers no other purpose than to confine the matter within the wound, where it must produce extensive ulceration and destruction of important parts of the foot. In the latter case, where quitter is produced by a tread, and when the sinus formed is very superficial, the use of the cautery may be very proper; and if it can be so applied as to inflame the whole extent of the wound, it may entirely carry off the disease. According to Mr. Blaine, there are two general methods of curing quitter; one by removing a part of the hoof, cutting away the diseased parts, or suffering them to slough off or exfoliate. The other, to apply caustic to the diseased surfaces, introducing it within the sinus, thus destroying the ulcerated parts, and allowing the healthy parts to throw them off. The latter is called by farriers 'cutting out a quitter,' or as they suppose that the
FARRIERY:

Part VI.

Diseases.

the core or slough that comes away formed a part of the complaint. Mr Blaine objects to removing the hoof, as it would take up a considerable time before the new horn can be formed; and it is probable that in the new hoof there will be a false quarter, which will render the horse unsound, besides that, during the formation of the new hoof, fresh sinuses may be produced. In the method of cure by caustic, he thinks that the disease may be completely removed in three or four weeks, whereas the other method may require as many months. The mode of applying the caustic is, to examine carefully the extent and direction of the sinuses, and then to fill them up with powdered blue vitriol, verdigris, or corrosive sublimate. Mr Blaine has found that a paste made of corrosive sublimate, mixed up with flour and butter, forms a very good caustic for this purpose. Some of it is to be introduced by means of a probe, to which a piece of sponge is fastened, which must be carefully introduced in every direction, so as to touch all the diseased parts, after which the whole foot is to be bound up; but the bandage must not be applied too tightly. In two or three days the dressings are to be renewed, and this is to be repeated at intervals till the sloughs come away, when a healthy action of the parts will take place, and the cure soon be completed. Another method of introducing caustic, by which the sinuses may be completely filled, is to mix up the caustic with hog’s lard, and roll the mass into small pellets within gauze-paper, which may be easily introduced into the cavities.

Many farriers have fallen into a mistake with respect to the nature and treatment of quittor, that has been the ruin of many horses. They suppose, that during the progress of this disease, a bone is formed which they call a quittor bone; and they think it necessary to remove this bone, before a cure can be completed. This error seems to have arisen from an opinion of Lafosse, who conceived that the derangement which accompanied this disease originated in the cartilages being affected; which he affirmed were capable of being thus diseased, but incapable either of exfoliating like bone, or sloughing like ligament; and therefore that to promote a cure, the whole of the lateral cartilage on the affected side must be removed. But his first premises were erroneous, for cartilages are vascular, as we know by their being tinged with bile, and by their being at times absorbed; this is particularly the case with the lateral cartilages, which in almost all old horses are partly absorbed. As they are vascular, they must be capable of living action; though it is slow, and hence, where disease exists, they will exfoliate like other parts. This practice of Lafosse has in this country been for some time tried among many of the more intelligent farriers, and was still further propagated by the late Professor Ste Bel. Many horses have been ruined by this indiscriminate practice: for the future elasticity of the foot, which is a great measure dependent on these cartilages, must be lost; besides the necessary removal of the hoof to get at the cartilage, a false quarter almost always remains.

Wounds are frequently inflicted in the soft parts of horses and dogs, and these are more common in the legs, feet, and joints, than in any other parts. The treatment of wounds must depend in a great measure on the part where they are inflicted, and the form of the instrument that produced them. A clean cut made in the muscular parts is easily healed, by applying slips of sticking plaster as soon as possible, so as to keep the edges of the wound close together; or where plaster cannot readily be applied, by taking a stitch or two through the edges of the wound, and tying the strings gently together. When the edges are found to adhere, the strings must be cut away, and the holes which they made will soon fill up. If any considerable blood-vessel has been wounded, it will be proper to secure it, if possible, by means of ligatures, rather than by applying a styptic button. All wounds should be made as clean as possible, before any attempt is made to heal them. Sometimes the wound is so situated that it will not admit of being sewed up; but in these cases we may in general pass silver or steel pins from the edges, at about an inch distance from each other, and twist a thread crosswise from one to the other, so as to form what is called the twisted suture. In all cases where sutures are used, it will be proper to apply a sticking plaster over the edges of the wound. If the wound should not heal by these means, a formation of matter will take place, and then the sore is to be treated as a common ulcer, taking care that its edges be always kept as near together as may be, by sticking plaster or a bandage.

If the wound is very large, it may excite considerable inflammation and fever. In these cases, if the animal is plethoric, it will be proper to bleed him, or at any rate to administer cooling remedies. If, on the other hand, there has been much loss of blood, or if the wound shows no disposition to heal, and the matter formed is thin and ichorous, an opposite plan of treatment will be required. The animal must be supported by nourishing food, and strengthening remedies.

The most troublesome wounds are those of the feet and joints, as they are in general very difficult to be healed.

Wounds in the feet are not uncommonly produced by the horse treading on sharp stones, broken glass, the feet, sharp bones or nails. These are generally punctured wounds, and will be considered presently. Sometimes a deep wound is made on the coronet, by a sharp part of the heel of the shoe on the opposite foot, or any other substance penetrating downwards between the coffin-bone and the hoof, or between the lateral cartilages of the coffin-bone and the joint. Wounds of this kind are attended with much danger, from the difficulty of evacuating the matter, that may be formed, or of producing that healthy action in the parts that is necessary to make them heal. In such cases Mr Feron recommends the application of a blister, extending from the fetlock to the foot, so as to produce external irritation, which may relieve the internal parts. In the mean time the foot is to be kept in a vessel of warm water all day, and a large warm poultice of bran and water is to be applied round it at night. The intention of this practice is to prevent suppuration, but if should nevertheless, take place, and if matter should be formed between the hoof and the sensible lamina; the suppuration is to be encouraged, and we are to endeavour to prevent the formation of sinuses, by rasping the hoof very thin, just below the seat of the wound, so that we may be able to make an orifice for the evacuation of the matter downwards. Mr Feron advises...
advices to delay this opening as long as possible, and
when it is performed, to take care that the lamina be
properly pressed after the operation, to prevent coming
tout through the hoof, and forming an incurable sand-
crack, or false-quarter. The bathing the foot in warm
water, and the application of the bran poultice, must be
continued till the foot is perfectly healed. If proud
flesh should appear through the opening that has been
made in the hoof, it is to be pared away with a sharp
knife, then fired, and covered with a small pledget
spread with soft ointment, on which is sprinkled a little
powdered blue vitriol. It is evident that, during the
cure, the horse must be kept perfectly at rest; and it
is recommended to administer diuretics, and now and
then a gentle dose of physic, to keep the bowels modere-
ately open.

Wounds of the joints.

Wounds in the joints are commonly attended with
very serious consequences, as it frequently happens
that the capsular ligament is divided, and in this case
the synovia or joint-oil constantly exuding through the
opening, prevents the disposition to heal. A wound in
the joints is common among horses in the army, and
such as are employed in hunting; and a horse that has
received such a wound in general becomes perfectly
useless, from the improper method of treating these
wounds that has in general prevailed among farriers.
By their treatment, either an incurable sinus is produ-
ced, or a secretion of bony matter takes place within
the joint, forming what is called an anchylosis or stiff-
joint. The method generally practised by ordinary
farriers is, to inject within the joint a mixture of tur-
pentine and oil of vitriol, a solution of corrosive sub-
limate and lime water, or some other corrosive sub-
stance. The more rational of them content themselves
with an injection of tincture of myrrh. All these sub-
stances produce such a high degree of inflammation
within the joint, as not unfrequently to destroy the ani-
mal.

Of late, a much more rational mode of treatment
has been adopted by Mr. Coleman, and is described
in the first number of the Veterinary Transactions.
The following is the method recommended by Mr.
Coleman for treating wounds of the joints and capsules.

"Where a joint, a mucous capsule, or the sheath of
a tendon is opened, the first application necessary is the
actual cauterity. The instrument most proper for
the operation should be made of iron, two feet in length,
rounded at the extremity about the size of a small but-
ton, with a wooden handle. The temperature of the
iron should be moderately red. If it be black, the
heat will not be sufficient to produce a proper discharge
of lymph, to close up the wound; and if it be white, it
will destroy too much of the surrounding parts, and per-
haps do mischief to the ligament. Although the oper-
ation itself is very simple, yet some knowledge of the
structure and economy of the parts, for the purpose of
applying the cauterity with the best possible effect, is
necessary. The object in view is to produce a glutinous
substance to close up the cavity, and before the slough
is removed, for granulations below to supply the place
of the lymph; but if the ligament itself be destroyed
by the cauterity, it must, like other dead parts, separate
from the living and come away, and then the joint will
still be opened. It is, therefore, of importance not to
destroy the ligament of joints with the hot iron, but
confine its application to the external soft parts. In
these cases, it is generally proper to cauterize the whole
external surface of the wound; and if the discharge is
not immediately stopped, the iron has probably not
been applied sufficiently deep, or too cold, to produce
a proper discharge of lymph. Where a cure is possible
to be effected, the actual cauterity will frequently close
the cavity and stop the discharge. Sometimes, however,
in the course of one, two, or three days, the discharge
appears again by the sides of the lymph, and then
the same operation should be repeated. In some instances
Mr. Coleman has had occasion to apply the hot iron five
or six times, and nevertheless succeeded ultimately, with-
out the least lameness. The same treatment is likewise
to be recommended for penetrating wounds into the
chest and abdomen. The lips of the wound should be
cauterized, and, if requisite, repeated in the same man-
ner as is recommended for wounds of other cavities.

When the cavities of veins become inflamed, some little
variation is necessary in the treatment, as accidents of
that nature are frequently attended with consequences
different from the opening of other cavities, and require
a trilling alteration in the treatment. When a hemor-
 rhage takes place, it may be very generally stoped by the
application of the cauterity; but if this fails, and the
parts are too much swelled to admit of a pin, there is
no other remedy than to take up the vein by a ligature
above the diseased parts; and there may be instances
in which it may be advisable to tie up the vein below.
In general, however, the actual cauterity will prevent
the necessity of a ligature; and if it fails, tying up the
vein will succeed only in those cases where the veins
above is free from disease. In general, the vein is thin-
kened and inflamed, and if a ligature be applied on a
vessel in a state of inflammation, the disease will be for-
med, and the vein inflamed above. In a case that occurred
to Mr. Goodwin, veterinary surgeon at Oxford, where
the jugular vein was tied, an abscess took place over the
occipital bone, commonly termed the polli evil.

That disease, however, most probably did not originate
in consequence of the tube being obliterated, for in most
successful cases of inflamed veins, the sides of the vein
unite and destroy the cavity. After the office of the
inflamed vein, from the application of the actual cau-
tery, is closed, a considerable degree of swelling fre-
quently remains, and this may be removed by a blister.
When abscesses form in the adjacent parts, they should
be treated in the same manner as common abscesses."

A puncture of some part of the lower surface of the
foot is a frequent occurrence. It may arise from the
wounds of a prick of a nail in shoeing, from a nail picked up in
travelling; or from glass, flint, or any other sharp body.
Injuries of this kind are proportioned in their effects
to the parts punctured, and not entirely to the depth of
the wound. A puncture of the frog penetrating even
to the fleshly frog, is not usually so serious as that which
penetrates the sole; hence a wound any where at the
hinder part may penetrate deeper with impunity than
towards the centre, and likewise in the front, though
considerable inflammation usually follows from this last.
When the capsular ligament is wounded in these cases,
the consequence may be very serious, as a stiff joint is
commonly produced. When it is found that the cap-

Diseases.

F A R R I E R Y: Part VI.

sular ligament has been wounded, the external opening
must be enlarged, and a hot iron must be applied to
the
Part VI.

FARRIERY.

2. The second head of causes that produce lameness will comprehend strains, fractures, and luxations.

Strains may take place in any of the muscular parts or ligaments, but they most commonly happen in the fleshly part of the shoulder, or in some of the ligaments of the feet.

A strain in the muscles of the shoulder, has been generally called a shoulder-slip, under the idea that the shoulder-bone has been disjointed, or the blade-bone pushed out of its place; but the structure of the parts shows that the former of these accidents can scarcely happen, on account of the great strength of the capsular and other ligaments that surround the shoulder joint; and a dislocation of the blade-bone is, by the extent and strength of the muscles that unite it with the ribs, nearly impossible, unless by such a force as is sufficient to destroy the texture of the muscles, and tear the limb from the body. A strain of these muscles and of the ligaments that surround the shoulder joint, is, however, by no means an unfrequent occurrence, but affections of other parts are often mistaken for a shoulder strain, as we shall see presently. A strain in the shoulder, when first received, is generally attended with considerable inflammation and swelling of the part, which are usually sufficient to distinguish it from other affections. When the strain has continued long, and the inflammation has subsided, the distinction is not so easy.

In cases of recent shoulder strains, it will be proper to draw blood from the plate vein, and if the inflammation is extensive, to administer a purge, and keep the animal rather low, to keep down the inflammation as much as possible; and it will be proper to bathe the parts frequently, with some astringent lotion, or with a warm fomentation, as directed under bruisage. A rowel may also be placed in the chest, or a santon in the side of the fore-leg. Complete rest is necessary; and to render this the more perfect, the horse should be fitted with a patten shoe, and should have a bed of litter constantly below him. When the inflammation has subsided, gentle friction, and the occasional use of astringent lotions, will in general soon restore the use of the limb; and as soon as the horse can bear it, moderate exercise may be employed.

Injuries done to the ligaments and tendons, are also injuries of the usual called strains; but if we understand by this the liga-

356

tment, an extension of the strained part, the appellation is improper, since the tendons appear to be entirely without elasticity, and the ligaments nearly so. These parts cannot, therefore, be properly strained, though by unusual exertion, their texture may be so far injured as to produce stiffness, inflammation, and swelling, but will have the same effect in causing lameness, as a strain.

Injuries of this kind are more dangerous than more muscular strains, their treatment is more difficult, and the cure more tedious. The treatment usually adopted by ordinary farriers, is to apply the same astringent and stimulating lotions, as in strains; but here they commonly do harm, as they generally produce a greater secretion of coagulable lymph, which still more obstructs the motion of the part, and renders the lameness permanent.

One of the worst cases of these injuries, is what far-

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riers
A horse labouring under this injury, even after the inflammation has subsided, is extremely weak and stiff in the joints of the foot; but when he has been for some time at work, the lameness in some measure goes off. This has led some persons to suppose that a strained horse may be worked sound, but this is a very erroneous opinion, and the practice of continuing to work a horse that has been newly strained, under the idea of removing the stiffness, is equally cruel and injudicious.

The treatment of strains or injuries of the ligaments or tendons must be such as will most effectually prevent inflammation, and promote the absorption of the effused fluid. Local bleeding from the veins of the part, and warm fomentations frequently repeated, seem to be the most advisable; and a bandage should be always applied where the nature of the parts will admit of it, and should be continued till the lameness is removed. Various stimulating applications have been recommended in these cases, as soon as the inflammation has subsided, such as oil of turpentine, embittered spirit, verjusage, &c. but these must not be employed while any considerable inflammation remains. It is somewhat remarkable that Mr Feron recommends astringent and stimulating applications in the text of his work, and says there that they may be employed with safety; but, in a note at the foot of the page, he speaks of having inserted those astringent prescriptions for the purpose of satisfying the different opinions, but that he is fully convinced, by a long experience, that warm fomentations and warm poultices of bran and water, are infinitely preferable in strains or contusions, to these expensive prescriptions, and are always to be tried first.

It will be proper to elevate the heels of the horse's shoe by calks, and Mr Blaine recommends that the heels of the hoof be encouraged to grow, or that a thick-soled shoe be used. If there still remains much swelling, firing will prove one of the most effectual remedies, as it will both promote the absorption of the effused fluid, and will produce such a degree of constriction of the skin as will answer the purpose of a permanent bandage. In such cases the cautery must be applied, so as to make perpendicular lines on the skin.

Dogs are very subject to strains; and where these are strains or forcible, a mixture of spirit of wine and oil of turpentine, the size or strong Goulard, applied before a fire, is the most useful remedy. Sometimes from blows or other accidents, such as slipping their hind-legs, or getting them entangled in the bars of a gate, hounds are lamed in their stifles, as it is called. In general the above applications and long rest will remove the lameness; but when a considerable quantity of coagulable lymph has been effused, it is not easily re-absorbed, and the lameness continues. When this happens, some huntsmen recommend the operation of cutting for the stifles, and Mr Daniel speaks of a huntsman who used to perform this operation very dexterously in the following manner. The bone is laid bare by a transverse cut, and upon it is found a substance, like a stiff jelly, which is the cause of the lameness, and is in fact the coagulable lymph that has been effused. This jelly is taken away, and a wire is run through the ball of the hind foot on the contrary side, and twisted in such a manner as to keep that leg from touching the ground, so that the band may be compelled to use the stifled leg. In this way the dogs were always cured. The same huntsman recommended that
Part VI.  

FARRIERY.  

Diseases.  

That when a dog had been entangled in a gate or stile, he should, as soon as released, be taken by the hind-feet, and twisted round five or six times, turning with him; and it is said that this prevented any ill consequence from the bruises that he received in the stile, while endeavouring to disengage himself.

Some of the ligaments or tendons of the extremities are now and then ruptured. This is not a common case, but it may happen, either to the suspensory ligament, or the back sinew.

A rupture of the suspensory ligament is found most likely to happen to young horses while breaking, and to cavalry horses while under training. The accident is generally called breaking down, as, when it happens the horse appears unable to support himself. The fetlock is brought almost to the ground, and the limb is evidently exceedingly weak; but the horse can bend his foot when he raises it. This circumstance distinguishes a rupture of the suspensory ligament from that of the flexor tendon or back sinew; as, in the latter case, the power of the flexor muscle being destroyed, the horse is unable to bend the foot.

It appears from the observations of Mr. Coleman, and some experiments that have been made by Mr. Ferrot, that the flexor tendon has little or no effect in giving support to the heels; but that this office is almost entirely performed by the suspensory ligament. Hence, when this is ruptured, the horse loses one of his principal stays, and the foot is of course unable to support its usual weight, whence the horse breaks down.

A perfect cure of this accident can seldom be expected; and the only way to relieve the animal will be to obviate the inflammation as much as possible, and to elevate the limb, and especially to raise the heels, in order to relax the injured parts. An intermediate substance will in time be produced between the two parts of the broken ligament, that will enable the horse to walk and perform some of his functions, but he can never afterwards be depended on for the road or the field.

When it is ascertained that the back sinew has been ruptured, which is discovered by the inequality of the horse to bend his foot backwards, it is generally recommended to kill the horse, as a cure is by most deemed impracticable. Mr. Blaine recommends to bend the limb from the ancle downwards, and to keep it in that situation by throwing the animal, when he thinks that a perfect cure might be made. There would, however, be considerable difficulty in keeping the limb in such a confined situation for so long a time as would be necessary to unite the ruptured tendon; and after all, there is the greatest probability that a very slight exution would produce a fresh rupture.

Fractures of the bones may take place in any part of these animals, but they are most common in the feet of horses and the legs of dogs.

The navicular, coffin, and small pastern bones of a horse are not unfrequently fractured, and Mr. Ferrot speaks of a small pastern bone being broken into seven pieces. It is not surprising that these bones should be broken, when we consider the immense weight that is generally sustained by them, and the great exertions which a horse sometimes makes to recover a false step. These bones, when broken, will be united by a callus, provided that the limb be kept in such a situation as to prevent motion; but this can rarely be effected, even in cases where the bones of the foot are fractured, still less in those cases where a fracture of the larger bones has taken place.

One of the most common fractures of the bones in a horse is that of the ridge of the ilium, or haunch-bone, of the hind leg. This bone, from the projecting angle formed by its ridge, is peculiarly exposed to injury; and when the ridge is unusually prominent, as sometimes happens, or when the horse is more than commonly lean, the probability of fracturing this bone is still further increased.

Fractures of the haunch-bone may be occasioned by falls, by blows, which are often given by brutal ostlers and carters, with the butt-end of a large whip, or perhaps a broomstick, and they are very commonly produced by striking the haunch violently against a post, or the edge of a wall; when the horse turns too sharply round a corner, or passes swiftly through a narrow gateway.

It may be ascertained that such an accident has taken place, by the pain the horse feels in the part, and where the fracture is considerable, by the cracking of the parts of the broken bone against each other, but still more certainly by an evident cavity of the haunch, from the depression of the ridge. The muscles of the belly, in the upper part of the flank will appear sunk in, especially when the horse lies down, and will form a sort of hollow between the haunch and the rib. The horse, when he attempts to move, will be as lame as if one of the bones of the leg were broken, owing to the extreme pain that motion excites in the muscles, that besides being severely bruised, have lost one of their principal attachments.

When an accident of this kind has happened, it is necessary to keep the animal perfectly at rest, as nothing but repose can produce a reunion of the fractured bone. The parts may be gently rubbed with some stimulating liniment, as in other cases of bruises, and some recommend the application of a charge, or strengthening plaster. It sometimes happens, where only a small part of the bone has been broken off, the horse completely recovers his former activity; but more commonly such a deformity is produced by the ridge of one haunch remaining lower than that of the other, and by the callus that forms between the end of the divided bone, as to render the horse more or less permanently lame.

When the legs of a dog are broken, it is easy by means of splints, to keep the limb in such a situation as to effect a union of the broken bone; and we have not unfrequently met with cases of this kind, where a complete cure has been effected in the course of a few weeks.

The ribs of a horse are sometimes broken, either by falls, or from the brutality of their keepers, as by striking them with the heavy handle of a whip or cudgel. If the end of the fractured rib does not penetrate into the chest, so as to wound the lungs, a cure may in general be readily effected, by fastening a handage round the body over the seat of the fractured rib, and keeping the horse at rest and on a low diet.

Luxations or dislocations of bones are exceedingly uncommon in the horse, owing to the great strength of the...
Diseases of the ligaments that surround the joints. These may, however, sometimes happen, and we are by no means of Mr. Blaine's opinion, that the immense strength of the muscles in a horse would prove any obstacle to the complete reduction of such a luxation. If, indeed, we endeavour to reduce the luxation by pulling and hauling at the luxated limb, in order to overcome the power of the muscles, and thus produce a counter-extension, which is still, we believe, the method generally employed by surgeons to set a dislocated limb in the human body, we shall most certainly be disappointed. But if, instead of this vain attempt, we place the limb in such a situation as that the power of those muscles which are the antagonists of the muscles that keep the limb in its dislocated place, may be fairly exerted, there will probably be little difficulty in replacing the bone in its socket, as the very strength of the muscles will assist us in the operation.

364. Lameness is very commonly the effect of tumours of the mucous bags or capsules, or of exsiccences formed on the bones of the legs and feet, or on the hoof.

In most of the joints there are appendages or membranous bags, called bursae mucosae, or mucous bags, that are filled with a mucous fluid secreted into their cavities, for the purpose of assimilating the motions of the muscles and tendons near the joint. It often happens that these mucous capsules are enlarged either from hard work, which is a very common cause of their enlargement, or from some injury done to the neighbouring parts. When the enlargement is but small, it is of little consequence, but when the bags become unusually distended, their size impedes the motion of the joints. These tumours have received different names among grooms and farriers, according to the place where they are seated.

365. Wind-galls. When the mucous bags that are situated near the pasterns become enlarged, the tumours are called wind-galls.

366. Bog-spavin. When the enlargement takes place in the mucous bags on the inner side of the hoof, the disease is called bog-spavin.

367. Thorough-pin. When the tumours are seated in the upper and back part of the hock, between the gemelli muscle and the tendons of the great flexor muscle of the foot, the affection is called thorough-pin.

368. Capaulet. When the swelling is situated at that part where the tendon of the gemelli muscles is inserted into the point of the hock, it is called capaulet or capped hock.

Of all the various swellings, the wind-galls are the most likely to produce lameness, and next to them the bog-spavin. The capaulet and thorough-pin are seldom of much consequence.

369. Treatment. In the treatment of wind-galls and similar tumours, the object is to remove the unusual swelling, and to prevent its return. The swelling can be removed only by evacuating the contents of the tumour, or by promoting its absorption. The former was recommended by Dr. Beacock, and appears to have been successful in a few cases. The tumour is opened with a sharp knife, and when the fluid has been evacuated, an escharotic substance composed of burnt album, white vinegar, and red precipitate, is applied to the wound, to produce such a degree of inflammation as may contract its cavity. Probably firing would have a better effect. Mr. Coleman and the eldest of the veterinary college, are much adverse to this operation, and certainly where it can be avoided, it is not desirable. Absorption of the accumulated fluid may often be produced by the application of blisters, and other stimulating applications; but this is most certainly effected by producing pressure on the tumour, by means of a bandage applied round the part, with a bolster or compress immediately over the swelling. When the unusual enlargement has been reduced, its return is best prevented by firing the skin, so as to produce a considerable degree of constriction.

Horses are subject to various exsiccences on the bones, or exostoses, as they are called, which, when they form near the joints, or below the tendons of the muscles, generally produce lameness. These exsiccences have received various names, according to their situation. When they are formed about some part of the knee or cannon bone, they are generally called splenets, though farriers often call the exsiccences at the knee nodules; and when there are two small bony enlargements near each other, they are called jowts. The exsiccences at the knee are not very common, and when they occur, are generally the effect of a wound; but splenets about the cannon bone are very common, especially among young horses, owing to the blood-vessels in the being larger in proportion to the absorbents than in old horses; and hence the disposition of bony matter, in certain cases of injury, is greater than what the absorbents are able to take up again. These exsiccences are easily produced in young horses, by any blow or other injury that is capable of producing considerable inflammation; as striking part of the cannon bone which is the usual seat of splenets in what is called the speedy cut, or by producing unusual pressure on one side more than on the other. Although a splenet may not be in the neighbourhood of any material tendon, it may still produce lameness by the pain which it excites; but when it interferes with a tendon, or some important ligament, lameness must in general be the consequence.

When an exsiccence appears on any of the bones that enter into the formation of the hough, it is called a bone-spavin. It is most frequently found on the upper and inner part of the small metatarsal bone, or on some of the wedge-like bones on the inside of the hough. In the former situation it is often produced in consequence of the outer heel having been raised by calking; and in what are called cat, cow, or sickle houghed horses, it is often brought on by their natural deformity, though in these latter cases the exsiccence is most commonly formed on the inside of the hough.

An exsiccence situated on the back part of the hough towards its point, is called a court. This is sometimes formed on the hough, but it is frequently only in unusual hardness and swelling of some of theligaments.

When an exostosis forms on the lesser pastern bone, producing a hard swelling round the coronet, it is called a ring-bone. A deposition of bone over the lateral cartilages is sometimes also called by the same name.

The treatment of all these exsiccences is much the same, and one object must be, either to excise the absorbents vessels to increased action, or as to remove the bony exsiccence, or to take this way away by means of operation. The former of these is not likely to be successful,
Part VI.

FAIRIERY.

Diseases painful, except in the early stage of the complaint, when the bony matter is not completely hardened. If the excrecence be discovered in time, blisters are to be applied over the part, and repeated frequently, and strong mercurial ointment, or an ointment composed of corrosive sublimate and blistering ointment, is to be applied over the part, and gentle friction should be frequently employed on those parts of the limb that are above and below the swelling. By these means the excrences may sometimes be removed; but when they have become too hard, these stimulating applications will scarcely excite the absorbents to sufficient action. The only method to which we can then have recourse is an operation long ago practised by the old farriers, apparently with considerable success. The bony excrecence is laid bare, by making an incision through the integuments, and then the excrecence is cut off by means of a sharp chisel struck by a mallet. After this the skin is to be laid down over the part, and we are to endeavour to heal the wound as soon as possible, by sticking plaster and a proper bandage. Firing is much employed by the French for the removal of ring-bones and other excrences. Mr. Lawrence recommends that in firing a ring-bone, the instrument employed should be thinner than usual, and that the lines described should not be more than one-fourth of an inch distant from each other, being crossed obliquely like a chain.

Sometimes an inflammation takes place on the lower part of the hoof, between the sensible and horny soles, or between the outer crust and the binders, producing a slight effusion of blood, and leaving a considerable tenderness in the part. When the hoof is examined after being perfectly cleaned, there is commonly seen a discoloured spot, sometimes red, but more usually blue, or blackish, like what is seen below one's nail, when the finger is jammed. This affection is commonly called by farriers a corn, (in Scotland, we believe it is called a stone-crest), though it is by no means similar to a corn in the human foot. Horny excrences which might properly be called corns, are sometimes however produced on the horse's hoof; and of this nature, we suppose, were the corns on the feet of Caesar's horse.

This complaint is always owing to an improper pressure on the horny sole, by which the sensible sole is squeezed between it and the coffin-bone. Hence a quantity of blood is effused from the vessels of the sensible sole, which, if it remains for any length of time, produces an unusual tenderness in that part of the hoof. Corns are generally produced by shoes that are too hollow next the hoof, so as to allow a stone to get between the shoe and the sole, and thus press upon the latter; or it may be produced by the shoe being made too short or too narrow, and thus indenting itself upon the sole between the binders and the crust.

The best manner of treating a corn appears to be, to remove that part of the sole which is immediately below the seat of the affection with a drawing knife, taking care to cut farther than the seat of the effused blood; then to insert a pledget dipped in tincture of myrrh, into the opening. No pressure must be applied upon the part, and a piece of the shoe opposite the corn should be cut out, to prevent pressure from taking place. The horse must be allowed to stand quiet, on a level surface, and must not be worked till the horny part of the sole that has been cut away shall be renewed; and even then it would be proper to turn him to grass for some time, without shoes, or with very small tips of iron at the toes.

Lesions may be produced by many injuries of the feet, brought on by hard work, bad shoeing, or other ill treatment.

When horses are ridden hard on pavements, or hard dry roads, especially if the frog has been pared down, or even the crust cut away too much in shoeing, the battering produced on the hoof frequently brings on an inflammation of the sensible part within. This may happen also to cart horses made to draw heavy loads, under similar circumstances.

When the horse's hoof is not very delicate or tender, Grogginess, this battering sometimes only produces a stiffness, or swelling of the legs, and contraction of the sinews. This state is commonly called groginess, or a horse that has his feet thus battered, is said to be groggy.

If inflammation is excited within the hoof, a most Founder. painful species of lameness is produced commonly called a founder, or the horse thus lamened is said to be foudered.

The complaint is also called foot-founder, to distinguish it from a disease which we shall describe hereafter, and to which farriers sometimes give the name of body-founder. This inflammation may take place in any of the feet; or in any of the fore-feet; and it is most commonly produced in the fore-feet, and as, from the pain which the horse experiences, he endeavours to throw as much as possible of his weight, upon his hind-feet, and appears unable to support himself on his fore-feet, he is said to be down before.

This complaint most commonly takes place in horses; but it may take place in cattle or sheep, brought on by hard driving, on hard stony roads, when sent to fairs, or markets. In these animals, however, the complaint seldom proceeds to such a height as in horses; and it is in them more easily relieved.

The symptoms of founder are thus described by Mr. Feron. 'Founder horses have a general stiffness of the fore-hand, attended with a considerable acute pain of the joints, ligaments, and muscles, connected with it. The pain which the animal suffers on moving the joints, obliges him to keep the flexor muscles in a constant relaxed state, which position ultimately produces an entire debility and stiffness of every joint which compose the fore extremity of the animal. If the horse has been neglected, or the disease so rapid in its progress that it cannot be removed, the symptoms will increase so rapidly, that in a very little time we may observe the cutaneous veins become turgid and varicose, similar to the lymphatic enlargement in fancy. In this state, exercise considerably increases the pain and violence of the symptoms, the animal falls off his food, his health becomes very much impaired, and a general decay of the whole limbs, particularly observable in the extensor muscles of the fore-arm, soon renders the animal useless for activity.'

When the complaint affects the fore-feet, the horse throws his hind-feet as far forward as possible, which leads those who do not understand the nature of the complaint to suppose that the horse is affected with a weakness in his loins. When it is seated in the hind-feet the horse throws his body forward, in order to re-
FARRIERY.

Diseases.

A horse is supposed to labour under an affection of the chest, which has been called chest-founder.

The complaint usually comes on very rapidly, and sometimes appears a few hours after hard riding, or after the application of other causes, that will immediately be mentioned.

It may be easily known that a horse is foundered, as he can scarcely walk or first coming out of the stable, and evidently labours under great pain. Like many other affections that produce lameness, the horse appears to be relieved by exercise, but this relief is only temporary; and exercise only tends to increase the disease.

Mr Feron says, that, on dissecting the feet of foundered horses, he has frequently found the membranes of the joints thicker than in their natural state, and sometimes a disposition to anchylosis, or stiff joint; which in some of the joints was evidently observed.

The founder is very commonly produced by battering the hoofs on hard ground. It may be brought on by any causes that are capable of exciting inflammation in the internal sensible parts of the foot. It is frequently produced by washing the legs of a horse, while sweating; and according to Mr Feron, this is so evident, that if we observe the horses belonging to public coaches, in whom this practice is very common, we shall see that sixteen out of twenty labour under the torture of this disease. Founder may also proceed from allowing the horse, while sweating and fatigued, to stand long in a cold, damp air.

Causes.

In the treatment of founder, the great object is to remove the inflammation, which is best done by bleeding in the veins of the foot, and the application of blisters about the joints. The shoe of the affected foot must be removed, and the toe of the crust may then be pared to the quick, in order to produce a discharge of blood from the vessels of the affected part. It will be proper to pare the whole of the crust as thin as possible, especially at the heels and quarters, in order to allow the frog to come in contact with the ground. Blisters are now to be applied round the fetlock, down to the foot. Mr Feron recommends immersing the feet in warm water 14 hours after blistering, keeping them there all day, and applying a large warm poultice of bran and water at night. Mr Blaine, on the other hand, advises the use of cold astringent lotions, as Goulard or sal ammoniac in vinegar. Sometimes the pain in the feet is so violent, that the horse can scarcely bear to support himself upon them, and indeed if he could remain quiet, it would be better to let him lie down. But if he proves restless, he may be partly supported by means of a sheet drawn round him, with its corners pulled up to the ceiling of the stable by pulleys, so as to let the horse's feet just touch the ground.

The horse must be kept rather low, and if the inflammation is very great, or if there is any fever, it will be proper to administer cooling remedies, such as the drenches marked 22 and 25 in the receipts. The belly must be kept moderately open, and all exercise must be avoided.

Sometimes after the inflammation has subsided, the lameness still continues. This may be owing to the formation of horny matter between the sensible and horny sole. Mr Blaine recommends that this be removed by cutting away the horny sole; but we much doubt whether this operation would be attended with the desired effect.

Founder, properly so called, can take place only in those animals that have horny hoofs; but a similar affection not unfrequently occurs in the feet of bounded after a long and fatigueing chase. It consists in an inflamed state of the feet, produced by long running, especially over hard or stony ground. When the dog come home, their feet are hurt and swelled, inflamed, and sometimes cracked or chapped. The dog evidently feels considerable pain, and if he lies down for a little, he can scarcely be made to rise again. Dogs in this state are said to be stubbed in the feet, and are often so much lamed, that they cannot be taken out again for some days.

When the inflammation is but slight, it requires but little attention, as the dog will himself alay the swelling and pain by constant licking. When, however, the feet have been much bruised, the cracks pour out a bloody or purulent matter, and the case requires greater attention. The feet should be first bathed with warm water, and great care taken that no dirt or gruel be suffered to remain between the claws or in the cracks. After bathing, the feet may be rubbed with some digestive ointment, and a cold poultice composed of crumbs of bread well moistened with vinegar and water should be tied round the affected foot.

The hoof of the horse frequently becomes lengthened, and contracted at the heels and quarters. This natural shape is commonly the effect of bad shoeing, by which the frog is deprived of the necessary pressure on the ground, and thus the heels are prevented from expanding, while the nails that are fixed in the quarters contribute to prevent expansion there, and thus the hoof is unnaturally lengthened at the toe. This contraction is considerably increased by the best of ordinary stables, and by the evaporation that takes place from the hoof while the horse stands within doors, as account of the vacancy left below the frog, while the heels are elevated above the ground. Contraction of the hoof causes lameness, by producing an unnatural degree of pressure on the sensible parts within, especially on the sensitive frog, which is not unfrequently inflamed in these cases.

The remedy for this defect is to bring the frog gradually to press upon the ground, by lowering the heels but as, in the very sensible state to which the feet are commonly brought by contraction, it might be dangerous to apply pressure to the frog at once, it is advisable to lower the heels gradually, in the manner directed in No. 146. If the frog is much diseased, as sometimes happens, a bar shoe should be employed, by which means slight pressure may be made by fixing an iron plate from the heels of the shoe towards the toe. The best means of producing pressure in these cases would probably be to employ Mr Coleman's artificial frog. The upper part of the hoof should be rasped thin, especially at the quarters, as these parts of the hoof will then be more easily expanded by the motion of the lateral cartilages. The lower part of the hoof should also be kept moist, especially the frog.

Mr Blaine remarks, that dark chestnut horses are more subject to contracted feet than others, and he relates a case of a mare belonging to himself, who had all her feet contracted. These he endeavoured to expand by
Diseases. by means of jointed shoes, furnished with a sliding bar, which was kept in its situation by means of pegs, so that in this way the heels of the shoe might be gradually widened, by moving the cross bar farther towards the toe. This method is very ingenious, but Mr Blaine acknowledges that it did not fully answer his purpose.

When the heels have been gradually lowered so far, that the frog can bear the proper pressure, the horse should continue to wear a thin-heeled shoe; but if he is not required to be worked, it would be better to send him out to grass without shoes, where the pasture is not too dry.

It often happens in cases of contracted feet, and in some other cases, when the frog does not receive the due degree of pressure, that a running takes place from the cleft of the horny frog, occasioned by a degree of inflammation which is followed by a secretion of purulent matter. This complaint is commonly called a running thrush. While it extends no further than the horny frog, it is seldom attended with any serious consequences; but if it be neglected, the matter extends through the horny to the sensible sole, and produces canker or quitter.

Some horses have naturally a running from the cleft of the frog; and so long as this is slight, and the parts are kept clean, it is of little consequence. We know there are some persons who conceive a slight running thrush, as rather beneficial to a horse, and do not esteem it as a mark of unsoundness; but we cannot agree with these gentlemen in either particular, as, though the complaint does not in itself absolutely render a horse lame, so long as his feet are properly attended to, it will, if neglected, degenerate into a foul ulcer, the matter of which may easily penetrate into the internal parts of the foot. A running thrush is very commonly the consequence of bad grooming, and suffering dirt and gravel to lodge in the cleft of the frog; and it is still more frequently produced in the common method of shoeing, by cutting and paring away the frog.

In the treatment of a running thrush, the principal objects are, to remove the cause that first produced it, and to stop the discharge of purulent matter. The matter is easily affected by applying to the part some stimulating liniment. Mr Blaine recommends for this purpose a composition of two ounces of tar, with six drachms of vitriolic acid, which is to be applied hot every day, by pouring it into the cleft of the frog from a spoon. The discharge, though easily stopped in this way, will soon return, unless the proper degree of pressure be given to the frog; and this is to be brought about by proper attention to shoeing the horse with thin heeled shoes, taking care that the heels be lowered gradually, and slight artificial pressure be made on the frog, till it is become sufficiently healthy to bear the natural pressure of the ground.

When the matter of a running thrush insinuates itself upwards to the sensible part of the foot, it forms what is called canker, in which there is a considerable inflammation, producing a luxuriant unhealthy fungus, springing up from all the diseased surface that is exposed, and producing a great degree of tenderness, and what may be called a rottenness of the hoof. If this disease continues for any considerable time, it attacks the whole substance of the foot, extending to the tenons, ligament, and bones, till at last the foot may absolutely drop off with disease. Mr Coleman considers canker as generally the effect of too much moisture applied to the foot or hoof.

To check the progress of a canker, the whole of the excrecence that appears on the external part of the hoof, is to be cut away close to the surface from which it springs, and such parts of the horny sole as appear to be detached from the sensible sole, should be removed, to prevent the matter from lodging in the internal parts. When the diseased part is fairly exposed to view, it is to be washed with a solution of some metallic caustic, such as nitrate of mercury, No 49. of the receipts, or a solution of lunar caustic, in the proportion of a drachm to two ounces of soft water. This is best applied by moistening a pledget of lint or two, and confining this upon the cankered surface, by applying a regular pressure by means of cross bars of iron introduced beneath the shoe. A continuance of these applications, while the frog is gradually exposed to pressure, will in general soon stop the progress of the disease, and when this is removed, the horn parts of the hoof that had been cut away, will be gradually removed; and by shoeing the horse properly afterwards, the disease will be prevented from returning.

Cattle and sheep are subject to a disease very similar to canker in the horse, producing a discharge of fetid matter from between the claws of the hoof, or sometimes from only one claw.

This affection in cattle is commonly called the foal's foul, or the cattle are said to be foul in the foot. Managers of cattle commonly divide this disease into two kinds, the soft, and the horn, which are said to require different modes of treatment. In the soft foul, a running of very offensive matter takes place from the heels, or between the claws of the hoof; and the animal appears exceedingly lame. The treatment in this case, consists in cutting away all the soft and spongy parts, and then applying a caustic liquid, such as will presently be described, for the foot-rot in sheep. The parts are then to be covered with a pledget spread with mild ointment, or, what is very common among farmers, a piece of fat bacon may be wrapped round the part, tied on the foot, and suffered to remain for two or three days. In the mean time the animal should stand very clean, and be allowed to rest as much as possible.

The horny foul seems to be very analogous to corns in horses. The animal is very lame, and, on examining the foot, the hoof feels very hot, and, when hard pressed, the beast evidently feels much pain. There will commonly be found some part of the horn penetrating into the softer parts of the foot, either at the heel, or between the hoofs. In the treatment it is necessary to cut away these parts of the horn, as well as any part under which there appears much inflammation. For this purpose, it will probably be necessary to cast the animal, but care should be taken that he be thrown on a soft place. After the hoof has been pared away, a rag moistened with vinegar and water should be tied on, and the animal must be sent to grass in a soft smooth pasture. If the inflammation and pain are very great, it may be necessary to bleed from the veins of the foot.

In sheep it is called the foot-rot, and is generally produced by their being kept on a wet soil. It is remarkable that salt marshes do not produce it. According.
to Mr. Lawrence, frequent travelling to and from the fold, or by sucking oes from the hot dung of a sheep-house, will occasion it. Some are of opinion, that it originates from the same cause which occasions chilblains in the human feet; and this opinion is maintained in the essay on the diseases of sheep, affixed to Mr. Findlater's Survey of Peebles, where it is stated, that the remote cause of the disease is weakness, and the immediate cause cold and wet, as standing in cold weather upon wet pastures, with the feet constantly soaked in water. Dr. Wilkinson of Enfield considers moisture as the predisposing cause, and has found the disease to be produced from the sheep continuing in long grass during a mild winter. The same cause generally, although perhaps gradually, operates upon the whole flock, and then it has been supposed that the disease is contagious. The late Lord Somerville had a piece of pasture which always produced the foot-rot on any sheep that was put into it; but the disease was entirely prevented or rooted out by a careful selection of the sheep in order, by paring the hoofs of those that began to be affected, and by the use of cautics not too corrosive. These appeared to be the most proper means of stopping the complaint, and the best cautic application is said to be the nitrate of mercury. It is evident, that during the application, the hoofs of the sheep should be kept as clean as possible. Whether its greater or less prevalence depends on the less or greater attention paid to the sheep, is not perhaps fully ascertained. It is, however, certain that the sheep of some districts are entirely free from it. We are informed, that in Tweeddale the complaint is scarcely known.

There is a disease in the horse's foot, in which the coffin bone is forced backwards, and made to press unnaturally upon the heels, by which its edges being subjected to unusual pressure, become partly absorbed. Hence this bone, losing its support, becomes pressed in its concave part, where inflammation is produced, and bony matter is thrown out, rendering the lower part of the coffin bone convex instead of concave, and the sole is rendered unusually thin. This disease is called *pummiced feet*, and may be brought on in three ways; from improper shoeing, from inflammation, as in case of founder, and from a natural defect in the foot itself. It is said to be very common in wet soils. It is very commonly produced by applying the shoe red hot to the horse's foot. Its immediate cause appears to be an inflammation of the sensitive lamina, by which a quantity of coagulated lymph or of bony matter is thrown out, that forces back the coffin bone in the manner above described. When the disease is completely formed, it does not appear capable of being radically cured, but only admits of palliation. Mr. Blaine recommends, that the growth of the sole should be encouraged by every means, but the foot should not be kept improperly moist. The best means would be, the turning the horse out without shoes in dry pasture. No part of the heels or sole should be removed in this case, as the parts are already too slight. A shoe should be formed, if possible, that presents a hollow surface to the foot, and a plain one to the ground. This may be done, by making it of rather an increased thickness, which will admit of its being hollowed within, and bevelled from the outer to the inner edge of the web. Sometimes perpendicular fissures or cracks are seen in the hoof, extending between the fibres in a parallel direction from above downwards. These are called sand-cracks, and generally take place near the quarter, more frequently on the outer than the inner side, and oftener in the fore than the hind foot. These cracks sometimes come on suddenly, and then generally denote a contraction of the hoof. They are also said to have arisen from a wound in the vessel or part of the coronary ligament, bringing on a secretion of horny matter, which gets between the fibres of the hoof, and causes them to separate.

The means of preventing the crack from extending are to thin the hoof where the crack has taken place as much as possible, and to make a transverse section a little way across at the upper part. If the crack should still continue to gape, it must be carefully covered, and the hoof bound round, so as to close it as much as may be, and the portion of the crust that rests on the shoe should be chambered away a little, by which means the divided parts will be more likely to come together.

When a wound has been inflicted on the coronet, Pott's the coronary ligament commonly becomes injured, and the vascular part does not secrete so much bony matter as usual. Hence there is a space left between the old horny matter of the hoof, and the new that is formed from other parts; and this produces what is commonly called a false quarter. A false quarter may also be produced, in consequence of a gitter-extending upwards through the coronet. As the sensible lamina within the hoof are liable to be pressed in this vacant space between the horny edges, thus causing violent pain, the false quarter is attended with a lameness of the worst kind; for as this interference of the lamina sometimes takes place suddenly, while the animal is in motion, the pain makes him shrink, and he not infrequently comes down.

The only way of remedying this defect is, to excite such an action in the coronary ligament as may dispose it to throw out new bony matter, and thus fill up the vacant space. This is best effected by removing the surrounding horn, and applying blisters to the coronet, while the part of the hoof that is opposed to the shoe should be hollowed away as much as possible, to admit of the separated parts approaching each other.

When a horse in motion, especially in trotting, brings one foot so near another as to interfere, and thereby graze or wound one of the feet, he is said to cut. Sometimes the feet of a horse are in this way severely wounded, and temporary lameness is produced. In cutting, the horse may either wound the heels of the fore feet, with the toe, or side of the hind shoe, which is the most common case; or he may wound the fore part of the hind-foot, just above the hoof, by striking it against the heel of the fore shoe; or, lastly, he may bring two of the feet so closely together, as to wound the inner side of either.

Cutting may arise from a bad habit, or from a natural deformity of the feet, but it is very commonly the consequence of bad shoeing. When horses cut from turning out their toes, which is by much the most common cause, they are observed to have the inner quarter of the hoof lower than the outer, and the fetlock joints are thus nearer each other than those of horses which have their limbs straight. These facts led farrriers to a conclusion, that if the inner quarters were raised to a level with the outer, and especially if made even
Part VI

Fabriery.

Fie, and higher, the setlock joints would be thrown further apart, so that the foot would pass the supporting leg without striking: Accordingly, it has been usual to make the inner quarter of the shoe higher than the outer, and this has been the common practice for a long time. Mr Morecroft, by making trial of a shoe, of a shape the reverse of what we have described, namely, having the outer quarter thick, and the inner thin, completely prevented cutting in the horse, on whom those shoes were tried, and the utility of the improvement has been confirmed by succeeding trials. According to Mr Blaine, the principle on which this is supposed to act is, that when a horse is at rest, he supports his weight equally on both feet; but having his inner quarter much raised, in the common mode of attempting to remedy the defect of cutting, when one foot is elevated he must be supported obliquely on the other, and hence have a tendency to fall outwards; to prevent which he brings the moving foot nearer the supporting one, by which he strikes it. Considering in this point of view, it is not difficult to account for our author’s mode of reasoning on his method, which, by elevating the outer instead of the inner side of the supporting foot, must necessarily give it a disposition to lean inwards, and fall to the inside, which will throw the moving foot from the supporting foot. But, ingenious as this mode of reasoning may be, it is to be feared, that by thus throwing an increase of weight on the inner side, we shall sometimes be in danger of producing evils, that will counterbalance the prevention of cutting.

Lameness may be produced by any one of the causes that we have mentioned, but it may happen that a combination of two or more of these causes takes place at the same time in different parts of the same limb: thus the foot may be pricked with a nail, and a strain may take place nearly at the same time, in the sinews of the leg, or the ligaments of the joints; for the pain excited by the nail first makes the horse trip or stumble, and then, by his making a sudden exertion to save himself, or ease the prised foot, a strain of the ligaments or sinews frequently takes place. A similar complication is often produced in a horse that is affected with spavin, or other bony excrescences, as his exertion to save the limb that feels painful from the rubbing of the muscles or tendons of the spavin, may produce a severe strain in the muscles of the shoulder.

As the causes of lameness are so various, and the real seat of it frequently very obscure, a practitioner should be extremely cautious how he gives a decisive opinion with respect to either, before he has well examined the parts where lameness may take place, and enquired into every circumstance that may assist him in forming his opinion. For want of such precaution, and from a superficial examination of the part that is supposed to be the seat of the affection, egregious blunders and dangerous mistakes are not unfrequently committed, and applications have been made to parts that are really sound, when it is afterwards discovered, to the confusion of the practitioner, that the real cause of the lameness was in a different place. Nothing is more common than for ordinary farriers to apply their liniments and embrocations to the shoulder, when in fact the affection that causes the lameness is seated in the feet.

As, perhaps, in nine cases out of ten, the foot is the part that has received the injury, this should first be examined with the strictest attention, the hoof should be made perfectly clean, especially in its under surface, to see whether there be any crack or fissure, any discoloration, any particular heat, &c. The pastern and all round the coronet should be also carefully inspected: and, if nothing is found, the examination should be repeated next day, or even a third time. The foot is more particularly to be suspected of being the seat of the complaint, when the lameness makes its appearance soon after the horse has been shod, or has had his shoes fastened; as the foot may be lamed by a nail in shoeing, though the point of the nail has not penetrated to the quick. The nail may be so thick, or may pass so near the quick, as to press in a small part of the hoof upon the soft parts, thus producing exquisite pain, and perhaps inflammation. It is therefore proper also to remove the shoe from the foot of the affected limb, and if the cause of lameness is not very evident, to wait a few days to see whether the removal of the shoe has produced any alteration for the better.

No certain rule can be laid down for judging of the seat of lameness from the motion of the affected limb, though this is considered by some as one of the surest marks. The deranged motion in one part of the limb commonly arises from sympathy with another part that is the real seat of the affection.

We have now, we believe, mentioned all the import-ant cases of lameness, except the string-halt, or click spavin. This is an affection of the hind quarters, producing a sudden jerking of the legs upwards, when the horse attempts to move. It appears to be a nervous affection, and seems to be somewhat analogous to the chorea, or St Vitus’s dance, in children. We do not know that this affection has ever been cured, but it is said that it may be palliated by allowing the horse to run much at large, and letting him remain untied in a large stable. Mr Lawrence recommends that; after a hard day’s work, both hind legs be immersed in a warm bath up to the hocks, and kept there as long as the water continues warm, when they are to be rubbed perfectly dry, and the same bath and rubbing repeated in the morning. He also advises anointing the back sinews, and about the hocks, with strong camphorated ointment.

We have occasionally, in this and the preceding chapters, spoken of abscesses and ulcers, and their treatment; and we can add little here on that subject, as it will be fully treated of in the article SURGERY; and the instructions to be there laid down will apply nearly as properly to the inferior animals as to man. We may just remark, that foul ulcers, and such as do not heal kindly, are perhaps more common in some of the inferior animals than in man; and hence they require in the former applications of a more stimulating nature, to excite a proper degree of healthy action in the ulcerated part. There are a few particular ulcers which call for consideration in this article, and we cannot, perhaps, treat of them in any part of the treatise more properly than under the morbid affections of motion.

There sometimes takes place an inflammation, and consequent suppuration in the mucous capsules, at the articulation of the head with the first vertebra of the neck, near the insertion of the cervical ligament. This affection is commonly called the pull-eel. It is almost always
always the consequence of an injury done to the back of the head, by a horse's hanging back in his collar, by striking his head against the rack or manger; and is very frequently produced by a blow given on the head by brutal coachmen or carters. An ulcer in this part is often very difficult to heal, and when it extends beyond the skin, the matter sometimes insinuates itself below the ligament of the neck, and on each side of its anterior border, and frequently produces a caries or rottenness of the vertebrae. The cure of the poll evil is most easily effected when the inflammation is first discovered, before a suppuration takes place; as, when once matter is formed, it commonly produces sinuses in the loose cellular substance about that part of the head, and these are not easily healed. When, therefore, we have reason to suppose that inflammation has begun in the skin of this part of the neck, every means must be employed to prevent its progress towards suppuration. A blister should be immediately applied over the part, and when this has done its duty, a solution of sal ammoniac in vinegar, or vinegar and water, should be applied by means of a cloth kept constantly wet. If a suppuration appears inevitable, it must be encouraged by fomenting the part frequently with warm water, or by the repeated application of warm poultices; and when the swelling appears sufficiently ripe, it must be opened, which is best done by introducing a seton from the highest to the most depending part of the tumour, as directed in No. 173. The cord of the seton must be examined every day, wiped dry, and rubbed with a little digestive ointment, and the sore should be carefully excluded from the air.

If the suppuration has proceeded any length, before it is discovered, there will probably be a number of sinuses, or pipes, as they are called, with matter lodging in each. If it can be easily effected, it would be proper to lay these open, and make them communicate with each other, or, if their direction can be ascertained, a seton may be passed through each. When a proper opening has been made for the matter, and care taken that none of it lodges, the sore will soon heal, by the application of the proper stimulants.

It is sometimes necessary to employ the knife in this case; but when this is done, the greatest care should be taken not to wound the ligament, or, as the farriers call it, the fix fix of the neck. The best method of avoiding this is, to have the animal's head fastened very high to the rack, by which the ligament will be more slack, and the finger can be easily introduced below it, so as to be a guide to the knife.

We mentioned in No. 341, the chafing of the back with the saddle. There is another injury of a similar kind, that is often suffered by the withers, from the saddle being allowed to press on them too long. This pressure and rubbing sometimes produces an inflammatory swelling, which, if it be not so soon discussed, goes on to suppuration, and produces a sore which farriers call fistulous withers, or a fistula in the withers. This is also a very troublesome ulcer, as the matter sometimes penetrates below the shoulder, and makes its way down the bones of the fore leg; or, by insinuating itself among the vertebræ of the back, renders them curious.

The treatment in this case is much the same as in the last; the inflammation should be discussed as soon as possible, and if matter forms, it should be evacuated by means of setons. It is frequently required to pass a seton through the tumour on each side of the withers, in order to produce a proper inclination of the orifice, to carry off the matter. When sinuses form, they must be opened, as in the case of poll evil.

There is sometimes a species of ill-disposed ulcers in the external part of the ears of dogs, very difficult to heal. It is generally called cancer. These, when healed, leave hardened edges, which frequently break out again in the course of a few months. The best application in this case is lunar caustic applied to the edges, to encourage them to slough off; but if this should not be found sufficient, the best remedy will be to sear off the diseased parts with a red-hot knife, or they may be cut by a simple incision.

**CHAP. III. Morbid Affections of Digestion.**

In order that the food may be well digested, when received into the stomach, it is necessary that it undergo the previous operation of chewing; unless it be of such a nature, as to be easily soluble in the gastric juice, without this previous preparation. The latter is the case only with dogs, whose food consisting almost entirely of animal matter, requires little or no chewing. But the food of horses, sheep, and cattle in general, requires to be well chewed, either when first swallowed, or in sheep and cattle by subsequent mastication.

The mouth in these animals is sometimes so swollen, or otherwise affected with sores or cracks, that it is with difficulty the animals can chew their food. Sometimes there are bloody chinks or chaps in the palate, occasioned by thistles or other prickly plants, which are mixed with the hay, or grow up among the grass. These should be washed on their first appearance with salt and vinegar, applied by means of a rag tied to a stick. If neglected, these sores frequently become inflamed and ulcerated. If pimples arise, they must be opened when they begin to suppurate, by means of a pointed cauter.

There are sometimes found within the lip of some horses and other ordinary cattle, soft tumours, or pustules with black heads, which are called gisses, bladders, or blisters, in the mouth. They do not always occasion much inconvenience, but sometimes they grow to large size, so as to grow troublesome, and prevent chewing. When this is the case, they must be removed, either by fastening a thread about their roots, as directed in the treatment of warts, where they are of such a form as to admit of a ligature; or by the knife, applying afterwards the hot iron or cautery. In performing this operation, care must be taken to draw the tongue to one side, so that it may not be wounded. After removing these excrescences with the knife and cautery, the mouth may be washed with a solution of white vitriol or alum. Excrescences of a similar kind, called barbs or paps, sometimes grow below the tongue, and must be removed where practicable by means of a ligature, as it is dangerous to employ the knife. When these excrescences are neglected, there sometimes arise in the mouth little ulcers with white specks, very similar to the aphtous crusts that form in the human mouth. It is recommended by some writers to use the cautery on these occasions; but probably a detergent lotion, such as we have just recommended, will answer the purpose of removing them.
Part VI.

FARRIERY.

The mouth or tongue of horses is sometimes wounded with the bit or curb. When this happens, a lotion made with alum dissolved in water, and sweetened with honey, may be employed; and the bit should not be used again till the mouth is healed.

Many veterinary writers have described the disease in the horse's mouth called the lampas, which is stated to be an inflammation and swelling of the first bar of the mouth in a young horse, so as to prevent his chewing. We believe that Lavois and Dr. Bracken were the first to deny the existence of such a complaint, which is now generally discredited among most of our modern writers. We have no doubt that such a swelling may take place; but it can scarcely be attended with the ill consequences commonly attributed to it, or require such vigorous treatment as is usually recommended.

It may happen, that any of these animals shall have a difficulty of swallowing, from various causes; either from an unusual narrowness in the gullet, or from the morsel attempted to be swallowed being too large. The latter very frequently happens to cattle who are fed upon turnips or potatoes; and the choking thus produced sometimes proves very dangerous, as, if the obstruction is not speedily removed, the animal will die for want of breath. The method commonly employed among country farmers for unchoking cattle, as they term it, is to thrust down the throat a large stiff rope, ravelled at the end, and well greased. This often succeeds; but it is a clumsy method; and if the rope, by having been long used, or becoming dry, should lose its stiffness, it will be bent in endeavouring to force down the obstructor, if the ravelled end be not of a large size, or the obstructing morsel of an irregular shape, the rope may pass between the side of the gullet and the obstruction, without this being removed. Several intelligent farmers have therefore laid aside the use of the rope, and have contrived an instrument similar to the probang employed by surgeons. An instrument of this kind has been already mentioned, in the description of Mr. Hunter's feeding byre in No. 236. An account of one that appears to us to be more useful and ingenious, has been communicated to us by the reverend Charles Findlater, minister of Newlands in Tweeddale. It is the contrivance of Mr. Charles Alexander, a farmer in Mr. Findlater's neighbourhood, and has long been employed by him for the purpose of relieving choked cattle. The following is Mr. Alexander's construction of his instrument, as politely described to us by Mr. Findlater.

Take three small canes, of the thickness of the little finger, or thereabouts, of the length of 58 feet, that they may reach down the throat, and into the stomach of the largest ox. These canes are to be bound together by strong smooth twine rolled tightly about them (the circles of the twine touching each other), from top to bottom. Bees wax is then to be rubbed along the twine, to fill up any inequalities, and the whole rod is to be well oiled before it is used. There is a round knob at each end, the larger 2½ inches in diameter for larger cattle; the other less for lesser cattle. These knobs are formed of the twine rolled hard, and when formed may be strengthened in their position, by being sewed by means of a shoemaker's awl or bong, and a wax bristled thread, such as they employ. The thread knobs are made tapering up the canes from their breadth extremity; but it must be remarked that the surface of this extremity is not rounded like a clue, but hollowed into the form of a cup. The intention of this hollowed form is, to make certain of catching hold of the obstructing body; as, if the knob was round, it might pass by it. After the knobs are formed, they are covered with soft leather, which by its flexibleness will adapt itself to the hollow end of the knob as soon as it reaches an obstacle. The knobs must be securely fixed to the canes, for if they fall off, they leave an indigestible substance in the stomach. Such is Mr. Alexander's probang, the only improvements on which we would advise are, to make the knobs of sponge, firmly fastened to the canes, by passing twice through holes bored in them, and adding at each end two or three bights of twine, for the purpose of catching hold of any obstacle, thus making the instrument almost exactly like a surgeon's probang. We think the sponge preferable to the twine, as it will not be so liable to injure the animal's throat by its hardness, will adapt itself more readily to the form of the obstacle, and may be more firmly fixed to the canes.

When cattle are put into a field of young clover, or over-fed grass, especially if they have previously been kept on poor or dry fodder, they are apt to eat voraciously of their new repast, and the young succulent food, when received into the stomach, soon ferments, and produces such a quantity of air, as to swell the stomach to a violent and dangerous degree. Cattle thus affected are said to be over-fed, hove, or blown; or the affection of the stomach thus produced, is called over-feeding, or stomachs fig-sickness. If not accidently, the animal's stomach not unfrequently bursts, from the inability to evacuate the accumulated air; for there seems, in these cases, to be a constriction of the gullet, so that the air cannot escape upwards, while the number of stomachs, and the spasmodic contraction produced by the unusual distention, prevents its passage by the anus.

The necessity of speedily relieving the animal, prompted the employment of what must at first have been considered as a very desperate remedy; namely, stabbing the animal. An opening is made with a sharp pen-knife into the paunch, in the thin part between the last rib and the buckle-bone; and through this the air rapidly escapes. Sometimes the barrel of a quilt is inserted into the wound, to prevent its closing before all the air that is produced during the fermentation of the food, has escaped.

Stabbing the animal, is a remedy that should not be had recourse to, but on the most urgent necessity; as the wound can seldom be made with such nicety as not to wound some important organ, especially some large blood-vessel. Indeed frequently the distention of the stomach, and consequently of the skin and muscles of the belly is so great, that the moment the knife is introduced, a dreadful rent takes place, producing such a wound as may be attended with fatal consequences.

Happily this operation is not often necessary, as it is found that the administration of some internal stimulating medicine will check the fermentation of the green fodder, and promote the absorption of the extricated air. Many farmers have for some time given tar with this intention, administering an egg shell full to each beast; of late, however, the use of ardent spirits has been introduced, and it is found that a pint or matchbox of
of whisky or gin, mixed with an equal quantity of water, is the most efficacious remedy. Laudanum has also been recommended, but probably it is not superior to common spirits (D).

It has been the practice with some farmers, to introduce on these occasions, the common rope employed in cases of choking, into the stomach, and move it up and down, so as to produce a gradual evacuation of the air; but we should suppose that the evacuation produced in this way must be extremely slow.

Dr. Munro senior, professor of anatomy in the university of Edinburgh, some years ago contrived an elastic tube, that might be introduced down the throat into the stomach of the animal, and thus speedily and effectually evacuate the air. A description of this instrument, and the manner of employing it, appeared in an Edinburgh newspaper, we believe, with the doctor's authority. It has since been published in a popular treatise on the diseases of black cattle, entitled "Rowlin's Complete Cow-Doctor," from which we have taken it.

The doctor begins by observing, that the swelling of the belly is owing to the distention of the stomachs by fixed air, disengaged from the succulent grass in consequence of fermentation, the discharge of which by the mouth seems to be prevented by a spasmatic contraction of the upper orifice of the stomach. He concludes that the cattle may with certainty be saved, if the air be drawn off in due time, without injuring the stomach and bowels; and he affirms that this may be done with great ease by passing a flexible tube down the gullet into the stomach.

The tube is to be composed of iron wire, as large as a common stocking wire, or about one-sixteenth part of an inch diameter, twisted round a smooth iron rod, three eighths of an inch diameter, in order to give it a cylindrical form; and after taking it off the rod, it is to be covered with smooth leather.

To the end of the tube, which is intended to be passed into the stomach, a brass pipe, two inches long, of the same size as the tube, and pierced with a number of large holes, is to be firmly connected.

To prevent the tube from bending too much, within the mouth and gullet, in time of passing it down into the stomach, an iron wire, one eighth of an inch diameter, and of the same length as the tube, is put within it, which is to be withdrawn, when the tube has entered the stomach.

He has found that the space from the fore teeth of the under jaw, to the bottom of the first stomach of a large ox, measures about six feet, and he has passed such a tube, five feet and nine inches long into the gullet and stomach of a living ox. The tube ought therefore to be six feet long, that we may be sure of its answering in the largest oxen.

After the tube is passed into the stomach, it may be allowed to remain for any length of time; as when it is pressed with one side of the throat, it does not intercept the breathing of the animal. The greatest part of the elastic and condensed fixed air, will be readily discharged through the tube; and if it be thought necessary, the remainder of it, or the superfluous drink, may be sucked out, by a bellows fixed to the upper end of the tube, with a couple of valves, one at its muzzle, and the other at the side of it, so disposed as to allow the air to pass in the direction from the stomach upwards.

By means of such a tube, the air is not only more certainly discharged than by stabbing the animal; but the dangers avoided which the stabbing occasions, not so much by the irritation which the wound creates, as that the air, and the other contents of the stomach, getting into the cavity of the belly, between the containing parts of the bowels, excite such a degree of inflammation as frequently proves fatal to the animal.

This tube may be also useful for the purpose of introducing stimulant medicines in the stomach, when the contraction at the upper orifice would prevent their being given without some such contrivance.

An instrument of this kind is sold in London, at Macdongal's No. 15, Great Wind-Mill Street. It should be made of various sizes, for sheep as well as cattle. According to Mr. Blaine, Mr. Eages of Graffham farm, near Guildford, has simplified this mode of relief much, by the invention of an instrument, for which he was rewarded by the Society for the Encouragement of Arts, with fifty guineas. This is simply a cane of considerable diameter, and six feet in length for oxen; to which is affixed a knob of wood, at the end to be introduced into the stomach. That for sheep is considerably smaller, and three feet long. This instrument, for its simplicity, is much to be preferred, as it is found to occasion the evacuation of the air so effectually as the other. In cases of emergency, and in a judicious hand, the flexible part of a common cart whip might answer the end.

Flatulence may be produced in horses, by eating greedily of rich food, to which they have been unaccustomed, or after having fasted long; especially if they drink much water immediately after. A horse in this state should not be taken out to work, as, from the distention of the stomach, there is danger of injuring the horse's wind, or even in some cases of bursting the stomach. If the distention has not proceeded to a great length, and if the horse is not costive, gentle friction on the belly, and administering a ball made of some of the cordial seeds, will generally procure relief; but if the complaint proceeds to a great height, and there is gripping pain, attended with costiveness, it becomes a case of flatulent colic; the prescriptions and treatment of which will be considered in the next section.

When this flatulence comes to a great height, it forms the disease that is commonly called acute indiges.

Acute indiges arises from the horse eating voraciously, after having been kept without food for many hours; especially if the food then given him be of a flatulent kind, such as grains or draft, young sweet grass, clover, or the like. The horse's stomach being really small, is easily discommoded by an unusual quantity of food, or by the air disengaged from such as easily runs into fermentation. Hence arise swelling and tightness of the stomach, and acute pain. The horse discontinues eating,
The method pursued by the parent fly, in order to lay its eggs in the most favourable situation for being received into the stomatch of the horse, is extremely curious. It is thus related by Mr. Bracey Clark, who appears to have witnessed the process.

When the female has been impregnated, and the eggs are sufficiently matured, she seeks among the horses a subject for her purpose, and approaching it on the wing, she holds her body nearly upright in the air, and her tail, which is lengthened for the purpose, carried inwards and upwards. In this way she approaches the part where she designs to deposit the egg, and suspending herself for a few seconds before it, suddenly darts upon it, and leaves the egg adhering to the hair, by means of a glutinous liquor secreted with it. She then leaves the horse at a small distance, and prepares a second egg, and poising herself before the part, deposits it in the same way. The liquor dries, and the egg becomes firmly glued to the hair. This is repeated by various flies, till four or five hundred eggs are sometimes deposited on one horse. The skin of the horse is always thrown into a tremulous motion on the touch of this insect, arising from the very great irritability of the skin and muscles at that season of the year, occasioned by the continual teasing of the flies. The inside of the knee is the part on which these flies seem to prefer depositing their eggs, and next to this the side, and back part of the shoulder. It is curious that these parts are what are most exposed to be licked by the animal. In licking, the eggs adhere to the animal’s tongue, and are carried into the stomatch with the saliva.

The bots attach themselves to every part of the horse’s stomatch, but are usually more numerous about its further orifice, and are sometimes, though less frequently, found in the bowels. Their number varies considerably; sometimes there are not above half a dozen; at others they exceed 100. They most usually hang in clusters, fixed by the small end to the inner membrane of the stomatch, to which they adhere by means of two small hooks.

The body of the larva is composed of eleven segments, all of which, except the two last, are surrounded with a double row of thorny bristles, directed towards the truncated end, and are of a reddish colour, except the points, which are black. These larvae evidently receive their food at the small end by a longitudinal aperture which is situated between the two hooks or tentacula. The lips of this aperture appear somewhat hard, horny, and irregular.

Their food is probably the chyle, which being readily pure aliment, may go wholly to the composition of their bodies without any excrementitious residue, though on dissection the intestine is found to contain a yellow or greenish matter, which is derived from the colour of their food, and shows that the chyle as they receive it is not perfectly pure.

The slowness of their growth and the purity of their food must occasion what they receive in a given time to be proportionally small; from which probably arises the extreme difficulty there is found in destroying them by any medicine or poison thrown into the stomatch. After opium had been administered to a horse labouring under a case of locked jaw for a week, in doses of one ounce every day, on the death of the animal I have found the bots in the stomatch perfectly alive. Tobacco has...
FARRIERY.

Mr. Clark does not apprehend they are so very injurious to the horses as is generally conceived. When removed from the stomach a deep impression remains where they adhered, but whether they ever irritate it so as to bring on a fatal spasm of the stomach itself, or of the pylorus, or, by collecting round this passage, prevent the food from entering the intestines, has never been investigated with sufficient accuracy. The ignorant surprise of farriers on opening the stomach after death, and being presented with so singular an appearance as the bots, has without doubt very often occasioned the death to be attributed to these, though it is certain but few horses on our commons can escape them.

Instances have occurred of violent inflammation excited in the stomach by the bots. An example of this is related by Mr. James Clarke. He was once desirous of a farrier in the neighbourhood who was indisposed, to visit a horse that had been a patient of his for some days, and report the situation he was in. When Mr. Clarke entered the stable, the servant was giving the horse a drink, which he was afterwards informed was composed of an infusion of liliaeaed, in which was dissolved one ounce of nitre, with honey to sweeten it; and in the last portion was poured, from a small phial, about half an ounce, or more, of spirits of hartshorn. The horse seemed very uneasy after the drink, he was soon seized with a violent trembling and shaking, a profuse sweat broke out over all his body, and run down his sides, as if water had been poured on him; at the same time his legs and ears were quite cold; he lay down seemingly in great agony; he was soon after convulsed all over, and died in about half an hour from the time the drink was swallowed. Mr. Clarke obtained leave to take out his stomach where he was, on condition he should sew up the skin afterwards, in order to prevent any bad smell in the stable, till he could be carried off. In inspecting the stomach, the stomach, the mucous membrane of it was found greatly inflamed, and a mortification had taken place on one side, where it appeared of a darker colour, and here there was a small hole, through which a lead probe passed into the cavity of the stomach from the outside; the coats of the stomach were considerably thickened, and of a darkish red colour resembling the liver; at the same time the stomach was considerably distended and full of food: on turning it inside out, an incredible number of bots were found sticking all round the sides and lower part of it, so that it appeared entirely covered with them, sticking as closely to one another as bees in a honey-comb; and so firmly were the heads of these vermin fixed in the coats of the stomach, that endeavouring to pull some of them off when alive, they broke in two, and their heads remained sticking in the coats of the stomach.

The great irritation produced by such a number of these worms sticking in the coats of the stomach had no doubt occasioned at first an inflammation there, and from its continuance this was tending to a mortification, before the drench was given, and would have occasioned the horse's death.†

Another species of Oestrus, viz. the hemorrhoideal, also produces eggs, which when received into the stomach of the horse become bots. This insect has been termed hemorrhoideal from the appearance of the bots when coming out of the anus of the horse, when they are very like the swelling produced by the piles or hemo-rroids. It was supposed by Linnaeus and some other naturalists, that this and the last species introduced their eggs into the bowels of the horse, by entering the rectum; but this opinion is now fully refuted.

The part chosen by this insect for this purpose, is the lips of the horse, which is very distressing to the animal from the excessive titillation it occasions; for he immediately after rubs his mouth against the ground, his fore-legs, or sometimes against a tree; or if two are standing together, they often rub themselves against each other. At the sight of this fly, the horse appears much agitated, and moves his head backward and forwards in the air, to balance its touch, and prevent its darting on the lips; but the fly, watching for a favourable opportunity, continues to repeat the operation from time to time; till at length finding this mode of defence insufficient, the enraged animal endeavours to avoid it, by galloping away to a distant part of the field. If it still continues to follow and tease him, his last resource is in the water, where the Oestrus is never observed to follow him.

The teasing of other flies will sometimes occasion a motion of the head similar to this; but it should not be mistaken for it, as it is never in any degree so violent, as during the attack of the Oestrus.

At other times the Oestrus gets between the fore legs of the horse while he is grazing, and thus makes its attack on the lower lip; the titillation occasions the horse to stamp violently with his fore feet against the ground, and often strike with his foot, as aiming a blow at the fly. They also sometimes hide themselves in the grass; and as the horse stoops to graze, they dart on the mouth, or lips, and are always observed to poise themselves a few seconds in the air, while the egg is preparing on the point of the abdomen.

When several of these flies are confined in a close place, they have a pungent and strong musty smell; and I have observed both sheep, and horses, when teased by them, to look into the grass, and smell to it very anxiously; and if they by these means discover the fly, they immediately turn aside, and hasten to a distant part of the field.

The eggs of this species appear of a darker colour than the former, and we are unacquainted with the circumstances attending their passage to the stomach.

The larvae of the Oestrus hemorrhoideal, as well as the former species, appear to have been termed among the Romans, coccus, which seems to have been a general expression for any kind of soft imperfect animal, and to have been very analogous, and as extensively applied as the word grub is at present in the English language.

The presence of bots in the horse's stomach and symptoms of bots, is not always easily ascertained, as it is certain that great numbers have been found in the stomach after death, without appearing to have produced any unusual symptoms in the animal while alive. When, however, they have collected in any great numbers, or when the animal's stomach is peculiarly irritable, they are attended with the following symptoms. The horse has a disposition
Part VI.

FA R R I E R Y.

Diseases. position to rub his tail frequently, without any apparent humour or eruption that should make it itchy; he eats heartily, and is yet always lean and out of condition. His coat is rough and staring, such as we have described it to be in what is called a surfeit. There is also a sickly paleness of the mouth and tongue, attended with an unlewd odour of phlegm. The horse appears tuckled up in his flanks, which often heave; he turns his head now and then, and strikes his belly with his hind feet. These latter symptoms indeed, as they only indicate gripping pains, and often occur in ordinary colic, are not to be relied on, unless accompanied with the former. In cases of worms, it is said that the dun is yellowish, like melted sulphur, or is otherwise discoloured and very offensive. The surest mark, however, of the presence of bots is their being voided by the anus, where they are sometimes found sticking.

Treatment. As the bots are extremely tenacious of life, it is very difficult to expel them, and where they do not occasion any considerable irritation or other bad symptoms, it will be better to let them alone till they come away spontaneously. But when it is judged necessary to attempt their expulsion, this may be done by administering the sal indus, as directed in No. 60. of the receipts, and after it a strong dose of calomel and aloes.

We have said the bots are not proper worms; but there are several species of worms that are very frequent in dogs, and are now and then found in the horse. These are the lumbrici, or long round worms; the ascarides, or thread worms; and the taenea, or tape worms.

Lumbrici. The long round worms are seldom met with in these animals; but when they occur in the horse, they produce much uneasiness, and sometimes occasion colic and inflammation of the bowels. It is very difficult to expel these worms, as the only remedies by which this could be properly attempted, such as powdered tin and strong purgatives, cannot with propriety be often given to a horse, as, from the structure of his stomach, the former might produce considerable injury, and the latter are extremely debilitating.

Ascarides are now and then found in the great guts of the horse, and sometimes prove troublesome, but are seldom or never dangerous. They are best removed by clysters of lime-water, followed by purgative clysters.

414 Tape-worm. The tape-worm is seldom found but in dogs, where they are sometimes the cause of fatal diseases, especially to puppies. The symptoms of worms in dogs are, an itchiness of the nose and at the anus, both of which are perpetually rubbing against every thing; swelling and hardness of the belly, leanness, running at the eyes and nose, and frequent purging of a slimy or stringy matter. There is also a peculiar staring appearance of the hair, which points the wrong way.

Mr Blaine says that the bowels of dogs are so irritable, that they will seldom bear strong physic, and that he knows of nothing that will certainly destroy the worms in their intestines. He has tried with variable success, tin, quicksilver, pewter, calomel, and salvin, with other substances, but none of them appeared sufficiently certain to demand his confidence. When the worms are early detected, he thinks that purging doses of the compound powder of scammony with calomel, prove the most efficacious means. Mr Daniel re

513 commends aloe, hartshorn, the juice of wormwood, with some flower of brimstone, mixed together into a ball, about the size of a hazel nut, which is to be wrapped up in butter, and given three or four times a week, letting the dog fast for a few hours each time, which, he says, will destroy the worms. He also says that they may be destroyed by giving the dog as much finely powdered white glass as will lie on a sixpence, for three successive mornings, mixed up with butter; and if the worms are not voided in that time, the dose of the glass is to be increased, and it is to be repeated for three other mornings, by which time it will scarcely fail of producing the desired effect.

There is a sort of concretion often met with in the stomachs of cattle, and sometimes in that of horses, in the stomach, which is partly composed of a chalky substance, and partly, or sometimes almost entirely, of hair evidently arising from the animals licking off their hair and swallowing it with their saliva. The mass thus received into the stomach, being wholly indigestible, collects there, and forms these globular concretions which sometimes grow to such a size as to prove fatal.

The growth of these concretions is thought to be encouraged by the long use of dry hard food, without the animal's being allowed to feed from time to time on fresh green herbage. It is even thought that the timely use of fresh grass may prove the means of dissolving these concretions. Van Swieten, in his commentaries on Boerhaave, when speaking of chalky matters found in the liver and other organs, remarks, that sometimes there are concretions of the like sort found in this organ, but of a more friable texture, and of a whiter appearance, like gypsum or plaster of Paris. Such concretions were often observed by Olisson in the peri biliarii, and its larger branches dispersed through the livers of oxen that had been fed in stalls with hay and straw during the winter season and without exercise. But then these concretions are very friable, and they afterwards dissolve again, and pass out of the body when the cattle come to feed upon the fresh grass of the meadows; for in oxen that are slain in the spring or summer, they are very rarely to be found.

415 In dissecting horses (says Mr Clark) I have frequently met with chalky concretions in their livers and in the lungs, especially in those that have been fed long on dry food, and likewise round balls in their stomachs, sometimes of an oval shape. The latter seem for the most part to be composed of the dust they lick from their own bodies mixed with the hair. Whether the fresh grass dissolves them is not so certain; but that it causes these concretions to pass through the intestines, I have had a full demonstration. In May 1785, a horse that had been long fed on dry food was turned out to grass; in about eight or ten days afterwards, he was seized with violent gripping pains, which lasted for about 24 hours, when he died. As the horse was very fat, the man who had the charge of him wanted to make something of his grease. In searching for it, he observed a large space of the intestines of a very black colour; and on feeling it, found something hard and weighty within them. He immediately cut it open with his knife, and took out a large oval hard ball, which measured four inches in length, and three inches and a half in breadth, and which I have now in my possession. That this concretion was originally formed in the 3 T stomach,
FARRIERY. Part VI.

Diseases — stomach, there can be no doubt, as they frequently upon dissection have been found there, and nothing but its great bulk had hindered it from passing through the intestines.

The best means of obviating these concretions, is to allow the animal to feed occasionally on fresh green fodder; and, according to what has been said, this may sometimes remove them after they are formed.

Horses and other domestic animals sometimes labour under a loss of appetite. Animals may eat less than usual, or they may refuse to eat at all, either from a want of that sensation in the stomach, which we call hunger, or from a dislike that the animal takes at the food that is set before him. Want of appetite is a symptom of several diseases, particularly of fevers and internal inflammations. When this happens, it would be absurd to force food on the animal's stomach, as it could not be digested, and would only aggravate the violence of the disease.

Want of appetite very often attends very great fatigue. It is also very frequently the effect of an improper use of cordial and strengthening medicines. It may, however, be the effect of weakness of the stomach, not brought on by those means. In such a case, cordials and tonics are very proper, and their use should be accompanied with gentle exercise.

This loss of appetite in the horse, is commonly called chronic indigestion, and is usually accompanied with a roughness and staring of the coat, the skin having the appearance which we have described in No. 328 under hide-bound.

An affection of a similar kind takes place in cattle, in which it is called loss of the cud, from their not chewing the cud as usual. It is known by the animal's mourning, having no inclination to eat, or dropping his food, without swallowing it. It frequently arises from the stomach being loaded with hard food, which is difficult of digestion, such as acorns, or coarse dry straw. It may also arise from a weakness of the stomach, which is not uncommon in hot weather, and may be brought on by confinement and want of fresh air. The treatment is much the same as in horses.

Horses are subject to an affection of the stomach, in which they sometimes eat voraciously, or greedily swallow substances that are indigestible. Horses labouring under this complaint are called foul feeders, as they eat clay, mortar, dirt, fool litter, or even the dung of other animals.

This is properly a symptom of indigestion, and seems to be owing to a peculiar acidity of the gastric juice, and in most cases there is evidently an acid upon the stomach. The best remedies are bitters, and other strengthening medicines, combined with salt of tartar, or some other antacid. The receipts marked 61. and 62. are well adapted to these cases. These remedies should be assisted by pure air and regular exercise; and where costiveness is present, it should be obviated by the use of warm laxatives. Care should also be taken to keep the stable clean, and to have a quantity of clean straw below the manger, that the horse may not be tempted to eat other substances that are more injurious.

Foul feeding.

Surfeit in dogs.

A surfeit is sometimes occasioned by hounds eating putrid flesh, or that of horses that have died; or been killed, when violently affected with the farcy. Arising from the former cause, the farcy which attended the disease of Mr. Fisc in Kent, is a curious instance.

In drawing the covers, the bounds met with the carcass of a diseased bullock, with which they gorged themselves; the contamination was immediate through the pack; they were generally seized with staggering convulsive fits, operating to so violent a degree, that eight couples of bulls died in the field in less than two hours, and it was supposed the whole pack would have fallen victims, but for timely application of oil and other medicines. Mr. Daniel, from feeding with the flesh of horses sent from a post stable, in which the farcy and the glaunders had spread their ravages, had an opportunity of speaking to the latter; the bounds broke out all over in blisters, discharging a watery humour, similar to those occasioned by the farcy; they caused great stiffness, and were extremely painful. This inoculation took place, notwithstanding most of the horses were sent alive to the kennel, and were properly slaughtered, and none of the flesh was given raw to the bounds. Physic, and taking them frequently to the salt water, and well rubbing the sores by hand with it, at length recovered them. For checking a common surfeit, ox-gall and train-oil, equal quantities; the affected parts to be well rubbed, and some physic taken inwardly will quickly restore them.

There are two diseases that affect the bowels, which we cannot consider more properly than at the end of this chapter. These are rupture and folding of the fundament. These may take place in any of the domestic animals, but they are more common in horses, as they seem most frequently the effect of great exertion. Barrenness, or rupture, commonly proceeds from strains in labour, kicks on the belly, high and difficult leaps, especially when heavy laden. It may be produced by the gorging of oxen, by being staked, and by various other accidents. Gibson says that he has known it produced by too deep an incision being made in inserting a rowel.

The bowel may be ruptured either at the navel, or through the rings at the back part of the belly into the scrotum or cod. The tumour, when not too large, will return on being pressed, as if it were merely flatulent, and the rupture or chasm may be felt. It is easy to conceive that such a defect is incurable, excepting possibly in a very slight case, and a very young subject; the intention must be to palliate, to render the animal as useful as possible, and as comfortable to itself. In a recent case, bleed, and give emollient and oily elysers, boiled barley, malt mushes, nitrate water. Foment twice a day with camphorated spirits, and vinegar warm; and poultice with oatmeal, oil, and vinegar.

Folding of the fundament is sometimes occasioned by falling of a long-continued looseness, and is most likely to be produced in such animals as are of a weak and delicate constitution, but is frequently brought on by hard riding or hard driving. Mr. Lawrence says that he has frequently seen it in hard-driven pigs. According to Soley's, it is in horses sometimes the consequence of docking.

When this complaint is first seen, it may in general be easily cured. The gut should be returned as soon as possible, by pushing it up with the ends of two or three fingers wrapped round with a piece of soft linen rag gently pressed; but before returning the gut it should be bathed with some astringent lotion, as a solution of...
Part VI.

FARRIERY.

Disease.
of alman or white vitriol, or part wine and water; and
a little of either of these should be frequently injected.
If the gut should become inflamed, it must be anointed
with some cooling liniment, such as receipt No. 28.
Cure must be taken to keep the animal's bowels open,
by frequent bran mashers. If the complaint continues,
nothing will effectually remove it, but cutting
off a part of the protruded gut. This may be done
with a common surgeon's knife, called a scapel, but,
it is sometimes performed with a sharp red-hot cautery.
The wound commonly soon heals, but the animal
should not be worked for some time after; but
should be allowed a long run at grass, or in a straw
yard.

CHAP. IV. Morbid Affections of Absorption.

The absorbent vessels of the human body have been
described in the article ANATOMY; and the structure
of these vessels, in the animals now under our considera-
tion, is sufficiently similar to render a particular de-
scription of them here unnecessary. The function of
absorption, and the arrangements produced in it by
disease, will be explained under those medical articles
that have for their object physiology and pathology.
It will be sufficient for us, in this place, to remark, that many
of the disorders of the animal frame, are greatly influ-
enced by the state of the absorbent system; and that
some complaints seem chiefly to depend on the loss
of the proper balance between the function of absorption,
and that of circulation. Sometimes the absorbent ves-
sels are too active, while the circulating system is pro-
portionally languid; at others the absorbent system
is languid, while that of the circulation is either unusually
active, or continues in its natural state. The former
seems to be the cause of leanness, constiveness, and some
other morbid affections; to the latter may be referred
the several species of dropsey. We shall here only con-
template two of these affections, leanness, and swelled legs,
as most of our readers will expect constiveness treated of
as a morbid affection of excretion; and most of the spec-
ies of dropsey must be considered as general affections
of the system; and therefore to be explained in the next
section.

An unnatural degree of leanness may take place from
many causes; as, 1st. From the want of a proper sup-
ply of food, whether from being dispensed too spar-
ingly in proportion to the labour of the animal, or from
its not being sufficiently nourishing. Hence we see
that such horses and dogs as are hard worked and ill
fed, are extremely lean.

2d. In stallions leanness is often the effect of being
suffered to cover too often, or too long at one season.
3d. It is a common attendant on several acute diseases,
as fevers, some inflammations, especially dysentery, or
what has been commonly called molten grease.

4th. Leanness is a common attendant on old age
This symptom requires little attention, as it is seldom
dangerous, except when it comes on very rapidly, and
is attended with great weakness, and manifest signs of
decay, in stallions that are too hard worked. It com-
monly soon disappears after the cause that produced it,
or the complaint, of which it is a symptom, is removed.

A swelling of the legs is very common to horses that
are suffered to stand long in the stable, without being
worked, or in some other cases that will presently be
mentioned. There is a swelling of the legs that is the
consequence of hard work, strains, or other causes that
excite inflammation; but what we are now considering
is a dropeal swelling, consisting in an accumulation of
watery fluid below the skin, similar to the swelled legs
of old people, and chlorotic girls. It may affect all the
legs, but it is more commonly confined to the hinder ex-
tremities. The swelling generally takes place above
the pastern and fetlocks; but if it continues long, it extends
further up the legs, and the skin sometimes cracks, and
there oozes out a watery fluid, or sometimes a purulent
or greasy matter. In this last case it has degenerated
into greese, which will be considered hereafter.

Swelled legs frequently take place in horses that are
newly brought into the stable, or a straw yard; especi-
ally if they are not regularly worked, and their legs re-
gularly rubbed down, at least twice a day. It is more
certainly produced, if the horse should be suffered to
stand long on hot litter. It is also not uncommonly
the effect of wading through snow or cold water, es-
pecially when the legs are heated. It evidently depends
on a decreased action of the absorbent vessels and veins
of the legs.

It may in general be prevented by regular exercise,
and frequent rubbing; but if it should occur in a horse
that is too full of blood, it may be necessary to bleed
and physic. If the swelling should continue obstinate,
it will be proper to apply a blister to the part, or to
rub the legs frequently with some stimulating liniment,
and if the complaint is of long standing, it may be pro-
per to insert a wavel in each leg; and the dispersion of
the swelling may be assisted by rolling hay bands around
the legs, by way of bandage. One of the most effectual
means of preventing a return, will be firing, making
perpendicular lines with the cautery from the fetlock to
the coronet. Regular exercise and friction must be per-
sisted in; and if the complaint is accompanied with
general weakness of the system, a nourishing diet, and
strengthening remedies must be added.

CHAP. V. Morbid Affections of Circulation.

The pulse in the inferior animals has been very
little attended to by veterinary practitioners; indeed the various
common farriers and cattle doctors scarcely know where their patients have a pulse, or where it may be
most readily felt.

The strength and frequency of the pulse in its natural
state, differs very much in the several species of the dom-
estic animals. It is in general stronger according to
the size of the animal; but its frequency diminishes in the same proportion, it being quicker in the smaller than
in the larger animals, even of the same species. We
cannot undertake to state exactly the average frequency
of the pulse, in the several animals, and the accounts
given by different authors vary considerably. Mr. Clark
says that the pulse of a horse in health, and no way
terrified or alarmed, is from 36 to 40 beats in a minute.
According to Mr. Blaine, it ranges from 45 to 55, being
generally from 45 to 50 in large horses, and from 50
to 55 in smaller horses. Dr. Hale found that the pulse
of an ox in health did not exceed 38 beats in a minute.

3 T 2
Mr. Blaine, in his first volume, states the medium pulse of a dog at 50 or 60; but in his second volume, p. 149, he says, that a dog has usually from 90 to 100 or 110 contractions in a minute, so that we may probably take the average at from 90 to 100. Perhaps the pulse of a sheep is slower by about 10 beats than that of a dog.

The pulse in the inferior animals may be most conveniently felt in the temporal arteries, which, as we have said in No. 164, are situated a little backwards above the outer angle of the eye. It may be felt also at the corner of the lower jaw, on each side of the fetlock joint, on the inside of the hock, and at the heart.

As much is to be learned from the pulse, respecting the nature of many diseases, and the degree of danger which they indicate; we earnestly recommend to our practical readers, that they take every opportunity of examining the pulse of these animals, when in a state of disease. We cannot here enter with propriety into an explanation of the morbid varieties of the pulse, as it would be only to repeat what is given in the pathological part of our work, to which we refer our veterinary readers; as the observations there delivered can be easily applied to the particular cases of horses, cattle, sheep, and dogs, by keeping in view the natural state of the pulse, in each species, as above laid down.

There are two general states of the system, that may take place in all animals, and which are chiefly distinguished by the state of the circulation, as ascertained by the pulse. These are plethoric, or fulness of habit; and debility, weakness, or inanition. The former is always attended with a fulness, and sometimes a hardness of the pulse; while in the latter, the pulse is weaker and small, easily compressed or stopt by the finger, and is sometimes slower, but often more frequent than natural.

When an animal has been kept for some time on a full nourishing diet, while he is at the same time confined within doors, and deprived of that regular exercise, which is necessary to carry off superficialities, he becomes fat, corpulent, and full of blood, or what we call plethoric. In this state the veins below the skin, from their being greatly distended with blood, are very prominent, excepting in those parts where they are bedded in fat; the pulse is, as we have said, full, and commonly strong, but in some cases it feels oppressed, as if the quantity of blood were too much for the cavity of the artery. The pulse in these cases is frequently slower than natural.

The animal becomes dull and sluggish, averse to motion, and if he be obliged to exert himself, evidently does so with difficulty, pants, and labours, and becomes soon fatigued.

This plethoric state is extremely common in horses and dogs that are pampered with high living, and little or no work. A horse in this state, though he may look well, is far from being in good condition, and is by no means fit for active labour. In fact, if such a horse is put to hard work, before he is properly prepared for it, there is the greatest probability that he will be completely ruined. Instances occur every day of full fed idle horses knocking up, or even dying on the road, and a long list of violent diseases is the consequence of this plethoric state of body. It lays the foundation of broken wind, inflammation of the lungs, phrensy, and above all of staggerers, or apoplexy. It is no uncommon thing to see a fat well-looking horse, fall down in convulsions, while drawing a heavy load, owing to the determination of blood to the head, from so great an exertion, while the vessels are too much distended. Most lap dogs and others that are parlor guests, commonly die of apoplexy. A lady of our acquaintance had a fine fat lapdog, whom seldom quitted the cushions that formed his bed; besides his mistress' chair, where he was fed with the nicest bits from the dinner table. Jack had been unusually heavy for a day or two, and one morning was found lying dead on his cushion; though he had the night before eaten a hearty supper.

To prevent the ill consequences that must arise from this plethoric state, these animals should be regularly exercised, and not suffered to eat too much. When the pellagra has already taken place, and where dangerous symptoms threaten the attack of some violent disorder, the best method of bringing the animal into good condition, is to lower his diet gradually, and gradually increase his exercise or labour; but when the symptoms are such, as indicate approaching apoplexy, or some other dangerous disorders, it will be necessary immediately to bleed and purge, and to take care that the animal be not put to any violent exercise till he be brought into good condition.

We must here remark, that frequent bleeding with a view to obviate pellagra, is extremely improper, as it tends to produce the very state against which it is employed. Bleeding, therefore, ought not to be had recourse to, except in cases of imminent danger.

There is a complaint that sometimes appears among cattle, when they are suddenly put on high feeding, after having been long accustomed to a poor and sparing diet. It is called by the graziers, hocks, and is probably of an inflammatory nature; but as it seems to depend entirely on a sudden distension of the blood vessels, and is speedily relieved by removing this distention, it may properly be considered in its place.

The complaint is said to begin with an uneasiness and swelling about the eyes, and about the guscular part of the throat, which extends itself gradually over the whole body, to the legs and joints; and in cows to the barren and udder. The animal appears languid, dull and heavy, and seems unwilling to stir from the place where he is; and when the disease has made some progress, he will not lie down till he is relieved. The legs become cold and numb, and as the swelling advances towards the hind parts, a copious secretion of saliva commonly takes place from the mouth, attended often with a swelling about the tongue. The disease is extremely rapid in its attack and progress, and if it be not speedily attended to, it will terminate in staggerers, or some violent inflammatory disease.

The cure of this affection seems to depend entirely on bleeding, which should be performed as soon as possible, taking away a quart or two of blood at a time, and repeating the operation some hours after, if the swelling is not diminished. It is recommended to rub the whole body well, both before and after bleeding; and if the mouth is much affected, it will be relieved by washing it frequently with salt and water. If there is any considerable heat, it may be proper to give a drench with nitre every four hours.

Insanitation is a state of body directly the opposite of what we have described; and is produced by very different
Part VI.

FARRIERY.

The artery that is most liable to be wounded in bleeding is the external carotid, which runs below the jugular vein, or sometimes a little to one side of it. This accident will, however, seldom happen, except when a ligature is used; but when this is employed, the jugular vein is pressed so closely on the artery, that the point of the steam or lancet may easily penetrate through the vein into the artery. M. Huard alleges, that in this way even the wind-pipe may be wounded, together with the artery, and that the animal may be choked by the effusion of the blood from the latter into the former.

When an accident of this kind has taken place, whether from bleeding, from wounds, or from the erosion of an artery by the acrid matter of a foul ulcer, it is necessary to take speedy means for preventing the ill consequences that may ensue; for, though the wounded artery be not very large, such an effusion of blood may take place from it, as may greatly weaken the animal, if it should not prove fatal. If the artery is small, the bleeding is easily stopped, either by applying such a degree of pressure, as may be sufficient to obliterate the cavity of the wounded vessel, or, what is often more convenient, by completely dividing it; after which the divided ends will contract so much as to prevent the further effusion of blood. If the wounded artery be large, it can be secured with certainty only by means of ligature. For this purpose, pressure must be made on the artery, between the wounded part and the heart, while an incision is made through the skin and muscles down to the place where the artery has been wounded, so that this may easily be discovered. Then a pretty strong thread, doubled and waxed, is to be passed round the artery by means of a crooked needle, with a blunt point, and is then to be tied fast about an inch above the wounded part. A similar ligature is to be fixed upon the artery at about the same distance, on the other side of the orifice, and the artery is to be cut across between the two ligatures. Thus, the further effusion of blood is completely prevented, and the wound may be healed in the usual manner. The part that was supplied with blood by the wounded artery, will, if the vessel were pretty large, be colder and less sensible than usual, but it will in general be sufficiently supported by the small branches of other arteries that join with the wounded vessels beyond the ligatures; and these branches will gradually become so distended as to supply the place of the divided artery, and restore the part to its proper functions.

It sometimes happens, that part of an artery becomes unusually dilated, forming what is called a true aneurism. This dilatation may take place in any of the arteries, but it is most common in the sorta or great artery within the body, and in the external carotid and popliteal arteries without. An aneurism of the external carotid is often seen in dogs, and sometimes in horses, especially such as are accustomed to draw heavy weights. An aneurism of an external artery is easily distinguished, by a considerable pulsation, which may be felt much more superficially than the ordinary beat of the artery, and is sometimes so remarkable, that it can be distinctly seen by the alternate heaving and sinking of the skin below which the swelling is situated. An aneurism of the sorta is not so easily distinguished in the inferior animals. The diagnostic marks by which it may be known...
Diseases. known in the human body, will be given in the article
Surgery.

These aneurysms are attended with considerable danger, and those of internal arteries commonly soon prove fatal. Aneurysms of external arteries are attended with a wasting of the bones over which they lie, owing to the increased absorption of bony matter produced by the pulsation of the dilated artery; and these swellings commonly burst in no long time, especially if the animal be exposed to any great labour or exertion.

The treatment of these aneurysms is exactly similar to that of a wounded artery described above. It consists in securing the dilated artery, either by pressure on the sides of the aneurism next the heart, or by means of two ligatures, one on each side of the tumour.

An effusion of blood into the cellular substance may take place from a vein, the orifice of which has not been properly closed after bleeding; or it may happen from the orifice in the vein not exactly corresponding to that in the skin, so that the skin gets over the orifice in the vein, and prevents the blood from flowing out. In this latter case there is said to be a thrombus of the vein.

When such an effusion of blood is observed, it is necessary to dilate the orifice in the skin, and to take away the clotted effused blood from below it. If the vein does not appear likely to bleed again, it will be unnecessary to pin it up; but if blood should still flow from it, it will be necessary to secure it by a pin. This, however, should not be suffered to remain too long, as it may produce inflammation and ulceration of the vein. Sometimes it is so long before the effusion of blood is observed, that the swelling is become considerable, and is attended with inflammation, or even suppuration. Where inflammation is present, but has not proceeded to suppuration, this latter may in general be prevented by keeping the part moist (after taking out the effused blood), with a solution of sugar of lead in vinegar and water. If matter is already formed, the swelling must be poulticed, or frequently fomented with warm liquors; and when the matter is let out, the sore must be treated as a common ulcer.

Sometimes the inside of a vein that has been opened in bleeding inflames, suppurates, and becomes a fistulous sore; and if this be neglected, the matter may extend to some important organ, as to the head, when the jugular vein has been opened, and produce death. When the vein is not very large, or the ulcerated part of it is considerable, it may commonly be healed by means of the actual escurry, or firing, as described in N. 351; but if the wound is very large, or the ulceration very extensive, it may be proper to secure the vein by means of ligatures applied on each side of the ulcerated part.

When the enlargement of any part of a vein takes place, without the vein having been wounded, the swelling is called by medical writers varix, or the vein is said to be varicose. This swelling seldom takes place in any of the domestic animals, except the horse, in whom sometimes the superficial vein that passes over the inside of the hock sometimes becomes variceous, and forms what farriers call a blood-spavin. The enlargement of this particular vein is always accompanied by hog-spavin, or an enlargement of the muscular capsules in the same part of the hock, and the former seems to be a consequence of the latter, being produced by the compression of the vein, by the swelling of the muscular capsule below it, whence an obstruction of the blood, and a consequent dilatation of the coats of the vein.

When the enlargement of the vein is not considerable, it requires no particular attention; but if it should increase so far as to be troublesome, methods must be taken for its removal. This may be effected, either by producing such a pressure on the vein as shall stop the circulation of the blood in it, or by tying up the vein with a ligature. In applying pressure, such a bandage should be adopted as may surround the whole hock, while the greatest pressure is made on the dilated vein.

Mr. Blaize recommends for this purpose a bandage including several of those elastic tubes, ladies glove braces or tubs are made of, which would occasion permanent pressure, and yet permit motion. But, should it still be found to resist this, its removal must be attempted. For this purpose, an opening should be made above the enlargement, and then including the vein within a ligature, and an opening below likewise, including the vein also at that part; the enlarged part may then be punctured, to let out the distended blood, and the remainder suffered to slough away.

Chap. VI. Morbid Affections of Respiration.

In many complaints, especially fevers and inflammations of the internal organs, the breathing becomes hurried, and inspiration and expiration, but especially the former, are performed more quickly than in the healthy state of the body. This hurried respiration, in the inferior animals, is known by the rapid heaving of their flanks; and when it is attended with considerable heat and dryness of the skin, it denotes considerable danger. Any particular consideration of this symptom will, however, be more proper, when we come to treat of the particular cases in which it occurs.

The principal affections of breathing which we shall here notice, are those in which respiration is rendered difficult, without being attended with fever or inflammation. Horses are more liable than other domestic animals to difficulty of breathing, and one particular modification of it, broken wind, is peculiar to this animal.

There sometimes takes place within the nostrils a snore, or gathering of thick clotted matter, which, when it comes to any considerable height, very much obstructs respiration, and produces a snuffling noise when the air passes through the nostrils. This affection is called the snore, or snuffle, and is almost peculiar to cattle. It is sometimes mistaken for a disorder of the throat, where it is imagined there is some obstruction; but when this rattling noise is found to attend the breathing of cattle, it may generally be discovered whether or not it be the disease in question, by a careful inspection of the nostrils. The swelling thus produced in the nostrils generally goes on to suppuration, and when it breaks the animal is relieved. The object of our treatment must therefore be to hasten the suppuration by the application of warm stimulating fomentations or liniments. A very common application in these cases is the oil of bays injected up into the nostrils; but perhaps the steam of warm water would answer every good purpose, and might be easily applied, by putting a warm brass mug into a canvas bag, and tying it to the animal's head; and this may
Farriery.

Chronic cough. Cough is almost a constant attendant on colds, consumptions, inflammation of the lungs, and other pulmonary complaints; and when it occurs as a symptom of these diseases, no particular attention is to be paid to it, as our principal object is the primary affection. It frequently happens, however, that after the inflammatory affection is removed, an obstinate cough remains; and if this is attended with no considerable difficulty of breathing, and if the horse eats well, and appears to be thriving, the cough alone requires our attention. This kind of chronic cough is generally more considerable in the mornings and evenings, and after eating, and is generally increased by any violent exertion.

Chronic coughs, though generally a consequence of previous inflammation, may arise from a peculiar irritative state of the top of the wind-pipe; and if this be the case, the use of some narcotic substance, as opium or hemlock, may be proper. A very obstinate cough is often the consequence of preceding inflammation, and is attended with a peculiar noise, as if the aperture through which the air came was diminished. This kind of noise is called roaring, and it is found on dissection that the wind-pipe is contracted by a quantity of coagulable lymph, that has been diffused during the inflammation. Mr. Blaine has seen a preparation where the diameter of the wind-pipe was reduced to one-third of its original dimensions, and it has often struck him as not improbable that the grasping the wind-pipe hard, as is sometimes done to try the wind, may bring on inflammation, and occasion this affection.

These chronic coughs, especially the roaring, scarcely admit of a complete cure; but they may in general be mitigated, by keeping the animal warm, and by avoiding violent exertion. The food should be such as is easy of digestion, and does not produce much distention of the stomach. Tar is much recommended in these cases, especially for the cough, or hoarse, that sometimes occurs in cows. An ounce of tar, with the same quantity of vinegar of squills, and a little oil of aniseed, is to be given every morning, in a quart or chopin of warm ale.

One of the most common defects in a horse's breathing is that which is called broken wind; the nature of which complaint has been of late much elucidated by Mr. Coleman. According to Mr. Lawrence, broken wind is discovered by the quick and irregular heaving of the flanks, and a more than ordinary dilatation of the nostrils; sometimes also, by a consumptive appearance of the body. But the usual method of trying the soundness of a horse's wind, is to cough him; which is performed by pressing the upper part of the wind-pipe with the finger and thumb. The strong, clear, and full tone of the cough, prove his wind to be sound; if, on the contrary, the note be short, whistling, and husky, the horse is asthmatic and unsound. Horses labouring under the worst stage of the disease are styled, in the language of the repository, roeters; from the noise they make in work, of very little of which they are capable. Broken-winded mares are generally barren, although we have heard of one which bred a whole team of horses after she became so. In confirmed broken wind there is sometimes observed a palpitation of the chest, with constant contraction and dilatation, and now and then a considerable cavity or depression may be perceived.

The old writers had many strange opinions with respect to the nature of this complaint. Gibson attributed it to an enlargement of the contents of the chest, and Dr. Lower thought it proceeded from a rupture of the phrenic nerve. A friend of Bartlet supposed the disease to proceed from a morbid or obstructed state of the glands and membranes of the head and throat, the enlargement of which prevented a free passage to the wind. According to Mr. Osmer certain glands, which are placed upon the air-pipe, at its entrance into the lungs, are become enlarged, and thereby the diameter of the tube is lessened; hence the received air cannot so readily make its escape, nor respiration be performed, with such facility as before; from which quantity of contained air the lobes of the lungs are always enlarged, as may be seen by examining the dead carcasses of broken-winded horses.

It is now satisfactorily ascertained, that the immediate cause of broken wind is a rupture of some of the air-cells of the lungs. The cause that most commonly produces such a rupture is over distention of the stomach, attended with hard and violent exertion. The horse being an animal that is always eating, will, when hungry, eat very voraciously, if he has an opportunity, and soon fills his stomach; and if, in this state, he is exercised violently, the circulation and respiration will be increased, but the lungs cannot expand sufficiently, because the diaphragm cannot descend from the pressure of the stomach. In this case, the circulation being hurried, the lungs do not undergo the necessary change, in consequence of their now being compressed. The animal then, endeavouring to take in more air, either actually occasions the cell to be ruptured, or something else to give way. If the cells are ruptured, the air escapes from these into the cellular membrane of the lungs, and there acts as foreign matter, or, at least, it cannot then produce the necessary change on the blood, when thus diffused; in consequence, difficulty of breathing arises from two causes: 1st, From the blood passing through the lungs before it has undergone its necessary alteration; and, 2dly, from the rupture of the air-vessels. The respiration is rendered slow, as is seen by the flanks being long in rising up, because there is no direct communication with the bronchia, as in the healthy state of the lungs; inspiration is, however, in a third of the time of expiration, which is seen by the sudden descent of the flank. The lungs, from containing more air, are specifically lighter than in the healthy state.

This local disease does not admit of a permanent cure, at least no medicine has yet had any such effect; but a temporary relief may be obtained, as we shall see hereafter. But we must not omit to mention here a most ridiculous practice which has sometimes been tried by common farriers, that of making an orifice above the rectum, and then introducing a machine similar to a medical instrument called a flagellum, with the idea of evacuating the superfluous air, or wind, which they suppose to have produced the disease.

Blistering the wind-pipe, rowelling the chest, and a small purgative of aloes and calomel now and then, have often produced a good effect.

A pound or two of shot has been strongly recommended to Mr. Coleman, as a specific; but, upon trial, it has been
Diseases. been found to have no obvious effect: it was thought that the shot would act by its specific gravity inclining the stomach further back into the cavity of the abdomen.

The treatment must be nearly confined to diet and exercise; the animal should have little hay, and water in particular must be administered with a very sparing hand. These substances which afford most nourishment in the least compass, as carrots, corn, split beans, &c. should be given; the horse should always be worked upon an empty stomach; and, upon the whole, his diet should be small in quantity, but nourishing. By observing this method, a broken-winded horse may do a great deal of work, and be useful to the owner.

According to Mr Blaine, internal medicines have sometimes been found useful in this complaint. Lime-water has been employed with advantage; and the use of tar is much recommended. Mr Blaine prescribes a mixture composed of two gallons of lime-water, four pounds of tar, and an ounce of fresh bruised squills, or garlic, of which an English pint (or must-chink) is to be administered every morning.

A complaint similar to the foregoing often occurs in the horse, and is called thick wind. It proceeds from a very different cause, being always the cause of previous inflammation, during which congested lymph has been effused, as in the roarer. Thick wind may be distinguished from broken-wind, by the inspirations and expirations being equal in the former; while in the latter the respiration is not so frequent, and the principal difficulty consists in expiration, which is of course performed in longer time than inspiration.

Little can be done towards a cure of this complaint. We may prevent the disease by good management in the administration of the alimenta, exercise, &c. Cola, mastic, and saliva, from the nostrils and mouth, are of a greenish hue, bordering a little upon the yellow. The breath is dull, and heavy, loathing all kinds of food, eating no more than a bare sufficiency for the support of nature; the skin is dry and itchy, especially behind the shoulders, where it can scarcely bear the touch. The beasts have an utter aversion to exercise, or stirring from the place where they are, and if removed with the least degree of precipitation, will break into a cold sweat. Their urine is of a deeper yellow than usual, which has sometimes led to believe it was red water, or bloody urine. The dung undergoes a very considerable alteration in all stages of the disease, and its general colour is blueish or brown, and much resembling burnt clay; but it varies in colour, according to the subject, or different circumstances and seasons. If the disease continues long, the beast gradually pines away, and at last dies of a decline.

It is said that horses have sometimes died of jaundice, in two or three days; and in those violent cases a black sanguine discharge has taken place from the mouth and nostrils a little before death. This is called by farriers the black jaundice, and after death the liver is found totally decayed. Mr Lawrence says that he has repeatedly seen cases of this kind. Gibson speaks of an inflammatory species of jaundice, attended with delirium and madness; but this was probably a violent inflammation of the liver.

We have said that the immediate cause of this disease is an obstruction of the gall pipe, commonly owing to
Diseases.

Farriery.

521

time, whereas in diabetes it passes off in a full and copious stream.

Incontinence of urine is extremely common to dogs, and often arises in these animals from excessive venery, or from the violent efforts which they are sometimes, by the brutality of bystanders, obliged to make to separate themselves from the females. It is also not uncommon owing to the presence of one in the bladder. M. Barruel, professor of the veterinary school of Alfort, had a little Spanish bitch, not above five inches high, and about seven years old, who was troubled with an incontinence of urine, unaccompanied by any other symptom; she was sprightly and well, and was in good condition. Not knowing to what to attribute the complaint, M. Barruel tried a number of remedies, such as warm bathing and oysters of various kinds, but without effect; at last he killed the bitch, and found in her bladder a stone that weighed an ounce and 40 grains, a very considerable bulk, if we advert to the small size of the animal.

This complaint is less common in the horse, but it may arise in any of these animals from a paralytic affection of the sphincter muscle at the neck of the bladder; which is sometimes the consequence of the bladder's being unusually distended with urine. When there is reason to suppose that it is owing to this cause, the best remedy is a blister applied upon the pubis, or the frequent application of stimulating liniments to the same part.

A difficulty of making water, or even an entire suppression of urine, is a very common disease among horses of urines, and frequently occurs in sheep. The symptoms accompanying this affection, differ somewhat according to the causes which have produced it; we shall therefore consider it under several heads.

1. One of the most common causes of a suppression of urine, is suffering the bladder.

2. From the urine being so long retained, the bladder becomes excessively distended; considerable irritation takes place, and when the distention has proceeded to a great height, the animal, though constantly stimulated to relieve nature, is not able to effect his purpose, owing to a paralytic affection that has taken place in the muscular coat of the body of the bladder, attended probably with a spasmodic contraction of the sphincter. If the animal be not soon relieved, a considerable swelling appears above the pubis, accompanied with great uneasiness; the urine becomes absorbed, and is carried through the circulation to various parts of the body, producing an itching of the skin, and generally, in no long time, apoplexy and death.

Sometimes, however, before any considerable absorption can take place, the bladder either becomes inflamed, or bursts, and discharges its contents into the belly, producing there inflammation and mortification.

This complaint is, as we have said, very common among sheep, constituting an affection which in Scotch, is called the watery brassy. It is said that young and vigorous sheep are most liable to it; and according to the writers of the ingenious appendix to Mr Findlater's Survey, the immediate cause of the disease, is feeding too freely on succulent diuretic food, and resting too long.

† Vol. VIII. Part II.
DISEASES long in their laires in the morning. It has been frequently observed, that this species of braxy is most apt to make its attacks upon Sundays, because shepherds generally sleep longer on Sunday mornings than other days of the week, and, of course, allow the sheep to remain too long in their laires. This disease may be prevented by avoiding too free a use of succulent diuretic food, and by moving the animals from their laires early in the morning, making them walk about for some time, in order to encourage them to pass their urine and purr.

In attempting to effect a cure, it may be known whether the bladder is affected, by a great fulness in the lower part of the belly, immediately above the pubis. The seat of the distemper being ascertained, a female silver catheter, or one of elastic gum, ought instantly to be passed through the urethra into the bladder of females. This will draw off the urine, and give immediate relief. But this will be attended with great difficulty in males; and if attempted, must be done with a long and properly bent catheter or bougie. In either case, when this cannot be accomplished, puncture may be made into the bladder with a trocar, directly above the pubis; taking care not to wound the intestines. By either of these methods, the urine may be discharged, and the animal relieved. In other respects, with a view to alay or prevent inflammation, evacuations should be procured by catheters and warm injections into the great gut.

2. In the case which we have been considering, the urine, though secreted as usual, could not be discharged; but a suppression of urine sometimes takes place from the secretion not going on as usual, owing to some affection of the kidneys, commonly an inflammation of those organs. We can scarcely with propriety consider this case here, but shall treat of it among the other inflammations in the second chapter of the next section.

3. Another cause that may produce a suppression of urine, or a difficulty in stailing, is a stone in the bladder, or gravelly concretions passing from the kidneys through the ureters or urinary pipes. We have just seen that a stone is sometimes found in the bladder of dogs; but doubts have arisen, whether this could take place in the horse. Examples of it are no doubt very rare, but we have sufficient proof that it may take place. Mr Clark of Edinburgh mentions that he has several stones taken out of different horses; and it is said that Dr Mead had in his cabinet one that weighed 13 ounces. M. Hazard gives an account of a dissection that he made of a horse that died of a suppression of urine, in whom the following appearances were observed. The bladder contained a considerable quantity of red and bloody urine. Its internal membrane was thickened, especially at its lower part; and it was also inflamed and gangrenous in several points. The ureter contained at about its middle, a fragment of a stone that entirely blocked up the passage of the urine, and had no doubt been the cause of this suppression. The stone was imbedded in a cavernous body like the kernel of a fruit. Within the bladder there was also a stone about the size of a largeullet's egg, broken into two portions.

If we consider that symptoms of gravel are by no means uncommon in the horse, that gravel is often found in his urine, and that calculous concretions have been frequently observed in his kidneys, we shall easily see that these cases are not so extraordinary as some may imagine. There is no doubt, however, that cases of a stone in the bladder cannot so frequently happen in quadrupeds, from their horizontal position, which prevents the stone from passing from the kidney into the bladder so readily as in the human subject. Hence the kidneys have often been found to contain stones of a considerable size, without the horse having been during life affected with symptoms of calculus.

When concretions form in the kidneys, they generally produce a great degree of irritation, and consequent inflammation; but if a horse is affected with a suppression of urine, there is reason to suppose that a stone is lodged in the bladder. The certainty of this having taken place may be very readily ascertained, by introducing the hand within the rectum, as the stone will, for the most part, be felt below the finger.

It is not probable that internal remedies can have any effect in cases of calculus in the horse. In the beginning of the complaint, when the symptoms are very slight, diuretic medicines may be tried, and will perhaps bring away the small sandy particles; but if a stone of any considerable size is lodged in the kidneys, the case is incurable. If the horse has got into the bladder, it may be extracted by making a cut into the bladder above the pubis, and taking out the stone by means of forceps, as such are employed by surgeons in the operation for the stone. In the mean time the animal may be relieved, by drawing off the urine from time to time by means of a catheter, which is easily used in the mare, and by preventing exertiveness. Too much labour or over exertion should also be avoided, and the animal should live chiefly on succulent food.

4. A suppression of urine may arise from an obstruction in or about the neck of the bladder. A curious at the next case of this kind occurred to M. Hazard, and he has the bladder related the appearances on dissection, which were as follows.

There was at the base of the spermatic arteries, on the right side, a glandulous body about the bigness of one's fist, through which oozed a lymphatic fluid, that was whitish and thick, in some places appearing like pus. The bladder was enormously distended with urine, and extended into the belly beyond its usual limits; it was inflamed and thickened; the urine was nearly in its natural state. The neck of the bladder was filled with varicose excrescences, that completely obstructed the passage. These excrescences were red, and so hard as to resist the knife; they contained each a small particle of hardened blood, in which two parts were distinguishable. The bottom of the bladder was very black, and its surface of a reddish yellow; the whole of the urethra was red and inflamed.

It will be pretty evident, that, should a case like this occur, it is incurable. It sometimes happens that the urine, or urine appears unusually red, as if bloody. This affection may take place in any of these animals, and it is called bloody urine, passing blood, or red water. It is most common among cattle. It may arise from falls or bruises, from overstraining at hard work, as in horses from a hard-run heat in racing, or after any violent exertion, such as a desperate leap; or it may proceed from inflammation of the kidneys.

When it takes place in cattle, the animals are affected with an almost incessant desire to stale; sometimes the
Diseases. they make but little water at once; sometimes the urine comes away in its usual quantity. In this latter case, if the urine be deeply tinged, it is considered as a very dangerous symptom; and when it happens, the horse leaves the herd, and appears to feel considerable pain; they hold up their tail, and sometimes hold their back higher than common. In fact, these symptoms, which do not seem well understood by the cattle doctors, indicate an inflammation of the kidneys.

When this disease is occasioned by stains, bruises, or any violent exertion, there is reason to fear that inflammation may take place. This must therefore be guarded against by bleeding, cooling drinks, and succulent food; by avoiding exercise and every thing that can heat or irritate. It is a common custom to give nitre and other saline substances in these cases, but when there is any inflammatory affection in the kidneys, these salts are improper, as they tend to increase the irritation of these organs. The best drinks in such cases will therefore be thin gruel, linseed-tea, or bran-water.

Cattle are said to be most subject to the red water in the spring, or summer, while at grass; and it is supposed to be produced sometimes by sudden changes of the weather, by want of water, or the use of such as is unwholesome. Young cattle are more subject to it than those of more advanced age; hence particular attention should be paid to these young animals; as when the affection has once taken place, it is considered as highly dangerous. These are the opinions of cattle doctors, and we suppose they refer chiefly to inflammation of the kidneys, of which bloody urine is, as we have said, a prevalent symptom. This formidable disease will be considered more at large hereafter.

It appears that when cattle are sent from Europe to the West Indies, the bulls, when first put on shore, are extremely liable to this complaint, which often proves fatal. It is attributed to the eager desire which these animals, after having been so long confined to a dry diet on board, have for green succulent food, in which they will of course indulge to exceed the first opportunity. The remedies found most effectual are bleeding, and the administering of nitre and purging salts; but it might probably be prevented by housing the cattle immediately after they are brought on shore, and accustoming them gradually to their change of diet.

Sometimes the colour of the urine in sheep and cattle is nearly black, and they are then said to labour under the black water. This affection is not well understood, but it is probably a variety of the last. It is said to be produced by feeding on cold, wet land, and that simple removal of the cattle to a more favourable situation will often effect a cure. Mr. Lawrence considers the black water as a symptom of incipient mortification of the kidneys, and recommends bleeding, unless in a cow, cordials and tonics, such as iron filings, with bark, opium, nitre, in strong beer, if the progress of mortification be apprehended. We may remark, that, if mortification of the kidneys has taken place, which may in general be known by the stinking smell of the urine; all these remedies could produce no effect; and it would be much better to kill the animal at once, than be at the expense of time, labour, and medicines, in attempting to effect a hopeless cure.

A scouring or purging is a very common disease in our domestic animals; and in some of them it is very dangerous, and very difficult to cure. The complaint is somewhat different in the several species, so as to require a particular description in each. Some horses are liable to be affected with a purging from the slightest causes, and on every exertion. These horses are called by grooms washy horses, and they are said to have narrower chests and lanker bellies than others; and it is to this unusual deformity that the purging is generally attributed. Some horses are said to labour under a nervous diarrhoea; those that are chiefly subject to it are young, and of a weak and irritable habit. The complaint generally appears on them only when at work; and when they are suffered to remain idle, their bowels are sufficiently healthy. Mr. Lawrence had a favourite young horse that was subject to this nervous scouring, and on whom he tried a variety of medicines to no purpose, as it was found that nothing but idleness could arrest the complaint. To use Mr. Lawrence's words, "the nag whilst at play, was always fat as bacon, and very firm in body; but a week's work reduced his flesh, and caused him to dung like a cow." Horses of this delicate constitution require great care and attention, or they will not be of much use to the owner. They should have strong nourishment, but it should be given in small quantities at a time. Mr. Lawrence recommends good old beans mixed with their oats, lucerne, or strong upland hay, with rice, mash, carrots, and occasional runs of grass.

A purging may be brought on in horses by a sudden change of diet, as from hay to grass, or from grass to hay. Hence, in such horses as are liable to disorders of the bowels, these changes should always be made very gradually. It is very commonly the effect of exposure to cold while the body is heated, and is one of the least dangerous affections arising from that cause. A purging may also be owing to irritating substances, such as crude, unwholesome, or undigested food remaining in the bowels; and in these cases it is often attended with pain, from the formation of an acid in the bowels.

A purging in horses is seldom dangerous, except when it arises to a great height, or continues very long, so as to produce a great waste of flesh, or very considerable weakness.

In general it is sufficient, in order to carry off a purging in horses, to avoid the causes which have produced it, where these can be ascertained; to wash away irritating substances from the bowels, by giving plentifully of diluting liquors, such as water gruel and linseed tea, or gradually to change the diet, if the purging seems to have arisen from improper feeding. If, however, the disease should continue obstinate, or be attended with unpleasant symptoms, means must be taken for checking or removing it. Some caution is requisite as to the plan of treatment to be adopted; as, if the complaint be checked too suddenly; some other dangerous affection might be produced. Veterinary writers differ considerably with respect to the treatment of diarrhoea in horses; some recommending gentle laxatives, as rhubarb, which Mr. Lawrence considers as the sheet anchor in those cases; whilst others as strenuously advise against the use of purgatives, and recommend opium and astrigents. Probably in most cases there is little need of laxatives, and after plentiful diluting, one of the best remedies will be clusters of starch or water gruel, with a small quantity of laudanum. If there is acidity in the stomach
FARRIERY.

Diseases.

In cattle, this complaint is sometimes very serious, and farmers not unfrequently lose several of these animals by it in a season. This has induced them to call it the scouring rot. When the purging has continued long, it produces in these animals a general weakness and loss of flesh. Their skin sometimes hangs loose about the body; in other cases they appear hide-bound; their hair turns sandy, or of a greyish colour; their eyes grow pale; the pulse becomes weak and irregular; their excrements thin and slimy, and frequently change colour, especially in the early stages of the disease; but when the complaint is pretty far advanced, the dung appears like half-chewed food; and in fact, in these cases the food appears to pass through the bowels without undergoing the digestive process. It is said that when the animals have been long affected with this scouring rot, they feel a great degree of distress and pain, when grasped on each side of the back-bone, just behind the shoulders; and this is considered as a sure mark that the beast has become tainted or unsound, from the scouring rot.

This complaint in cattle may arise from most of the causes that have been stated to produce it in the horse; but it is considered as being most commonly owing to their being overheated in driving, and to want of sufficient nourishment, either with respect to quantity or quality. It may be produced in cows, by their being constantly and too frequently milked, while they are deprived of proper nourishment; and it is not uncommonly produced by lodging on wet ground in autumn, and feeding on a coarse, unwholesome fog.

In the treatment of this complaint in cattle, a number of strange remedies have been employed, such as hogs dung, turpentine and butter-milk; deck root boiled in salt and water, and nettle root boiled in forge water. Among the most sensible receipts that we have seen, is one in Rowlin's Cow-doctor, composed of three ounces of bote aromatics, with two ounces of bay berries, and the same quantity of alum, of shavings of ivory, and powdered comfrey root, boiled in two quarts of skimmed milk, adding while boiling a handful of starch. This is to be given as a dose, for which, however, it is perhaps rather too strong. Mr. Lawrence recommends that, on the first appearance of the scouring, the cattle should be taken to the home fold, and put on dry food, which will generally supersede the necessity of medicine. The remedy which Mr. Blaine seems chiefly to rely on, is a decoction of an ounce of ipecacuanha, a drachm and a half of nux vomica, half an ounce of gall, two drachms of alum, and 20 grains of white vitriol, in a quart of water boiled to a pint. Perhaps this decoction is rather too complex, and some of its ingredients may be spared. The receipt, No. 53, is well suited to these cases. It may be supposed that where the scouring has continued for any considerable time, the bowels are become extremely sore and tender. In this case, mucilaginous or oily substances would be of advantage, and they should be given frequently, both by the mouth and by way of clyster. Mr. Lawrence recommends a pound of fresh mutton suet boiled in 3 quarts of milk until the suet is dissolved, to form a drink to be given warm. This, we doubt not, will answer extremely well. If the disease should go to an alarming height, starch clusters in laudanum may be given as a last resource. Mr. Blaine remarks, that in these cases, he should be disposed to try animal food altogether; giving broth to drink, or the blood of other animals, with meat balls forced down the throat; as he thinks it not improbable that thus a change might be effected in the constitution, which might pave the way to a cure.

Dr. Dickson thinks that much advantage may be derived in these cases, from a strong decoction of marstorn shavings and cassia, with powdered chalk, in the proportion of half a pound of chalk, 4 ounces of shavings, and an ounce of cassia, to be boiled together in two quarts (chopins) of water to three pints, (mutchkins) adding the cassia towards the close of the boiling. A hornful of this mixture is to be given several times in the day, shaking it well every time.

Calves, when first weaned, are subject to a species of la calvus purging which sometimes proves extremely obstinate; and it is said that the principal reason of the calf-feeders giving them chalk to lick, is to prevent this purging. It appears that this disease will take place in calves, when they are fed on the milk of some particular cows; and that when the milk is changed the complaint goes off. The purging may in general be checked by boiling starch and bean flour in their milk; and if it still continues obstinate, a little ginger and laudanum may be added.

This disease is extremely incident to young lambs, Pinnias and it is called by the shepherds pinning, because when the purging has continued for any time, there flows from the fundament a glutinous matter that fastens or pins down the tail to the hips, and prevents any farther evacuation. When this is observed by the shepherds, they commonly seize the lamb, and after washing away the glutinous matter from the tail, so as to disengage it from the hips, they rub the parts with fine earth, or other fine powdery matter, to prevent their sticking in future. Something of this kind is very proper, but hogs lard, or any other greasy substance, would answer the purpose much better. The disease is said to be produced by wet and cold in spring, together with the ewes eating too greedily of soft moist grass. It may be prevented or cured, by removing the flock to heathy or poorer pastures, that abound with astrigent or aromatic plants.

Mr. Findlater remarks, that among lambs fed with their dams, upon the rich improved pasture of Lothian parks, pinning never occurs; whence it is probable that it originates from milk concocted from poorer pasture, which gives more curd than cream to the milk, rendering the excrements of the lamb more viscid. When the mothers have little milk, the lambs are very rarely pinned. Pinning is therefore considered as a favourable symptom of the lamb's being well nursed. It is not considered as a disease in Tweeddale; though, if not reddressed, it would be productive of disease. It is considered as an accident to be guarded against, and which, like other accidents to which sheep are liable, requires the shepherd to be constantly walking through his flock. No Tweeddale farmer would, on this account, remove his ewes and lambs to poorer pasture, where the lambs...
Part VI. 

F A R R I E R Y. 525

Diseases. 456

In dogs.

Lambs would be worse nursed, as he knows, that if the
pinned lamb is timely noticed, and relieved by pull-
ing up the tail, all danger is removed.

Dogs are also very subject to this complaint, and it
may be brought on in these animals by any of the
causes which we have mentioned as producing it in the
other species. In young dogs it is often the effect of
worms, and in this case the stools are slim, greenish,
and sometimes bloody. Common looseness in dogs may
be removed by much the same remedies as in other ani-
mal; as by ipecacuanha, opium, with starch, or arrow
root clysters, and prepared chalk, if there is any acidity
in the bowels; but where it proceeds from worms, it
cannot be effectually removed till they are expelled.

Furring must be carefully distinguished from dysen-
tery, or what is called bloody-flux in the human species,
and brake-shaw in sheep, as in this latter there are
symptoms of inflammation, and commonly more or less
of fever. The distinguishing marks of this disease will
be considered hereafter, as we cannot properly treat of
it in this place.

Costiveness, or binding of the belly, occurs occasion-
ally in all these animals; but it chiefly calls for atten-
dion in the horse, as in him it is more frequent and more
dangerous. It arises for the most part from want of
exercise, when the horse is kept upon hard dry food, as
oats or beans. It is a constant symptom of colic and
of inflammation in the bowels, and the continuance of it
always aggravates these complaints, and seldom fails to
produce them where they were not before present.

It is best prevented by occasional change of diet; by
giving the horse barley boiled, or green food now and
then, where he cannot be frequently sent to pasture;
and every night or two allowing him a mash of bran,
or, if he is of a very costive habit, of malt. Regular
exercise and good dressing, especially friction on the
belly some time after feeding, are also good preventives.
If it should arise to any considerable height, the bowels
must be emptied by back-raking, and the administra-
tion of softening, laxative clysters, which may be repeat-
ed every three or four hours till the bowels become suf-
ficiently regular. Purges given by the mouth, though
they may, after some hours, remove the costiveness,
seldom fail to do more harm than good; especially if the
complaint has continued long, and there is considerable
heat of the body, fulness of the pulse, pain in the bowels,
or, great irritation. In these cases, while the bowels are
opened by clysters, it may be proper to take away
a little blood.

Suckling calves are sometimes subject to costiveness.
When this happens, the chalk should be taken away,
and half an ounce or an ounce of magnesia be given them
in a pint of warm gruel; or if the costiveness continue,
a little rhubarb may be added.

CHAP. VIII. Morbid Affections of Generation.

It has been wisely ordered by nature, that the in-
ferior animals shall feel the passion of desire only at cer-
tain seasons; and these periods are generally so adapted,
that delivery shall take place at such a time of the year
as will be best suited to the rearing and feeding of the
young animal. It is probable that in a state of nature
these animals, whether male or female, do not ex-
perience inordinate desire, except at the proper periods;
and when domesticated, the females are scarcely ever sa-

cacious, except at these times. The males of these ani-
mal, however, in the domestic state, especially dogs, are
occasionally subject to excessive lust, and all of them,
during the periods assigned by nature, become some-
times very unruly, if not permitted to indulge their na-
tural appetite. Should circumstances render it neces-
sary to prevent them from indulging this propensity,
they must be kept on a lower diet than usual, or have
such food as contains least nourishment, in the largest
quantities, and must be made to use more exercise than
common. They must also be kept extremely cool, and
horses should at these times have less litter to sleep
on than usual.

It is of considerable consequence to those who make
breeding an object, that the animals who are to copulate
should not be indifferent to the act in which they are to
engage. It sometimes happens that either the male
or the female betrays a coolness or indifference, which
may defeat the object of the breeder. When it appears
that a stallion or a bull regards the mare or cow pre-
sented to him with transport, or turns from her when
she ought to do his duty, it is clear that something is
wrong, and that the issue of such a forced connection
would scarcely be worth the trouble of rearing. It is
said that Spanish stallions are more subject to this in-
difference than others.

If an indifference of this kind should take place in
an animal that is generally keen and vigorous, it
would be wrong to employ any incitement to stimulate
him to an action for which he has perhaps been unfit-

ed by too much exertion of the same kind during the sea-
son; but where the animal is naturally thus cool, and
has otherwise the requisite qualities of a good stallion or
bull, it may not be amiss to employ some stimulating
means before leading him to the female. He should be
kept on a generous diet, and when particularly required,
he may have a cordial ball given him, with a quart of
good ale after it. This will generally answer the pur-
pose, or if it does not, the animal is unfit for his office,
and should be discarded. It is a common practice
among some grooms to insert a slice of ginger into the
fundament of an indifferent horse, and this is said to
have the effect of rousing his latent powers.

Indifference for coition is more likely to take place
in the females of these animals, and it is no uncommon
thing for a mare or cow to refuse the male. In gen-
eral this is owing to a poverty of diet; and these
females should, like the males, before being taken to be
covered, be put on a generous diet with moderate exer-
cise. Probably all strong, stimulating remedies, such
as cantharides, which are sometimes given, do more
harm than good, as they may produce inflammation of
some internal organ, without producing completely the
desired effect. The cordial ball and strong ale are the
most innocent remedies in these cases, and where nature
is tolerably sufficient, they will be the most efficacious.

The parts of generation in these animals are subject
to certain accidents or diseases, and it is necessary that
we should notice the more common of these.

The horse is subject to what is called a falling of the
penis. This consists in a relaxation, and total weakness the penis
of the parts destined to sustain and support it in its na-

utural
FARRIERY.

Part VI.

Diseases. - A disease is a kind of paralysis of the erector and accelerator muscles, or a total atony of the suspensory ligament.

It may be produced by various causes, as by too great exertion in labour; hence it is common to draught horses that are hard worked. It may also depend on a violent spasm of the muscles of these parts, as this is always succeeded by a proportionate relaxation and atony. It is not uncommonly produced when a stallion is made to cover too many mares in one season.

When the case is slight, after returning the penis within the sheath, which should always be done, a pail or two of cold water, or of salt and water, may be thrown over it several times in the day, and the muscles may be moistened with some stimulating liniment. It has been advised to make superficial punction of the wound with a sharp needle, and then to wash it with distilled vinegar; but we do not know whether this plan has been attended with the desired success. If the complaint continues obstinate, the penis must be bolstered up, and a charge applied over the back part of the sheath, so as to leave sufficient room for the horse to make water. If the complaint is attended with a general weakness, tonics and cordial remedies must be applied.

A falling of the womb. - When a cow has been delivered with more than usual difficulty, or has been very long in labour before procuring assistance, it not unfrequently happens that the womb is inverted, or, as it is commonly expressed, the calf-bed comes down. This accident is more likely to happen to some cows than to others, and is more especially incident to those of a weak habit of body, and such as are unusually wide between the thighs. In such cases it would be proper to pay more than usual attention to the time when labour is expected to take place, and the stall in which they are kept should be made very commodious, that they may frequently lie down, as the weight of their burden will have most effect while they are standing. When the calf-bed is come down, it should be returned as soon as possible, by the operator clenching his fist after greasing it and putting it to the middle part of the womb, which he is thus to push gently into its place, and when it is up, he must take care not to withdraw his hand too suddenly; but it would be better to keep it within the womb for a little, as it will stimulate the adjacent muscles to preserve the parts in the proper situation. After withdrawing the hand gently, the external parts should be bathed with camphorated spirits, and the beast must be watched, to prevent the same accident from taking place again. It is the practice with some to lead the cow down a hill after returning the womb, as it is supposed that this is greatly advantageous to the parts recovering their proper position. If proper assistance cannot soon be procured, the inverted womb should be laid on a clean soft linen sheet, and carefully covered from the air, the irritation of which might produce an inflammation. If the relaxation of the parts is so great that the womb still comes down, recourse must be had to a stay, to put behind, to prevent the womb from falling down; and some have recommended stitching it to the adjacent parts with a wax thread. Probably this operation would be attended with more danger than benefit.

Cows and mares sometimes suffer abortion, or, as it is called, slip their calf or foal, before the usual time of labour. This accident may be brought on by violent exercise, especially by leaping hedges and ditches; by sudden frights, knocks, or bruises; and it is also said that it may arise from bad smells, and ardent desire in the mare or cow; but these latter causes are probably imaginary. It is advised by some to keep cows who have slipt their calves as free from having any communication with the rest of the cattle as possible, under the idea that the accident may become infectious; and it is declared that experience has shown, that without great care and management it may go through the whole stock, and even return the next season, if the same cattle are kept. We cannot vouch for the truth of these assertions, but if true, the circumstance is very remarkable.

When a cow or mare has slipt her young, unless this accident has been occasioned by great exertion, it is a proof that the animal is extremely weak, and she must be put on a more nourishing diet, and have strengthening remedies; but in general little is required after such an accident, but rest, and perhaps a warm bran mash. This latter may be frequently given to mares or cows during pregnancy, as constiveness may be a great means of producing abortion.

SECT. II. OF COMPLICATED DISEASES.

Many of the diseases that have been treated of in the last section, are very important, and several of them highly dangerous; but those which we are now to consider, have a superior claim to our attention, either from their fatality, the rapidity of their progress, or their intimate connection with some of the most important or destructive maladies that affect the human race. They will, therefore, require a somewhat fuller discussion than we have thought necessary to give to the diseases described in the last section.

We shall class them under the several heads of Fever and Febrile Eruptions; Inflammations; Lethargic diseases; Spasmodic diseases; Dropsey; and Anomalous diseases, which will form the tides of as many chapters, the last comprehending those affections of which the nature or cause have not been fully ascertained, with those that could not properly be reduced under any of the former heads.

For the general doctrine of fevers, inflammations, comas, spasms, and dropsey, we must refer to the medical articles of this work.

CHAP. I. Of Fevers and Febrile Eruptions.

All the domestic animals may be affected with primary or putrid fever; and this may be either of an inflammatory or putrid kind.

I. INFLAMMATORY FEVER. Synoehs.

Inflammatory fever is, we believe, seldom seen in a primary or idiopathic complaint, except in the horse; and to the consideration of this fever, in that animal, we shall here confine ourselves. The symptoms are thus described by Mr Blaine:

"It is not easy to say what is the first symptom of fever in the horse; but from the effect that we see arise in some cases, it may be presumed that it is a cold fit. It is usual however first to observe this complaint,
We have said that simple fever is not common in sheep or cattle; but when it occurs in these animals, the symptoms differ little from those above described.

It must be remarked, that though the foregoing description will apply to most cases in horses, all the symptoms here laid down will not often be found in the same case; but they will vary according to the constitution of the animal and other circumstances. Sometimes the fever will have less of the inflammatory type, and will approach to what is called a low or nervous fever. Cases of low nervous fever are, however, very uncommon among horses. Mr. Blaine says that he has met with no instance of this kind, but that he was assured by a Mr. Bloxham, a veterinary practitioner of considerable observation, that he had met with a well-marked case of typhus fever. In cases that approach this low type, the heat of the body is more irregular than in the pure inflammatory fever, and the mouth often continues moist though drink be refused; and the secretions and excretions are usually not so much affected. Sometimes there takes place a discharge of glutinous matter from the nose, and the eyes are watery. The pulse in these cases usually ceases to be full after the first 24 or 36 hours; and though it still continues hard, it is more frequent than before, and becomes small and irregular as the disease advances. This low variety of fever, is more dangerous than the true inflammatory fever, and requires more particular attention.

Inflammatory fever may be produced by any cause that violently agitates the body, and unusually accelerates the motion of the blood. It may be produced by excessive exertion and fatigue, or by an exposure to cold while the body is overheated. It is said to have been sometimes brought on by a sudden fright. A very common cause in hot climates, is long exposure to the direct rays of the sun. Pure inflammatory fever is certainly not contagious.

In the care of inflammatory fever it is necessary to draw blood as soon as possible; and the quantity of blood taken away should be in proportion to the violence of the inflammatory symptoms. We are disposed, however, to think, that a less quantity than is usually recommended, perhaps not more than two quarts at once, will be sufficient, as the weakness that comes on in the latter stages of all fevers, will be greatly increased by too much loss of blood. The blood should be preserved in a proper vessel, as directed in No. 162, that it may be ascertained how far it will be proper to repeat the operation. When blood has been drawn, the horse should be back-raked, or a hand passed up the rectum, and the dung drawn carefully away, after which a blister should be thrown up, such as No. 17, of the receipts. It should be blood-warm, and should be passed up vigorously and gently. If there is much determination to the head, a blister may be applied to the neck, or aセット inserted near the head as may be. Cooling medicines may be administered, such as the drenches, No. 22 and No. 26. All heating or cordial medicines, and stimulating food should in the early stage of the fever, be carefully avoided. The diet should consist of light food that is easily digested, such as sweet hay, or, if that can be procured, locerne or sainfoin bran mashies, and, by way of drink, thin gruel.

The rational mode of treating fevers, lately introduced...
FARRIERY.

Other viscera, and it generally uncommon in several of the eruptive diseases. In some of these complaints the fever demands particular attention; but in most of them it is merely a secondary symptom, and yields to the general treatment of the disease.


Putrid fever does not commonly attack horses, though it has occasionally raged epidemically among these animals. Lancisi, an Italian physician, has described an epidemic fever that raged among horses in Italy about the year 1712, and Mr. Osmier mentions an epidemic of a similar kind, attended with critical accidents. He calls it the distemper, and says that it had raged at different periods for more than 50 years.

The most serious epidemic fevers that have ever appeared among domestic animals, are those which, from their violence and fatality, have been called murrains or pests, and which have raged occasionally from the earliest historical accounts.

Columella mentions a contagious disease, which he calls cruda, that scarcely differs in its symptoms from the murrains that we are presently to describe. The following is his description. "Crebri rostros, ac ventris sonitus, fastidio cibi, nervorum intensio, brachios occuli, proprie quae hos neque ruminant, neque ligant, deterget." He advises bleeding in the tail, and baths, and plying the ears; and if it appears that the disease is contagious, he recommends the infected cattle to be separated from the rest of the herd.

A similar disease is also described by Vegetus, who recommends a similar treatment, with the additional advice: "Mortuus cadaverae ultra feras visa prehendit, et aliis comminoe sub terris." To carry the carcasses to a distance from the farm, and bury them deep in the earth.

Marius, a Burgundian ecclesiastic, who wrote in the 6th century, mentions a disease, which he considers as the smallpox, that destroyed great numbers of cattle. "Hoc anno (570) morbus validus, cum proflatio ventris et ventra, Italia, Galliamque validissimum, et animalia bubola per loca superscripta maxima incurret."

The first accounts that we have of any disorder of this kind, since the beginning of the present century, are related by Ramazzini and Lancisi, two physicians then living in Italy, where this disorder first broke out in the year 1711, in the territories of the republic of Venice, in the country round Padua; and was said to have been brought from Dalmatia, a province of Turkey, by some merchants importing living cattle, according to their annual custom, from thence and the surrounding parts. The disease soon spread itself through most parts of Italy beyond the river Po, and appeared two years after in the district of Ferrara, where it so ravaged the country, in the years 1713 and 1714, that Lancioni, a celebrated physician of that time, informs us, it was a prevalent opinion, that the whole species would quickly become extinct. From Italy it travelled through the Tyrolese into France, and after Germany suffered, as well as the Low Countries; and from these parts it was supposed to have been transported into Great Britain and Ireland. But there
no record of a new infection in this country since the
year 1714, till the middle of last century, when we
probably received the infection from Holland, where
this disorder then reigned, having received the infection
from some of the neighbouring parts of Germany and
Flanders.

About the year 1744, it was reported to have been
brought by some traders into Essex, who had purchased
calves in Holland, and some parts of the provinces of
the low countries, which had the infection, and carryed
through several counties, till it became a matter of im-
portance to the state; and on the 12th of February
1745 gave occasion to the passing of an act of parlia-
ment, commanding that every probable, or even pos-
sible, means should be employed, by officers appointed
for that purpose, to prevent the further spreading of it.

Premiâms were given to those who killed their cattle
as soon as the infection made its appearance, and fines
were imposed upon every one who acted in opposition
to the established laws, respecting driving, exposing, or
selling cattle, supposed or found to have caught the
disorder. Every precaution, however, which could be
suggested at that time, proved ineffectual; and fresh
orders were issued by his majesty in council, which
for some time were also found to produce very little ef-
fect. It became so alarming to the country, that many
eminent medical characters in different parts of Eng-
land, closely applied themselves to the study of re-
medies for this calamitous distemper. They differed
in opinion, whether it was a contagious or infection
nature; or proceeded from a malignancy in the state of
the atmosphere, or some peculiarity in the nature of
their food. The contradictory opinions which prevail-
long among them, nearly prevented some of the eldest
professional men from appearing in behalf of the public;
especially Mr Barker, who wrote an ingenious pamph-
let on the subject, and whose mode of treatment pro-
ved more successful than that of many others, whose
pretensions were given to the public in a more confidant
manner, and more strenuously supported.

From the several histories that have been given of
the disorder, it appears to have differed in its symptoms
and effects, according to the countries in which it ap-
ppeared, the various seasons in which it commenced
its ravages, and some other circumstances not fully as-
certained. There seems to have been no doubt that
the disease was infectious, or at least that it was easily
propagated among the species of animals which it at-
tacked; but it does not appear to have been capable of
spreading to other species; as men, horses, sheep, and
dogs, that lived in the neighbourhood of the infected
animals, shewed no marks of having received the con-
tagion.

In the historical sketch of the writers on veterinary
medicine, we mentioned several works on the subject
of the murrains that prevailed over Europe in the last
century; and of these it will have appeared that the great-
er part were the production of foreigners. The most
celebrated of these foreign publications were those of
Sauvages, Gœtlccke, and Camper. The work of the
latter upon this subject is extremely valuable; and as it
was written for the instruction of people in general,
having been delivered in the form of lectures before a
crowded audience, it is preferable to many others that
have appeared on the subject. It is given in the third
volume of Camper's works on natural history, physio-

FARRIERY. 529

Diseases.

appearance of the murrain in

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symptom among cattle, at that time of the year, and
therefore Dr Brocklesby did not consider it belonging
to the present disease; the hair was rougher on the
skin than ordinary; their eyes looked heavy, and
when the principal disorder appeared, they refused
fodder, but had an insatiable thirst for a time: The
milch cows decreased in their milk, which remained to
a certain quantity, sometimes for two days, before it
changed colour, but at length often dried up. Upon
craving to chew the cud, a shivering seized them all
over, and a high fever immediately came on; the milk,
if any remained to that time, curdled over the fire, but
did not in the first of the disorder. At first the belly
was costive, but for the most part a looseness succeeded
within forty-eight hours after the shivering fit. The
stools were first green and watery, and of a stinking
smell; their consistence, however, altered afterwards
to a viscid, slimy matter, the purging accompanied till
about the seventh day, and about that time the excre-
ments became thicker, in such as recovered; and these
soon chewed their cud again, and tasted of fodder,
which they had before absolutely refused through the
whole disease. All that had not the looseness before
the third day died. The urine was very high colour-
ed, and in smaller quantities. The degree of fever
was observed very high; upon the third day the pulse
beat near a hundred times in a minute, whereas the in-
genious Dr Hales found a sound ox's artery not to ex-
ceed 38 pulses, in the same time. At different in-
servals,
FARBIERY.

Diseases.

The valse, after the attack, they all laboured under a prodigious difficulty and panting for breath; some suffered these after the first day, others not before the third. But this disorder suffered remissions, and seemed to be augmented towards evening, and at night. Several beasts discharged, towards the fourth or fifth day, when ill, a very great quantity of a frothy matter from the mouth and eyes; others ran actually purulent matter from the nostrils. As the disorder advanced, the eyes sunk more in their orbits, and some were observed to be quite blind. Towards the conclusion, the fore parts of the body, and particularly the glands about the head, were prodigiously swelled, and several beasts had a universal erythema, or cracking of air beneath their skin; these that were not blooded, equally with such as were. Frequently one might observe puttures break out on the fifth or sixth days, all over the neck and fore parts. Some cattle were raging mad on the first day; such were necessarily killed; some dropped down, fell asleep, and died; others died on the third, most on the sixth or seventh, very few alive to the fourteenth day; before death the horse and dogs grew remarkably cold.

The appearances in the dead bodies of eight different cows were as follow: The flesh was of a sound colour, and everywhere lined with fat, the cellular membrane between the skin and flesh was distended with air to above the thickness of three inches. The paunch was prodigiously distended with food, in all of them, but it contained not any thing preternatural; nor indeed in the vesicular or second stomach, were there any morbid appearances; but, upon incision of the amaceae, or third stomach, in which the food is naturally without much juice, a most offensive stench rushed out, with a large quantity of thin greenish water.

The blood-vessels on the inner surface of the ventricle were very full. The abomases and part of the intestines discovered the like morbid phenomena. The liver, spleen, and kidneys, were as usual; but the gall-bladder seemed to be in the greatest necessity, as always; some filled themselves more than ordinary; the liver in some was thicker than the rest, and the gall tasted disagreeably sweetish. Dr. Brocklesby did not observe any purulent matter investing the inner surface of the intestines, though other gentlemen discovered such, in some cattle, if he was rightly informed; but there appeared in some a slimy mucus, all along the intestinal canal.

The lungs universally showed the strongest signs of a preceding high inflammation; most of them were turgid with red blood, while the smallest vesicles of the bronchian, or air-vessels, were very much inflated. Some few arterious vessels were replete with a glutinous, glairy mucus, and all the lungs appeared larger than they do in common. The whole inner surface of the trachea, or wind-pipe, was covered with a frothy mucus; but he never found any ulcers with purulent matter either at the root of the tongue, or in the lungs. Upon opening two or three heads, he found large quantities of extravasated serum; and the blood retained fluidity in the larger vessels long after death.

The mode of treating the cattle recommended by Dr. Brocklesby is as follows: Before the cattle are suspected, he advises two setons, or pegs, to be put deep into the dewlap, and into the under part of the neck; and immediately upon refusing fodder, the beasts should have three quarts of blood taken away; and, after twelve hours, two quarts more; after the next twelve hours about three pints may be let out; and after the following twelve hours, diminish a pint of blood from the quantity taken away at the preceding blood-letting; lastly, about a single pint should be taken away in less than twelve hours after the former bleeding; so that when the beast has been blooded five times, in the manner here proposed, the worst symptoms will, it is hoped, abate; but if the difficulty and panting for breath continue very great, he sees no reason against repeating bleeding, or at least against taking away the fifth time, instead of a single pound, twice that quantity.

In the mean time the setons or pegs should be daily promoted to suppuration by moving the cord; and the cattle should have as much bran-water as they choose to drink luke-warm. This should be made a little tart or sourish, either with common vinegar or spirit of vitriol; and immediately after the first bleeding they and all should have a drench composed of a drachm and a half of camphor, well rubbed with two succes of honey, adding an ounce and a half of nitre, and about a quart of water-gruel.

It is extraordinary that this treatment, with a little variation in the internal medicines, is recommended by Mr. Feron as the result of his own experience, in what he calls the general inflammation of cattle. It is a curious coincidence; as we suppose that Mr. Feron, from his not noticing Dr. Brocklesby's pamphlet, has never seen it.

The doctor recommends keeping the cattle very warm, and guarding against the admission of any cool air, a practice in which he will scarcely be followed at the present day.

The symptoms of this distemper as described by Dr. Layard's Laryard are, on the first appearance of the infection, a consort of decrease of appetite; a putting out of the neck, imply the most some difficulty in deglutition, a shaking of the head, as if the ears were tickled; a hanging down of the ears, and of the head; and a drench composed of a drachm and a half of camphor, well rubbed with two suces of honey, adding an ounce and a half of nitre, and about a quart of water-gruel.

The head, horns, and breath are very hot, while the body and limbs are cold. The fever, which was continued the three first days, now rises and increases towards evening; the pulse is all along quick, contracted, and irregular. A constant diarrhoea, or scouring of liquid green fæces, a stinking breath, and nauseous steams from the skin, infect the air they are placed in. The blood is very fœtid, hot, and frothy. The urine, or stale, is highly coloured; the roofs of their mouths, and their barbs, are ulcerated. Tumours, or boils, are to be felt under the panniculus carnosus, or fleshy membrane of the skin; and eruptions appear all along their limbs, and about their udders. If a new milch-cow be thus ill, her milk dries up gradually, her purging is very violent, and on the fourth day she is commonly dry. There is a certain numbness or sharpness in their udders, that a visible irritation is to be observed during some time in none. They grow much, are worse in the evening, and mostly lying down. These symptoms continue increasing till the seventh day from the invasion, on which generally, though
Part VI: FARRIERY.

If after the seventh day from the invasion (at which time a crisis may be expected), the eruptions, boils, or abscesses are decreased in bulk, or totally disappear, without having broken or discharged outwardly, or an aggravation of the symptoms already mentioned, with no intermission; it may be assuredly pronounced, that the beast will die.

As to the care, immediately upon the first appearance of the distemper, the beast should be put into some place where it may be kept clean, warm, and as free as possible from infectious stews of other beasts in the same condition. The beast must be bled in proportion to its strength, washed with warm water and vinegar, to clear the hair from flit and insects, and rubbed every morning and evening, for a quarter of an hour, with a dry linen or woolen cloth, or straw, to promote perspiration. A roselal is also to be made in the dewlap, which is to be dressed twice every day, which roselal is also to be kept in a month at least after the recovery of the beast.

Should the beast be hot, hang down his head, breathe with difficulty after the bleeding, dung hard, and the skin feel tight and thick; then it will be very proper to give a gentle, cooling purge in this first stage. When the beast has voided the hardened dung, or if it should not have wanted purging, the following drench is to be given. Take of mustard-root, three ounces; of turmeric and horse-radish-root, each one ounce; of fumigreek-seeds, bruised, two ounces; of chamomile-flowers, dried leaves of feverfew, rue, and sage, each one handful. Boil them half an hour in a gallon of small ale, well hopped, to three quarts; then strain the liquor, and give the beast three pints in the morning, and the remainder in the evening. No dry or solid fodder is to be offered till the beast chews the cud again. Between these drenches a quart or two of distilled vinegar-whey must be given frequently in the day, to dilute the hard fodder, and strengthen the coats of the stomach; and hay-water may be also given. Great care must be taken, twice or thrice a-day, to cleanse the mouth, barbe, and nostrils of the distempered cattle, with some abstaining acidulated liquor. On the fourth day, if the beast be heavy, dull, shivering, no pimples or knots arise, and a purging be coming on, the following drench must be given at about eight in the evening, and repeated three or four nights, as occasion requires.

Take of Virginia pinto-root, contrayerva root, chamomile flowers powdered, of each half an ounce; Venus creeaine, six draughts: Mix all these in three pints of vinegar-whey, and give the drench lukewarm. Let a person sit up all night with the beast, and give it frequently a quart of vinegar whey. Venus creeaine may also be serviceable; and if there be any signs of mortification from the dark and relaxed appearance of the mouth, the coldness of the skin, the black fetid dung, insensibility, &c. the Peruvian bark must be instantly given every four or six hours, as occasion may require, taking the usual medicines in the intervals. In the last stage, let the swellings that puff up the skin be opened and digested; and after the crisis takes place, if a scouring should ensue, it is not to be hastily stopped, though diligently watched and restrained, lest it weaken the beast too much; and to cleanse the stomach and bowels, let a purge of rhubarb, senna, &c. be given. Dr Layard advises to let the beast drink water-gruel lukewarm, and keep it on dry meat, though sparingly; and at night to give an ounce of a decoction of discordium, in a quart or three pints of small ale, warm. But if after the crisis the beast be castive, and the skin dry, harsh, and tight on the flesh; darding may be procured by giving in the evening a mask of bran, with a handful of beans bruised, and an ounce of Epsom salt. He recommends, however, the greatest exactness in observing when the crisis is over; for the least laxative medicines, or opening food, at the height of the disease, and consequently in the former stages of expulsion and maturation, will certainly bring on a scouring, attended with fatal consequences, or at least very difficult to be removed. In winter time, the cattle, upon recovery, should not be turned out at once to the pasture grounds, let these be ever so dry; but towards the middle of the day, in fair weather, turning them out two hours, and then bringing them in again, will gradually use them to the open air. In summer, morning and evening will be the most suitable times for the heat of the sun, or cold, may bring on other disorders.

A farmer, (says Dr Layard), lost ten head of cattle, and two more were dying, and seven others ill, when I took upon me the direction of the seven which were last fallen ill. By the preceding treatment five of these recovered. One cow, very near her time of calving, died; and the seventh was certainly lost for want of observing the due time of the crisis, and purging too soon.

Such are the accounts given by Brooklesby and Layard, of the symptoms and treatment of this destructive malady; and it will be seen that their accounts differ no more than what may be expected from two different persons describing a similar disease that occurred at two different periods; for the murrain described by Dr Brooklesby appeared in the years 1744 and 1745, while that of which Dr Layard has given an account occurred between 1750 and 1760.

The causes and nature of this disease have not been exactly ascertained. Some have supposed it connected with a peculiar state of the atmosphere, and that it did not originate in contagion. Many considered the principal causes of the disease to be previous hard winters, obstructed perspiration, worms in the liver, and corrupted food.

Hard winters have been considered as a cause of this disease, because it was in 1710, after the hard winter in 1709 that the great mortality among the cattle was observed; and because the hard winter in 1740 was followed by the contagion in 1741, which spread over the most part of Europe. Not to mention many others, the murrain in 1768, followed immediately after a pretty hard winter in 1767. On the other hand Camper remarks, that the hard winter in 1727 was not followed by the contagion; from which it would appear that the epidemic does not necessarily depend on the severity or mildness of the preceding winter.

It was attributed to many to obstructed perspiration; and to prevent its attack, it was proposed to cover the cattle during the nights of autumn, and to make them sleep within doors during the spring nights.
Diseases. It may, however, be observed, that if this reasoning were true, the disease ought to have been less prevalent, or ought not to have appeared at all, in those provinces where, for the sake of saving the dung, they house the cattle at night, even in the summer as well as in the spring and autumn. Besides it appears that the contagion was not known at Bern, though the cattle in that district lay all night in the field whenever the weather would permit.

Camper justly ridicules the idea of the disease originating from worms.

"If (says Camper), you demand of me to what I attribute the first of the distemper, I shall answer, as it were to wished that all naturalists would do in similar cases, that I do not know; that the subject is above my comprehension, and doubtless above that of every man."

There seems no doubt, however, that the complaint was infectious, and that, provided proper means were taken to prevent infection, the distemper would not spread. The means proposed by Dr Layard and some other medical practitioners, to destroy the contagion, was to bury the carcasses of infected animals, and to stamp out, so far as it appeared to have received the infection. Incubation was proposed by some, as a means of diminishing the ravages of the murrain; and is said to have been practised in Denmark with considerable success: but if this be true, it is probable that the epidemical disease that raged in Denmark was of a different nature from that which appeared in Britain, and on some parts of the continent; as incubation seems to have been tried in these places without effect. What probably led to the proposal of incubation was, that the disease was considered by some as exactly similar to the smallpox in the human body. This opinion was adopted by Dr Layard, and seems to have arisen from the boils or suppuring tumours which appeared on the bodies of most of the affected cattle; but these tumours do not appear to be similar to the eruption that takes place in smallpox, but rather resemble the boils or buboes that take place in the plague and some other highly infectious fevers. On the whole, it seems to us pretty evident, that the disease is of the nature of putrid fever, and we have therefore ranked it under this head.

It appears from Camper's works, that incubation was attended with so much success in many cases on the continent, that a great number of cattle was saved by it, who probably could not have been recovered from the natural disease. The advantages attending incubation according to Camper are,

1st, That we can expose to the danger of contagion such calves and heifers only as are of a moderate price.

2d. That the heifers pass through the disease before they take the bull, and consequently before they are pregnant. This is attended with more advantages than may appear at first sight; for when the contagion attacks a whole herd, all at once, oxen, calves, heifers, and cows are seized without distinction. Such cows as are pregnant generally slip their calf, and even if they should perfectly recover, their womb is so disordered that it will never afterwards be capable of retaining the calf; besides, that afterwards it is a long time before they come in heat, so that the proprietor is obliged to keep them for a whole year without deriving from them any benefit, except he fatten them for the butcher.

If the success of inoculation, as well as the certainty of the cattle being incapable of a second infection, were fully ascertained, the plan of inoculation would be extremely proper. If these points were fairly established, would they not, however, considerably militate against the opinion that is entertained by the best writers on the subject, even by Camper himself, that this disease is an idiopathic putrid fever, and not an eruptive complaint like the smallpox?

Considering the disease as one that is highly contagious, every method should be taken to check the progress of the infection. For this purpose the houses where the cattle are stabled, should be kept perfectly clean, and well ventilated. It would also be proper to fumigate these places twice a day with the vapours of some mineral acid, such as the nitrous or mercuric acids, as has been recommended by Dr Johnstone, Guyton Morveau, and Dr Carmichael Smith. This fumigation may be easily effected by placing pickings of warm sand in various parts of the cattle-houses, and particularly at the doors. Women also should be provided a cup containing common salt or pounded nitre, on which is to be poured a sufficient quantity of sulphuric acid or oil of vitriol, stirring the mass now and then with a glass rod, to promote the escape of the acid vapours.

We shall conclude this subject with a series of queries that were circulated among medical men on the continent by the Society of Medicine at Paris, for the purpose of gaining every necessary information respecting this alarming pestilence, as they may tend to direct the inquiries of those who shall in future have an opportunity of observing the distemper.

1. What is the situation of the country in which the epidemic appears, and what is the nature of the soil?
2. Of what quality are the waters which the cattle usually drink, and of what dimensions are the reservoirs that contain them?
3. What is the quality of the pasturage, and what are the plants which most constantly grow in the pastures?
4. Of what nature is the fodder and the grain that are given to the cattle within doors?
5. Have there been any abundant rains or inundations; has the water continued for a long time on the ground, and what are the effects it has produced on the fodder?
6. Or has there on the contrary been any great drought, and how long has it continued?
7. What has been the season for getting in the hay, and for harvest; and what effect does the season seem to have had on the hay and other fodder?
8. What circumstances seem to have rendered it necessary for the cattle to work?
9. Has the distemper been announced by any previous symptoms; and what were they?
10. Did the disease come on with shivering, with coldness of the horns and ears, and with the loss of appetite?
11. Did the heat come on soon after the cold fit, or was it not preceded by a cold fit?
12. Do the animals continue lying, without being able to raise themselves on their legs?
Part VI.  

**FARRIERY.**

14. When they are lying, is their head low, or how do they hold it?
15. Are their eyes red, watery, and hot?
16. Are their nostrils dry, or does there oozze from them a mucous matter?
17. Is their tongue in the natural state, or is it very red, or is it covered with a yellow or brown mucous; is it moist or dry, or are there on it any tubercles?
18. Is their throat inflamed, or are there on it any aphthous crusts?
19. Is the animal fatigued with a cough, and is this cough very frequent?
20. Does the flanks heave or not?
21. Do the animal seem to feel any great pain when he is touched in the flanks, or the belly, on the spine, or the rump?
22. Are there any pastules or tumours on the surface of the body?
23. Is the hair smooth or staring, or does it come off when the skin is curried, or even when the body is rubbed with a wisp of straw?
24. Does the animal seem much disorder, or does he refuse every sort of drink?
25. Does he chew the cud?
26. Has he a frequent discharge of urine, and what is the colour and consistence of it?
27. Has he a discharge by stool more frequently or less than usual, and are the excrements natural, or very dry, or very liquid; what is their colour and odour, and is his discharge preceded or accompanied with a frequent elevation of mind?
28. Are there to be observed any little convulsions below the skin, especially about the neck?
29. Is the belly in its natural state, or is it swollen; is it soft, or hard and tense?
30. At what periods do these several circumstances take place?
31. How does the distemper terminate; what are the symptoms that announce a healthy termination, and what are those which precede death?
32. In what state after death are found the stomachs, the bowels, the liver, the spleen, the lungs, the heart, and the brain?
33. What remedies have been administered to the diseased beast?
34. What sensible effects have these remedies produced?
35. Lastly, what regimen has been observed in the convalescent state?

The cutaneous diseases incident to domestic animals are but few, when compared with the CHANCMATAS that take place in the human body. Many such diseases are, however, described by veterinary writers, especially on the continent, where they seem to be much more prevalent than among us. In particular, it appears, that in the southern parts of Europe the sheep are frequently affected with an eruptive disease that nearly resembles the smallpox; and, like this disease in the human subject, there are two varieties of this affection, a distinct and a confluent. A very particular account of this disease, as it occurred at Cauterets in the department of the Lower Pyrenees in France, was drawn up by M. Tenon, and communicated by him to the agricultural society at Paris; and a translation of it has been published in the Farmer's Magazine for May 1804, from which we have taken it.

3. SLEEP-POX. Clanehes, Fr.

This distemper, which at Cauterets is called the smallpox, is contagious; and indiscriminately attacks wethers, ewes, lambs, and goats, more especially when shut up during winter in confined lots. The animals are kept very hot. It is a very singular circumstance, that this distemper should only appear at Cauterets, after intervals of twelve, fifteen, or twenty years; while in Guienne, and the Higher Languedoc, it rages every year. Besides, that in the former mountainous tracts, the weather is colder than in the plains of the latter districts, the sheep of the Pyrenees are kept more apart from each other than in the low countries, and the different flocks are much less liable to meet together, or pass through the same roads, by which they are not nearly so much exposed to the danger of infection.

When seized with this distemper, the sheep become dull and weak, and they lose their food; the head, eyes, ears, and gums, are swelled; and hard white tumours appear in the groins and under the joint of the shoulder. Three or four days after the appearance of these tumours, pimplles break out on different parts of the body. At first, these are situated on the naked skin between the thighs, and on the places where the wool is short and scanty; afterwards, they break out about the head, and successively over the whole body, even on the eyes, ears, and throat. In this stage of the disease the animal swallows with pain, being obliged to hold back the head, and to stretch out the neck for the purpose, and it breathes with great difficulty. As the disease goes on, the pimplles enlarge, and become inflamed, particularly at their bases; they suppurate and burst; the matter which runs out mixes with the wool, and mats along with it into hard lumps, and afterwards dries and falls to powder; the wool falls off in lumps; and even the scarfs skin peels off in large pieces, which are full of holes. When the distemper begins to abate, the sheep rub themselves on the posts of the racks, and on any other hard substance which comes in their way, and by this means the wool, along with the loose skin and dried pus, are rubbed off. If proper precautions were not employed, this would infallibly spread the contagion by infecting any other sheep that might be brought into the same cote; but, on purpose to destroy the infection, new cotes are either substituted for the old ones, which are pulled down and burnt; or else the infected cotes are washed with cream of lime, and the cots are thoroughly fumigated with burning juniper and other aromatic plants.

There are several varieties of this disorder. In some of these the eruption of pimplles is by no means complete as above described; sometimes the pimplles grow black, and dry up without coming to suppuration; at other times the disease is of a complicated nature. But as the disorder only appears at distant periods among the sheep at Cauterets, we are not to expect very full information concerning its various degrees from the shepherds of that district; neither have they any decided experience of the effects of sulphur, or seetum, or...
FARRIERY.

Part VI.

When, at Cauterets, the disorder begins to abate, whatever be the season of the year, the animals are cliped, on purpose to assist the drying of the pustules, and to favour the growth of a new fleece. After this the sheep fatten very quickly; and it is worth while to remark, that the fleece which immediately succeeds this disease is finer and more silky than any former or future fleece on the same beasts.

Formerly this disease made great ravages among the sheep at Carcassonne, till a method was fallen on to inoculate the disease. M. Tenon learned this fact in 1762 from Dr French, an Irish physician, who lived in Languedoc for several years; but it was not till 1763 that he received particular information on this curious subject from M. Berre, mayor of Carcassonne, to whom he had written for information, and who procured him a memoir on the diseases of sheep in that part of the country. From this memoir the following account of inoculating the sheep-pox is extracted.

"The seigneur of Maux, in the diocese of Narbonne, is the first, and almost the only person who has practised inoculating the smallpox on his flocks; and having been successful during ten years experience of the practice, his widow has ever since continued to follow his example.

"In the month of September, when the heat of summer is past, and before there is any danger of very cold weather; while the pastures are still in good order, and the lambs, which are now six or seven months old, are strong enough for withstanding the force of the disease, this season is chosen as the fittest for communicating the smallpox to the sheep. For this purpose the fresh skin of a sheep, either ewe, wether, or lamb, which has died of the disease, or, instead of that, one taken from a sheep which has been killed while affected by it, is placed on the floor of the cot. Into this cot all the young sheep of the year are driven, and they voluntarily rub and roll themselves on the diseased skin. Very soon afterwards the symptoms of the disease begin to appear; they have a dull and heavy appearance, hold down their heads, are somewhat fevered, and lose their food. On purpose to aid the eruption of the pustules, bread dip in wine is given to the sheep; they are anxiously preserved from being exposed to great heat or great cold, and particularly from rain. By these precautions they speedily recover, and it very rarely happens that even one dies out of a flock of three hundred.

Although the disorder has often spread over the districts in the neighbourhood of the estate where this practice prevails, there has been no instance of a single sheep, after undergoing the above described operation, having been infected a second time. It ought to have been noticed, that the inoculated flock is carefully prevented from mixing with any other sheep, by keeping it in a separate cot, and on a particular pasture, the other shepherds being forbidden to use either for the flocks under their charge. By these precautions, the disease is prevented from spreading, and the proprietors as do not wish to have their sheep artificially infected, have themselves to blame if they do not avoid the places where the diseased sheep are kept. Since this practice has been followed, it has been observed that the disorder has not returned so frequently, but that it has not proved
A greater blessing was never procured to mankind than what has been already derived, and will, we trust, be ultimately derived, from the invaluable discovery of the inoculated cow-pox, in preventing the person who has received it from being afterwards liable to various contagions. For this blessing we are certainly indebted to the labours and experiments of Dr Edward Jenner. There is no doubt that the disease was known many years ago in some of our principal dairy districts, but Dr Jenner has all the merit of having extensively circulated the discovery, and of having first applied it to those valuable purposes to which an almost universal experience has shown it to be well adapted.

The symptoms and origin of this disease amongst cows, have been briefly described by Dr Jenner in his publication on the subject. The first of these appeared in 1798, while Dr Jenner was practising in Berkeley in Gloucestershire, where he had an opportunity of frequently seeing the disease.

"In this dairy country, (says Dr Jenner) a great number of cows are kept, and the office of milking is performed indiscriminately by men and maid servants. One of the farmers having been appointed to apply dressings to the heels of a horse affected with the grease, and not paying due attention to cleanliness, incautiously bears his part in milking the cows with some particles of the infectious matter adhering to his fingers. When this is the case, it is commonly happens that a disease is communicated to some of the cows, and from the cows to the dairy maids, which spreads through the farm, until most of the cattle and domestics feel its unpleasant consequences. This disease has obtained the name of the cow-pox. It appears on the nipples of the cows in the form of irregular pustules. At their first appearance they are commonly of a palish blue, or rather of a colour somewhat approaching to livid, and are surrounded by an erysipelatous inflammation. These pustules, unless a timely remedy be applied, frequently degenerate into phagedenic ulcers, which prove extremely troublesome. The animals become indisposed, and the secretion of milk is much lessened."

There sometimes appears another kind of eruption on the udder of the cow, which on a superficial view may be mistaken for cow-pox. It consists of a number of white blisters on the nipples, and these blisters are filled with a whitish serous fluid. They are to be distinguished from the pustules that take place in the cow-pox, by their not having the bluish color of the latter, nor by their never eating into the fleshly parts, being confined to the skin, and ending in scale. This eruption also appears to be infectious, but not nearly in so great a degree as the true cow-pox.

Dr Jenner considers this spurious eruption as being chiefly produced by the transition which is made by the cow, in the spring, from a poor diet to one that is more nourishing, by which the udder at this season becomes more than usually vascular for the supply of milk. There is, however, another sort of inflammation and pustules, which appears to be not uncommon in all the dairy counties in the west of England. A cow intended to be exposed for sale, and having naturally a small udder, is for a day or two previously neither milked by the milker, nor is her calf suffered to have access to her; then the milk is preternaturally accumulated, and the udder and nipple become greatly distended. The consequences of this frequently are inflammation and pustular eruption.

As the eruption of the cow-pox disappears in a few days, little more is required than to keep the teats clean, and handle them as carefully as possible during milking.

The fact of cow-pox originating from the matter of Originates grease, or of the latter being capable of producing the former, was, we believe, first discovered by Dr Jenner; but the opinion was for some time considered as fallacious. Many unsuccessful experiments were made by Dr Woodville and by Mr Coleman to produce cow-pox by inoculating the udders of cows with matter from greasy heets. Some experiments made by Mr Simmons tended still farther to disprove Dr Jenner's opinion. But about five years ago, Dr John Loy published a small pamphlet, in which he has related some experiments made by himself, with a view to determine this controverted point. He was led to make these experiments from some cases that fell under his observation, of a disease very similar to the cow-pox appearing on persons who must certainly have derived it from the matter of grease. Dr Loy's experiments fully confirmed the opinion of Dr Jenner, and proved that the matter of grease would, by inoculation, produce in the human body a disease exactly resembling cow-pox, and like it capable of protecting the inoculated person from an invasion of the smallpox. Dr Loy also proved, that in some cases, the cow-pox might be produced in cows by the immediate application of the matter of grease, but this experiment did not succeed, unless the heet had also a general affection of the system. This led Dr Loy to suppose that there exist two species of grease, the one merely a local affection, the other a general affection of the system.

The reasons that induced Dr Jenner to suppose that cow-pox originates in grease are thus stated by himself, in his second publication on the subject of cow-pox.

First, He conceived grease to be the source of cow-pox, from observing that where the cow-pox had appeared amongst the dairies in Gloucestershire (unless it could be traced to the introduction of an infected cow or servant), it had been preceded at the farm by a horse labouring under grease, which horse had been attended by some of the milkers.

Secondly, From its being a popular opinion through that dairy country, and from its being insisted on by those who there attend sick cattle.

Thirdly, From the total absence of the disease in Scotland and Ireland (as the doctor was informed from the best authority), where the men servants are not employed in the dairies.
FARRIERY. Part VI.

Diseases. Fourthly, From having observed that morbid matter generated by the horse, frequently communicates in a casual way, a disease to the human subject so like the cow-pox, that in many cases it would be difficult to mark the distinction between the one and the other. The truth of this observation is well illustrated by the above experiments of Dr Ley.

Fifthly, From his being induced to believe from experiments, that some of those who had been thus infected by the horse, resisted the smallpox.

Sixthly, From the progress and general appearance of a pustule on the arm of a boy whom he inoculated with matter taken from the hand of a man that had been infected by a horse, and from the similarity to the cow-pox, of the general constitutional symptoms which followed.

Le Louvet. Continental writers describe a variety of eruptions under the general name of charbon, or carbuncle, which affect various parts of the body, and have received different names according to the part which they attack. We shall here only notice one of these which raged epidemically about the middle of the last century in Sweden, under the name called le Louvet.

It affected both cattle and horses, but seems to have been attended with different symptoms in each. According to M. Raynier, a physician at Lausanne, who published an account of the distemper, when an ox is seized with it, he suddenly loses his strength, trembles, seems desirous of lying constantly on the ground, whence he seldom moves except to refresh himself; he carries his head low, and his ears sloothing; he is sad, and moans; his eyes red, his skin very hot and dry, and his breathing frequent and difficult. When the disease has made some progress, expiration is always followed with a considerable depression of the danks; there is a frequent cough; the breath is very fetid; the heart and arteries heat violently; the tongue and palate are dry and become blackish; the animal loses his appetite and ceases to chew the cud; there is considerable thirst; the urine is scanty, reddish, and the excrement hard and blackish towards the beginning of the disease, and afterwards limpid and bloody, but not chance in the middle. On most of the animal inflammatory tumours are produced, which appear sometimes on the chest, sometimes on the vertebræ of the neck, and on the belly; at others on theudder, and the parts of generation. At other times they entirely cover the skin in pimpls, like those of the mange or scab.

All these symptoms do not often appear on the same subject; but in proportion as more of them occur, the disease is more fatal. In general, death takes place on the fourth day, when the symptoms are violent; if they pass the fourth day, and are not worse on the seventh, their recovery is pretty certain, though they are often not convalescent before the fifteenth day.

When the urine is turbid, and deposits a whitish sediment; when the excrements are more abundant than in the natural state, moist and not very offensive; when the skin is black and relaxed, the pimples filled with whitish matter, the thirst alleviated; when the appetite and rumination return, and when the pustules begin to dry up, a perfect recovery may be expected; but on the contrary, when there is much swelling of the belly, the animals moan much, when there appear great debility, trembling, convulsions, retention of urine, diarrhoea or dysentery, a fatal termination may be looked for.

On opening the bodies of such animals as die of this disease, there appear on the skin numerous black tumours, full of yellow serous fluid that effervesces with acids; the muscles are livid, soft and flaccid; the lungs wasted, full of tubercles and little clearers, especially on those animals which died on the fourth day. The stomach and bowels are bent with red tumours, full of a tenacious clammy fluid.

M. Raynier considers the predisposing causes of this disease to be the bad quality of the water which the beasts drank, the corrupted state of their food, excessive fatigue, low and ill-aired stables, deficiency of herbage, and tempestuous weather. Like many other medical men of his time, he held the immediate cause of the disease to consist in an alkaline state of the blood. The method of cure consisted in giving drenches of emollient decoctions, clusters of the same substances, with nitre and vinegar mixed with honey; and towards the latter stage of the disease, the Peruvian bark and morphine were administered. This was a very innocent and gentle treatment, and it is no wonder that so many of the cattle died.

Le Louvet. The disease called strangles in horses, is considered by Mr Blaise as a specific fever, accompanied with a disposition to inflammation in the glands of the head and throat. It most commonly attacks horses between four and six years of age, though it may occur at any period before six; but rarely appears after that age. Young horses are most subject to it when first brought to labour, and put on the nourishing diet of the stable, though Mr Lawrence has seen it in unbroken colts in the field. It seems that few horses escape having it once in their life.

It commences with a considerable degree of fever; the breath is hot, the eyes are heavy and languid, the horse thrusts out his nose, has a hoarse cough, and labours under some difficulty in swallowing. There soon appears a swelling between the jaws, or on the inside of the lower jaw, which usually extends to the parotid glands. These swellings, if left to themselves, go on to suppuration; and about the fifth or sixth day they break and discharge a considerable quantity of matter; but sometimes the heat, hardness, and swelling of the glands continue for a long time. These symptoms are usually attended with a running at the nose, which is considered as a favourable sign.

This complaint is seldom dangerous, though now and then there is some risk of suffocation, and sometimes it degenerates into glands. Of this Mr Lawrence has seen several instances. It appears to be contagious, and may be propagated by inoculation, which has induced us to consider it among the febrile eruptions.

The writers on farriery have strangely differed with respect to the nature of this affection. The elder Lafosse considered it as analogous to the smallpox; Bracken, as a species of cynanche, or quinsey; and it certainly nearly resembles the cynanche poroides, or mumps. Others have supposed it to be like the chicken-pox, or measls.

It is not agreed on whether it is better to check the inflammation
FARRIERY.

Inflammation of the glands, or to encourage their suppuration. Mr. Blaine recommends the former plan, which is best affected by bleeding, purging, and the use of diuretics; while a solution of sugar of lead is applied to the swelling externally; but if the swellings continue hard and hot, it will be proper to encourage suppuration by the frequent application of warm poultices. If there is much soreness and swelling of the throat, a large blister should be applied to it. If there is much fever, nitre or emetic tartar may be added to the horse's water; for it would be wrong to give him medicine in the form of a ball or drench. He may have frequent warm baths; and to encourage the running at the nose, there should be hung to it a bag containing a warm mash, which should be frequently renewed. The horse's head should be kept warm, and currents of cold air should be avoided. When the tumours break, the discharge should be assisted by enlarging the opening and applying warm poultices, and the ulcers may be dressed with the common digestive ointment. If the discharge proceeds by the mouth, the parts should be frequently washed with vinegar and water sweetened with honey.


In the fourth chapter of the last section, No. 423, we made a few observations on swelling of the legs, and we remarked that this complaint often terminated in grease.

Grease is a complaint that is extremely common among horses, to whom it is peculiar, not being known to affect any other species of animals, or at least there is no other animal in whom that peculiar secretion which constitutes the matter of grease in horses is found to take place. There appears to be two varieties of grease; the one a mere local affection, the other a more general affection of the system attended with fever.

The complaint first appears by a slight swelling about the coronet and pastern, sometimes accompanied with pain or itching, so that the horse rubs his feet against each other, or stamps and shifts himself from side to side. On feeling the swelled part, it is commonly found much hotter than usual, and is evidently red and inflamed. Very soon there may be perceived an oozing through the skin, of a yellowish fluid that is very offensive, and of an aforesaid greasy feel. This swelling gradually extends up the cannon towards the knee, and when the horse is taken out to work, he appears stiff and lame till he becomes heated; and when he returns from work, the leg appears hot and inflamed. The swelling and oozing of fetid greasy fluid gradually increase till cracks begin to make their appearance in the skin about the heels, the hair about these parts fall off, and the skin below appears puffy, of a whitish or livid colour; and on it are generally seen little bladders, from which a matter of the same kind as what we have described oozes out. These vesicles soon become ulcers, and the matter they contain assumes the appearance of pus, which irritates and inflames the neighbouring parts, fretting and excoriating the skin. Generally a number of red granulations or excrescences appear within the ulcers, and from their form are commonly called grapes; and if the complaint continues long, the hoof becomes fungous, or there is a luxuriant growth of soft spongy

Vol. VIII. Part II.

If the complaint be neglected, the ulceration of the part increases, and extends even to the bones, which become soft, spongy, and at last carious.

In what is called the confirmed state of grease, the affected parts are exquisitely sensible, and they bleed on the slightest touch, and there are commonly produced a number of horrid excrescences about the fetlock. The hair stands erect, and the horse becomes lean, weak, and excessively irritable.

Such are the general appearances and progress of grease; but there are often some little varieties in both. Sometimes the cracks appear very early in the disease, and sometimes there is considerable fever; but whether this precedes the appearance of the vesicles, or is occasioned only by the pain and irritation that accompany the complaint, we are uncertain. It should seem, from the observations of Dr. Loy and others, that a fever, such as accompanies eruptive diseases, frequently attends grease; and in this case, as we have said, it is to be considered as a general affection. It is described as such by Huard, and other continental writers; and they even speak of the appearances that have been found on dissection of horses that have died when affected with this complaint, of the repercussion of the eruption from cold, &c. On the other hand, there is no doubt that fever may be excited by the irritation of the parts, especially if the horse is obliged to work. It will take place in any of the legs, but is more common in the hind legs.

Such horses as have round fleshy legs, such as have white hair upon their legs, and in general, such horses as are weak and phlegmatic, are more subject than others to grease.

It may be brought on by various causes. It is very commonly produced by allowing horses to stand long idle in the stable. In this way the circulation, which is naturally more languid in the legs, especially in the hinder legs, than in other parts of the body, becomes so languid in the heels, that the veins cannot readily propel forward their contents, and consequently an accumulation takes place in the minute capillary branches; whence swelling and inflammation. This accumulation is assisted by the perpendicular situation of the legs, by which a column of blood, that for want of the action of the muscles is moved with difficulty, continually presses on the lower parts. Hence we find, that when horses are not allowed to stretch themselves at their ease, they are extremely subject to swelled legs and grease. The languid circulation is still greater in horses that are naturally of a weak constitution, or who have been debilitated by disease. So great is the effect of diminished exercise in producing swelled legs in grease, that some horses are always affected with this complaint when brought into the stable, and can be preserved from it, only by being regularly turned out into the field after work. It is very commonly observed, that when horses first come up from pasture, or from a straw yard, they are all more or less affected with swelled legs; and if these are not diligently attended to, they soon have greasy heels. It is certain that horses in their natural state, or while kept constantly at pasture, are never affected with grease.

Sudden changes from heat to cold, or vice versa, frequently produce this complaint; but, according to Mr. Peron, it is more commonly produced by sudden changes.
changes from cold to heat. "If (says he) a colt is taken from grass, and immediately kept in a warm stable, after having been used to the severity of the atmosphere, he then gets the disorder. When old horses are troubled with the grease, we shall find, that their feet have been exposed first to cold, and afterwards to heat, as when they have been in cold water or snow for a long time, and on coming into the stable have a large bed of straw, or perhaps hot dung, to stand upon. This sudden transition from cold to heat produces fever in the legs, particularly in the skin; when inflammation and cracks, similar to chilblains in the human subject, take place, and are called the grease in horses."

Nothing contributes more to the production of grease than negligence, with respect to keeping the legs clean, and rubbing them often. It is a disputed point, whether the hair that grows about the fetlocks is prejudicial or not to horses that are subject to grease. It is contended by Mr. Richard Lawrence, that grease is a very common consequence of removing the hair; and considering that the hair is a good preservative against sudden transitions from heat to cold, we are disposed to think its removal improper, where the heels are not already ulcerated. On the other hand, Mr. Blaine remarks, that whenever accidental wet occurs, this hair must retain a large quantity of it, and hence be long in drying, occasioning a copious evaporation, and thus producing much cold, and that the hair renders it difficult to keep the legs so clean, as they might be preserved without it. In supposing these arguments to have been only the necessity of greater care and attention in rubbing the heels dry and keeping the hair free from dirt.

Grease may also be produced by too much hard work, after which the legs swell, and the swelling being neglected the heels may become greasy. This, however, is probably not a very common cause.

Grease is said to be most common in spring and autumn, when horses are moulting or casting their coats.

On the whole, it appears that this complaint may take place in two different states of the body; a state of general weakness, the effect of constitution or disease; and a state of plethora, attended with proportioned languid circulation in the vessels of the legs or feet.

In the treatment of grease, we must consider whether it be merely a local affection, or be connected with some general morbid affection of the body; and we must also attend to the state of the affection, the nature of the local applications will depend much on the progress that the disease has made.

In the early stage of the complaint, when the inflammation is slight, and the skin is not yet broken, if it has been owing to want of exercise and plethora, it may be proper to draw blood from the veins of the thighs, and a diuretic ball, such as No. 12. or 13, should be given, and repeated every two or three days. The hair must be cut close, and the heels well washed with warm soap and water, after which they must be gently rubbed till they are perfectly dry, and bathed with some stimulating ointment. This plan, with gentle exercise and a cooling diet, especially bran mash, with an ounce of nitre in each, every night, will probably prevent the complaint from going any farther.

If the inflammation be very considerable, and the horse is plethoric, he must be bled pretty largely from the jugular vein, and have a mild purge. Cloths, dipped in vinegar and water, or in a solution of sugar of lead, should be applied to the heels after washing, and kept constantly moist with the same liquor. More than walking exercise here will be improper; but if it is run for a few hours or a day in a field will greatly contribute to removing the swelling. Mr. Fe-Ken, who is a great advocate for warm fomentations in inflammatory affections of the feet and legs, recommends the legs to be kept the whole day in warm water; and when they are taken from the bath, to be well wrapt up in a warm poultice of bran and water. If by these means the inflammation subsides, the legs may be washed with a solution of alum.

If cracks appear, great attention must be paid to keep them clean from dirt, and they should be frequently washed with a solution of blue vitriol. If grapes appear, they may be touched with blue vitriol, or burnt alum; or if they become large, they must be cut away with a sharp knife, and afterwards seared with a hot iron. If the ulcers are foul, one of the best applications will be a solution of verdigris, or the ointment commonly called Egyptianum, of which verdigris forms one of the principal ingredients.

The strictest attention to diet, regimen, and cleanliness must be observed, and the whole treatment, and gentle exercise must be persevered in. The best diet on these occasions will be cut grass, lucerne, fresh clover, carrots, or good sweet hay, and an occasional feed of corn. The horse should not be tied up in the stall, but should stand loose while he is in the stable, and should be allowed no litter, except at night. The stable should be kept perfectly clean and well aired, and not too warm.

Sometimes, even though the complaint should not at first have originated in debility, there will, if the disease is of long standing, be produced a considerable degree of weakness. In these cases the cure will be greatly assisted by giving strengthening remedies, such as bark, horse-cheesnut bark, &c. And as in this weak state of the body the discharge from the ulcerated surface is commonly thin and ichorous, the sores must be dressed with stimulating ointment; and if there appears a tendency to mortification, as sometimes happens, a powder of equal parts of Peruvian bark and opium should be sprinkled on the sores, before applying the plaster. If the discharge is very offensive, a fomenting poultice, such as No. 64, may be applied over the dressings.

It will readily appear, that the best means of preventing grease, will be to give the horse regular exercise, to dress him well, and especially to keep his legs dry and clean, and to avoid the extremes of heat and cold.

Grease might perhaps have been considered under the head of specific inflammation; but as it is sometimes attended with a general affection of the body, and is ultimately connected with one of the most interesting eruptive diseases, we thought it best to treat of it in this place.
Part VI.

FA R R I E R Y.

Diseases.

CHAP. II. Of Inflammatory Diseases.

1. INFLAMMATION of the Brain. PHRENITIS. Mad Stagger, Phrenzy, Megrim, or Sough. Mal de feu ou d’Espagne, Fr.

This is one of the most serious and fatal inflammations which affect the animal system. It attacks occasionally all the domestic animals, but horses and cattle are the most subject to it. In the former it is generally called the mad stagger, to distinguish it from apoplexy or sleepy stagger; when it occurs in cattle, it usually takes one of the other names which we have given as synonyms.

Inflammation of the brain is sometimes preceded by giddiness and partial blindness; the animal holds his head low, or rests it against the manger; he appears dull, heavy, and sleepy; gradually, however, these symptoms go off, and are succeeded by others of a very different nature. His eyes appear red, fiery, and sparkling; he now holds his head higher, and appears for some time to look constantly at any object before him: soon he becomes very restless, till by degrees he is quite unmanageable. He sometimes lies down, and tumbles about, and then remains quiet for a while; but he soon gets up again, and is as ungovernable as before, rendering it dangerous for any person to approach him. The pulse in this disease is full and rapid, and there is considerable throbbing of the temporal arteries. The pulse is not always the same in every case, being in general less frequent than in health, but sometimes more so. There is always a considerable degree of fever, and the head seems peculiarly affected. The secretions and excretions are generally diminished, but it is said that they are sometimes increased.

Such are the symptoms as they generally appear in the horse; those which take place in cattle, as they are described in the best books on the subject of cattle medicine, differ in a few particulars.

The animal is described as looking frightfully, being unusually watchful, starting often, groaning vehemently, as if affected with sudden and violent pain; his respiration slow, but he sometimes makes very long inspirations, and appears for a time as if his breathing was entirely suspended. Suddenly the beast will rise, turn about, and instantly lie down again, showing marks of great restlessness and delirium. When the frenzy is high, the eyes look red and furious; at other times they border on languor and stupefaction; but the beast always appears to labour under considerable fear, and dreads the approach of every thing; he is often quite ungovernable, and scarcely ever inclines to rest, except in the latter stage of the disease, when, if it has been neglected, or has not yielded to the usual remedies, a lethargy takes place, and the animal sinks. Sometimes the urine is hot and high-coloured; but it is said that before a fit of phrenzy takes place, the urine is often of a pale colour, and thinner than natural.

When the symptoms of fury or irritation suddenly cease, and a lethargy takes place, while the pulse becomes feeble, and the strength diminishes, the case is pretty certainly hopeless; but if the fever, redness, and flushing of the eyes gradually subside, without the pulse sinking, or great debility coming on, the beast may generally be pronounced recovering.

On opening the head of such animals as have died of this complaint, very evident marks of inflammation appear about the membranes of the brain, and very frequently in the substance of the brain itself. All the vessels are turgid with blood; and on cutting into the brain, innumerable little red points are to be seen, which do not appear in the natural state. Very commonly an effusion of blood, or of purulent matter, is found to have taken place in the cavities of the brain, or in some part near its surface.

The causes of inflammation of the brain are generally the same that produce inflammatory fever, applied in a greater degree; as great heat, excessive exercise, a sudden change from a poor to a rich diet.

The cure of this complaint requires the most prompt and decisive measures. Blood must be taken in large quantities from the jugular vein or temporal artery. Not less than three quarts should be taken from an ordinary horse, ox, or cow; and if the animal is very large, four may be taken; and the bleeding must be repeated a few hours after, if the symptoms do not abate.

When the beast is very furious, it is often dangerous to bleed in a very deliberate way; but as his recovery will almost certainly depend on a sufficient loss of blood in the early part of the disease, it will not be amiss to bleed him in the manner described by Mr Blaine, as having been practiced by an eminent veterinary surgeon, who being called to a horse affected with stagger, and in such a state of delirium that none of the ordinary precautions for securing his blood could be adopted, plunged a lancet into each jugular, and permitted the animal to bleed till he fainted, by which means, though the disease was far advanced, he saved the horse. After bleeding, a stimulant blister should be applied to the top of the head, and the sides of the neck should be well rubbed with a mixture of powdered cantarides and oil of turpentine, and other means used to promote external inflammation, for the purpose of determining the blood from the head. Mr Coleman is said to recommend in these cases the pouring of boiling water on the pasterns, by which means blistering will speedily be produced in these parts. In desperate cases the determination of blood to the head may be most effectually stopped, by tying a ligature about one of the external carotid arteries; but in doing this great care must be taken not to include within the ligature the nerves that run near the artery, as these nerves are the principal branches that supply the stomach; and if they be included in the ligature, the functions of that organ will be in a great measure destroyed. In addition to these means ofstiveness must be carefully guarded against. After back-raking, a stimulating purging clyster should be injected as soon as possible, and if an interval of quiet will permit, a purging ball, such as No. 1/2 may be given by the mouth. If the above means are adopted in proper time, the animal will generally be saved; but if some days have elapsed before vigorous steps are taken, there can be little hopes of a cure.

Mr Downing, in his work on cattle-doctoring, mentioned in No. 87, advises a method of treating inflammation of the brain in cattle, that is extremely contradicto-ry and inconsistent. He at first very properly advises bleeding; but be directs this to be followed by giving dispenses, a very powerful cordial medicine, the administration of which completely counteracts the effects of the bleeding. Dr Downing describes a fever of the
Diseases. The brain as distinct from inflammation; and he then treats

Farrery. of a sleepy fever. These are evidently symptomatic affec-
tions, and should have been given as such, as well as giddi-
dness, or swimming in the head, which is described by

Dr. Downing as a distemper belonging to the cavities
of the eyes and optic nerves. It gives a wavering mo-
tion to the body. For if the optic nerve, or its expan-
sion on the bottom of the eye called retina, be agitated
by any preternatural heat or other emotion, objects will
change their situation; therefore this disease is a fever
affecting the cavities of the eyes, or the optic nerves.”

2. Inflammation of the Eye. Ophthalmia Membran-

arum. Moon-blindness.

Though in the human subject there are several spe-
cies of ophthalmia, in the horse there is but one, which
is in a great measure synonymous to what has been cal-
cled ophthalmia membranarum by medical writers.
This disease is in the horse of considerable importance, as it
is not merely a local disease, but appears to be conno-
ted with some constitutional affection. Before we de-
scribe the symptoms and treatment of this complaint, it
will be proper to remark, that in the eye of the horse
there is a firm cartilaginous substance, situated at the
inner corner of the eye, the greater part of which is
hidden by the eyelids, but a small portion projects be-
yond them, and may be distinguished by its black co-

colour. This is commonly called the how, and by ana-
atomists the membrana nictitans, and is supposed to be a
production of the retractor muscle. Our reason for
mentioning this part will appear immediately.

Inflammation of the eye sometimes makes its appear-
ance very suddenly; at others it is gradual in its attack.
In general, one of the earliest symptoms of it is a swel-
lings of the eyelids, especially of the upper, which is
with difficulty held open; the eyes water considerably,
and drops of tears may be seen at the extremity of the
lacrimal duct, which do not appear in the healthy
state of the eye. The external transparent parts of the
eye become more opaque, and bounded, appearing a
blackish glassy hue; sometimes of a dull white, at others
brown or bluish. Red vessels may be seen running over
the white of the eye, especially at the corners, and
sometimes reaching to the centre of the eye. The cor-
nea is said to be most obscured on its upper part; but
this is probably owing to the situation of the person
who looks at the eye, who being below it, sees directly
through the lower part of the cornea, and but oblique-
ly through the upper. When the eyes are in this state,
the horse is very impatient of light, and holds his head
down to guard against it. The eyelids and ball of the
eye are evidently much hotter than usual, and some-
times there may be seen through the cornea, a small
quantity of thickish matter called pus, in the lower part
of the anterior chamber of the eye. The cartilaginous
membrane or how is now much more visible, and projects
forward considerably outward from the corner of the eye.

It not unfrequently happens, when the disease has
not proceeded farther than we have described, that it
gradually, sometimes pretty suddenly, disappears, and is
seen again in the course of a few weeks, although some-
times it comes back in the course of a few days.
The disappearance of inflammation in the eye of the horse
is sometimes so sudden, that the eye, which one day is
considerably inflamed, will appear the next perfectly
clear and healthy. Sometimes it seems to appear and dis-
appear periodically; and it has been supposed by
ignorant people, that in these periods it follows the
changes of the moon, whence it has received the name of
lunatic blindness. If the disease does not thus disap-
appear, or if it appears again, and reaches the height be-
fore described, the inflammation goes on, and the cor-
nea becomes more obscure; or, what very frequently
happens, the cornea recovers its transparency, and the
crystalline humour becomes opaque, forming the dis-
ease already spoken of in No 325.

In the horse, one eye frequently only is affected, as
whereas in man, both eyes are generally inflamed at
the same time. This disease more frequently occurs in
young horses of five or six years old, than in those of a
more advanced period. It is said that horses are more
affected with inflammation of the eyes till they are bu-
ked, or taken up from the pasture where they have re-
mained from their birth.

A p lethoric state of the body seems very much to
influence to inflammation of the eye, and this seems to
account for its occurring so frequently in horses of five
or six years old, as at that age they generally cease to
grow, and are, of course, more disposed than at other
times to fulness of blood. Sudden changes of tempera-
ture form a very common exciting cause of this disease,
and the heat and fowl air of a close stable frequently
produce it. Such horses are kept in dark stables
also more subject to it, from the effect of sudden ex-
posure to broad day-light. Want of exercise, or excesses
of idleness and hard work, may also assist in producing it.
Mr. Coleman considers this disease in the horse as
an inflammation of a specific nature, very different from
any that occurs in other animals. The principal reason
for supposing that the constitution is affected is, that
a horse affected with an inflammation of the eye cide
does not perspire, or sweats profusely, indicating a slow
fever. If the animal is bled or purged, the eye speck
becomes clear; and if the same cause is applied
the same eye, or any other eye, becomes inflamed,
and sometimes the disease appears alternately
in each eye.

Provided the proper means be taken in the ear-
ly stage of the disease, the inflammation is commonly
removed; but when the crystalline humour becomes
opaque, no means either employed have, as we shall
presently see, produced any benefit.

In the treatment of this affection, it must be re-
membered, that the constitution is deranged, and that our
remedies must therefore not be confined to local ap-
lications to the eye. General blood-letting will almost
always be required; but, unless the horse is very far
plethoric, this need not be repeated. It will be proper
also to apply a blister or two to the head, as near the
eye as possible, and the veins at the corners of the eye
should be opened, to draw blood from that part. The
horse must be put on lower diet, and should use only
very moderate exercise; the stable should be kept well
aired and cool; and if the horses eyes are very sensi-
tible, and the stable happen to have windows, these
should be darkened. It will generally be advisable to
give a purgative medicine; and the horse may drink
frequently of some cooling liquor, especially of water,
with nitre dissolved in it. Bowels have been sometimes
recommended; and it is said that considerable benet
has
Part VI.

FARRIERY.

Diseases. has followed the insertion of setons as near the eye as possible. They have sometimes been passed through the white of the eye, just below the transparent cornea; but to this we should object, as being liable to produce specks that may extend to the cornea. As there is generally considerable dryness of the skin in this complaint, it may be useful in some cases to administer a gentle sudorific, such as a solution of two drachms of emetic tartar, or No. 22. of the receipts may be given.

With respect to the applications to the eye itself, those which appear the most likely to be of advantage, are stimulating substances, such as tincture of opium, solution of blue vitriol, red precipitate, in the form of a soft ointment, such as No. 40. Sometimes, however, these stimulating applications do harm; and it is found that a weak solution of sugar of lead, or acetate of zinc, as prescribed in No. 31, are most useful. We must here take notice of an absurd practice that is in use among common farriers, of cutting away the haw, which they consider as a very principal part of the complaint. There is no doubt, however, that relief may have been procured by this operation, as it will generally be attended with a pretty copious effusion of blood, that will relieve the distended vessels; but as this effusion can be more easily produced by scraping the red vessels of the white of the eye; and, by opening the angular veins, there is no occasion to take away a part, which is certainly of considerable use to the animal.

Sheep are sometimes affected with inflammation of the eye; but in them, as in most other animals, it is merely a local disease, and is generally relieved by topical bleeding. In the corrected agricultural report of Perth, it is stated, that the common practice in that district for relieving inflammation in the eyes of sheep is, to open the veins in the corner of the eye; and hold down the animal’s head, so as to allow the blood to get within the eye. There is no doubt that this bleeding does good; and the introduction of the blood within the eye may, we believe, also be of service; not, however, in the way supposed by the reporter, but because it acts as a gentle stimulus.

We have already, in No. 324, made some observations on cataract, and noticed the inefficacy of all the usual methods of treatment. It may not be improper here to add the result of Mr Coleman’s experimental attempts to relieve this complaint, as stated by Mr Fenon.

"The professor has begun with bleeding from the jugular or angular veins, and, at the same time, employing purgatives frequently repeated, as well as diuretics administered one after another. After which he has tried all the medicines of Messrs. Phipps and Withen, but without any degree of permanent success. The local and surgical treatment has been as follows, viz.

1st, He has ordered scarifications, and to pass a seton through the membrana conjunctiva; but without effect.

2dly, We have removed some of the larger vessels going to the cornea, and divided them with the actual cautery, but with no success.

3dly, We have applied leeches to the conjunctiva, but without effect.

Lastly, We have taken up both carotid arteries, which was of no avail, from the anastomoses which the vertebral arteries form with them."
Diseases. night, and be nearly well next morning. This plan will also answer, if it be adopted immediately, on perceiving the chilliness, or shivering. If, however, considerable fever has taken place, and the animal's pulse is hard, it will be proper to draw blood, according to the urgency of the symptoms, before giving any internal remedy, or using warm clothing. After bleeding, a drench, composed of warm ale, with a drachm or two of salt of hartshorn, or half an ounce of spirit of hartshorn sweetened with molasses, will prove an excellent remedy; after taking which, the animal should be well rubbed down, and clothed as before. If the animal is costive, back-raking, followed by clusters, will be advisable; and throughout the treatment costiveness must be avoided. If there is considerable fever, the drench, N° 22. or 26. where costiveness is to be obviated, should be given every six hours. Some practitioners advise balls in these cases, as in most others; but as there is often some swelling of the throat, and always considerable irritation about the fauces, it is better to give the remedies in the form of drenches. The surgeon needs particular attention during the inflammatory state of the disease, as it will generally go off when the inflammation is removed; if it should continue obstinate, it becomes a chronic cough, and must be treated as directed under N° 436.

4. Influenza, or Epidemic Catarrh.

The epidemic catarrh also affects all these animals, and has sometimes been known to attack a whole yard of oxen, horses, and cows, in one night. It differs from common catarrh in the degree of fever, which, in this complaint, is always very considerable, and is one of the first symptoms. There is a smart shivering, followed by considerable heat and dryness of the skin, and the fever is commonly attended with great heaviness and pain of the head, and affection of the eyes. In this complaint there is also a great degree of weakness, which comes on pretty early in the disease, and this weakness not unfrequently brings on a fatal termination of the disease. Sometimes there is a considerable discharge from the nostrils; at others this discharge is either trifling, or the nostrils are dry, in which cases the fever is most considerable.

The epidemic catarrh appears to depend on some peculiar state of the atmosphere; but there is no doubt that it is capable of being propagated by contagion. It is more prevalent in the spring, especially when this has been preceded by a mild winter. It is said, that when cattle are at these times exposed to currents of air from the north-east, they are most likely to be affected with it.

In the commencement of this disease, it will be proper to house the animals; but too much warmth must be avoided, as it would tend to increase the weakness that forms a principal part of the disease. It may sometimes be necessary, when the fever runs very high, to draw blood once; and, at any rate, it will be proper to apply a blister to the head, or on each side the neck. Though warmth must be avoided, great care should be taken not to expose the animals to a draught of air. Warm moistens may be given as in common catarrh, but when the fever has subsided, cordials and strengthening remedies will be required; and if the appetite is tolerably good, the diet may be more nourishing than usual. The animals should on no account be hard worked, but be allowed to rest from the time the disease is first noticed, except taking gentle exercise when their strength will admit of it.

What is commonly called the distemper in dogs is now pretty generally considered as a sort of epidemic or contagious catarrh. We shall therefore treat of it in this place.

5. Of the Distemper in Dogs.

No disorder is more general among dogs than that Distemper which is generally known by the name of the distemper in dogs, and none is so destructive. It is asserted that, except the plague, no disease is so fatal to the animal which it attacks.

It appears that this disorder has not been known in Britain till within the last 50 years, but, during that time, it is astonishing what numbers of dogs have fallen victims to it. For these last fifteen or twenty years, however, the distemper has been less frequent, and has assumed a milder form.

The symptoms of the distemper are not alike in every case. The following are, according to Mr Blain, its usual appearances. It generally begins with a dry husky cough, attended with dullness and want of appetite, a running from the eyes and nose, and loss of flesh. As the disease advances, the dog appears much emaciated, and grows excessively weak, particularly in the loins and hind legs. Convulsive twitchings of different parts, especially of the head, come on, attended with dimness of sight; and, as the disease proceeds, and puts on a more virulent form, these twitchings degenerate into strong convulsive fits, which continue for a long time, and repeatedly return. In these fits the dog foams at the mouth, runs round, and appears to be in great pain, and to have a constant desire to dash. This is sometimes attended with obstinate costiveness, at others with violent purging. The stomach is extremely irritable; every thing that the animal takes being immediately thrown up. When the disease has reached this state, the animal seldom recovers, and is usually carried off in one of the convulsive fits.

In every part of this disease there prevails a want of energy, and a particular paralytic affection of the nerves. This latter symptom, in some instances, remains long after the disease has been otherwise removed; but, in general, the strength returns almost immediately on the removal of the other symptoms.

The distemper in its worst form is often mistaken for canine madness; but they may in general be distinguished, by attending to the following points.

1st. The distemper seldom occurs except in puppies, its most common period being from six to twelve months. Madness may occur at any age, but seldom attacks puppies.

2d. In the distemper dogs drink freely; in madness, though they often attempt to drink, it does not appear that they are capable of swallowing the water.

3d. In the distemper the animal does not attempt to bite; but, in madness, the propensity to biting seems to be incessant.

4th. In madness there appears to be a loss of reason at all times, though, as is said, they are so sensible, as to know their master; but in the distemper, though there is sometimes a loss of reason, it lasts no longer.
Farriery: 543

Part VI.

Diseases.

If, therefore, a young dog will drink, as soon as the effect of the convulsion is removed, but more particularly when his weakness is excessive, and strongly apparent in the intervals between the fits, it may be prettily safely concluded, that he be affected with the distemper, and not with madness. These circumstances, says Mr. Blaine, should be carefully remarked, as they are unerring, and may save many a valuable animal from a lingering end, and many a timid mind from the most dreadful apprehensions.

The cause of the distemper is difficult to explain; nor do the most careful dissections, in every stage of the complaint, ascertain more than that there is a general inflammation of the mucous membrane; but whether the true seat of the disease is confined to that membrane, and all the other symptoms are the consequences of it, or are real affections of other parts, is an undecided point, although it is certain that its first appearance is by an inflammation of the pituitary membrane, and which is one of the most lasting, as well as constant symptoms. That this inflammation is given from the membrane of the nose, to the upper part of the gullet and wind-pipe, is evident by the swelling of the glands of the throat, the tenderness and dry cough; and that this inflammation extends from thence to the same membrane of the stomach and intestines, is equally so, producing vomiting, convulsiveness, or purging. It has generally, as we have said, been considered as a species of scrofula; but it has been suggested to us, by an ingenious friend, that, from several symptoms, as well as from its attacking dogs only once in their lives, it is more analogous to pertussis, or chinchough, in the human subject.

With respect to the cure of the distemper, Mr. Blaine's directions and remedies appear to have been tolerably successful. With the nature of his remedy we are unacquainted, but believe it to be a preparation of mercury. This medicine has been made known by extensively advertising it, and although certificates of its utility are numerous, they make no part of the advertisement, but are to be seen at Mr. Boofey's, in Old Bond Street, London, the wholesale agent; the form is a powder. Explicit instructions accompany it; and the price, considered with its asserted efficacy, bears no proportion, as no sportsman would think five times the sum too much for the preservation of a valuable animal. Although so efficacious, it is nevertheless innocent enough for a child to take; nor must those who are advocates for strong remedies imagine, that, because the effects of this shake not the whole constitution, that the disease will not be eradicated by it. When the disorder is strong, after it is given, there is for the most part a gradual decrease of the symptoms, and nothing but a small moisture at the nose remains, which speedily disappears the next day. If the attack is slight, no more is seen of it, and the animal is at once well.

From the varieties in the size, and consequent strength of dogs, a difference in the quantity of the medicine is necessary; the packets are therefore marked 1, 2, and 3. For a mastiff, pointer, setter, or dog of a large size, No. 1. should be procured. Hounds, spaniels, and those of a middling size, require No. 2; and all the lesser dogs, No. 3.

It has been already observed, that in the severity of the disorder, there is frequently so great an irritability of the stomach, that every thing taken into it is instantly thrown up; in such cases, the powder should be carefully mixed with a small piece of butter, at the same time adding to it thirty, forty, or fifty drops of laudanum, according to the age, size, and strength of the dog; who is to be watched, whether the medicine is retained and kept as still as not; but should it be thrown up, notwithstanding this addition, in two hours after the same quantity of laudanum should be given with the powder, in a little broth or milk, and half an hour afterwards the powder mixed into a paste with treacle, honey, or flour, and thus the vomiting will be prevented. Should there be at the same time obstinate convulsiveness, it is probable that sickness may be the consequence of it, and must be removed before it will cease; twenty grains of jalap, or, in preference, fifteen grains of calomel, with four or five drops of laudanum, may be given in a small ball; or two table-spoonfuls of castor oil, may, if more convenient, be used. Should these not stay on the stomach, a clyster with milk, salt and oil seldom fails to remove the convulsiveness, after which the powder should be given, if there has been great sickness, with the laudanum; if not, without it.

When, likewise, extensive purging accompanies the complaint, the laudanum should not be omitted; as by running off rapidly by stool, the effect of the medicine is equally lost, as if it were vomited up. In such cases it will be proper to give before the powder, thirty or forty drops of laudanum, with two ounces of olive oil. We should always attempt to remove the sickness and purging, or convulsiveness, before administering the powder, as the effect of this will be then more certain. In the milder form of the disease, however, nothing is requisite but to give the powder in such a way, as that the dog may take the whole of it; for which purpose the powder should be well mixed with a small quantity of anything that the dog will eat; or, if he be averse to eating, it should be made up into a small ball with honey, treacle, or butter, and forced down his throat. It must not be mixed with any liquid, as it is so heavy that it would fall to the bottom, and thus will probably be lost. Care should be taken to give the medicine on an empty stomach, as the effect will otherwise be lessened or destroyed; and the dog should be carefully watched to see if the medicine be thrown up, as, if this is the case, or if there is reason to suppose that the whole dose is not given, a second should be administered. Mr. Blaine concludes with observing, that the symptoms remove without any particular appearance; yet so quickly, as that there is seldom any remains of the disease two hours after the medicines have been administered.

Mr. Daniel has witnessed the extraordinary effects in the distemper, from Dr. James's powder, given in the following manner. When the symptoms of the distemper are apparent, a third part of one of the parcels inclosed in the half-crown packets is to be given, mixed with a little butter, and the dog is to have plenty of warm broth, or milk and water, and, if possible, he is to be near a fire, or at least kept very warm. Two hours afterwards another third part is to be administered; and should neither of these operate by vomiting or purging.
at the end of four hours, give the remaining third. Care should be taken that the two first portions of the cure have the effect, the remaining third should not be given until four or six hours (according to the evacuation) after the expiration of the four hours; in the interim the dog is to be encouraged to lap, and if he refuses, he must be forced to take plentifully of warm broth, or milk and water. Very seldom, even when the case is inerter, but the evacuations are brought on by the taking of two packets, generally by the second dose; but should it so happen that there is no such proof of the powder's effect, the second parcel should be divided into similar proportions, and applied in the same manner, until the stomach is emptied. Warmth and warm liquids will quickly perfect the recovery. As soon as the dog's appetite returns, let him be fed (at first rather sparingly) with animal food.

Dr Darwin advises, that the dog be permitted to go about freely in the open air, and have constant access to fresh water. The use of being as much as may be in the air is evident, because all the air which we breathe passes twice over the patrid sloughs of the mortified parts of the membrane which lines the nostrils, and the maxillary and frontal cavities; that is, both during inspiration and expiration, and must therefore be loaded with contagious particles. Fresh new milk and fresh broth should be given them very frequently, and they should be suffered to go among the grass, which they sometimes eat for the purpose of an emetic, and, if possible, should have access to a running stream of water, as the contagious mucus of the nostrils, both of these animals and horses, generally drops into the water when they attempt to drink. Bits of raw flesh, if the dog will eat them, are preferred to cooked meat; and from five to ten drops of opium may be given with advantage, when symptoms of debility are evident, according to the age of the dog, every six hours. If sloughs can be seen in the nostrils, they should be moistened twice a day with a solution of sugar of lead, or of alum, by means of a sponge fixed on a bit of whalebone, or by a syringe. The lotion may be made by dissolving half an ounce of sugar of lead in a pint of

6. Rheumatism.

There seems no doubt that horses, and perhaps cattle, are affected with rheumatism; but it is sometimes difficult to ascertain the presence of the complaint, or to distinguish it from other causes that produce lameness. It may take place in any of the limbs, but it is more frequently observed to affect the hip-joint and the adjacent membranes; and when seated here, it is called the sciatica, and sometimes the hip-gout. It will require considerable judgment to distinguish this complaint; but it may generally be known by attentively examining the limb in which the lameness is seated, from the hip down to the foot, and, by attending to the causes that seem likely to have produced the lameness. In rheumatism, the skin will be found dry, and the affected part swollen, and the lameness attendant on it will be more readily removed by exercise than that which has its cause seated in the foot, or which arises from bony excrescences. Rheumatism in the horse, as in the human subject, may be either acute or chronic, and the latter is the more obstinate.

Rheumatism, like catarrh, is produced by sudden changes of temperature, and by exposure to a cold, moist atmosphere. It is no otherwise dangerous than as it renders the animal lame.

The cure of rheumatism differs according to its state. In the acute one bleeding may be proper; after which a warm wash, with two drachms of emetic tartar dissolved in the water, should be given, and the horse treated as directed under CATARRH. If a sweat is produced, and kept up for some hours, the complaint will probably disappear, and its return may be prevented by frequent friction of the affected part, regular exercise, a nourishing diet, and attention to avoid changes of temperature. In the chronic rheumatism, bleeding will be improper, and the most likely means of relief will be, to rub the affected parts several times a day with some stimulating liniment; or, if convenient, to use the warm bath for a considerable time together, or to foment the affected limb for an hour or two every night, after which the limb must be rubbed perfectly dry. Pretty constant exercise will also contribute greatly to the cure, and comfort must be avoided. A blister applied over the affected part will sometimes do good. According to Mr Lawrence, the only cure to be depended on is a month's run of salt marshes in the spring, and being continued abroad in some shady place till autumn, afterwards mercurial physic, and the best stable care.


The lungs are frequently inflamed in the domestic animals; and, as in man, the inflammation may be seated either in the membrane covering the lungs and lining the chest, or the pleura, or in the substance of the lungs, consisting of the two valves (the true peripneumonia). The disease has been called by common farmers, rising of the lights, from an idea that the lungs protruded against the throat, and caused that difficulty of breathing which is one of the principal symptoms of this complaint. The other vulgar appellation of rot seems to owe its origin to the appearance which the lungs sometimes present on dissection, being found in a state of mortification, and partial decomposition, as if they were rotten. It is of little consequence to distinguish the two varieties of the disease, as the treatment is the same in both.

According to Mr Feron, the symptoms of inflammation of the lungs in the horse are invariably as follow. The respiration is quick, the breath hot, the extremities cold, the tongue dry and hot, the flanks heaving, the patient never lying down, which forms a very characteristic symptom; and sometimes he hangs down his head. If nothing has been done, it is hardly possible to save his life, after three days have elapsed; and, after death, the right side of the heart is found to have been inflamed, and, on some occasions, the lungs are found filled with blood as actually to burst, and the lungs are found to resemble putrid liver, the cells filled with blood, from the great distension of the pulmonary arteries, and perhaps sometimes effusions take place; the pulse is oppressed, from the great distension occasioned by the blood in the right side of the heart, while the left side of that organ is weak from want of sufficient blood.

To Mr Feron's account it may be added, that the
DISEASES.

Pulse, at the commencement of the disease, is generally more full, harder, and more frequent than natural; but, as soon as the disease reaches the stage at which it is usually first observed, the pulse becomes small and oppressed, and but little increased in frequency; the veins of the neck are swelled and prominent, and the eyes are generally red and starting. There is sometimes cough, at others none; but the difficulty of breathing is always great, and the horse stands extended, panting for breath, with heaving flanks and open nostrils, till, no longer able to support himself, he drops down and dies. This fatal termination sometimes takes place in a very short period; in 48, 36, or even 24 hours.

The only disease with which this can easily be confounded, is colic; and the discriminating marks will be mentioned when we treat of this disease. At present it will be sufficient to remark, that when a horse appears dull, holds his head very low, breathes with difficulty, especially during inspiration, stands stationary, has a quick breathing of the flanks, a fulness of the eyes, and redness of the inside of the nostrils, and when the pulse is small and oppressed, he may almost certainly be declared affected with inflammation of the lungs.

It may not be improper to give a brief explanation of the symptoms which we have enumerated; and they are chiefly to be explained from the difficulty with which the blood passes through the lungs, on account of the unusual accumulation in the pulmonary vessels. Hence the difficulty of breathing, and the aversion that the horse expresses to lie down; for it is evident, that he will breathe more easily in a standing posture than if he were lying, because, as was remarked in the table of the extremities of the muscles, some of these act on the chest when the fore legs are fixed, and thus assist in carrying forward the ribs, and thus increasing the cavity of the chest. The impeded passage of the blood through the lungs also explains why the pulse is weak and oppressed; and hence, when this obstruction is relieved by lessening the quantity of blood, the pulse never fails to become stronger and fuller.

The causes of inflammation of the lungs are doubtless sudden changes of temperature, especially when the animal is plethoric; it is probable that the most common cause is a sudden change from heat to cold and moisture.

It is at present, however, more fashionable to consider the reverse of this as the general cause of pulmonary complaints; and we understand that Mr. Coleman goes so far as to say, that horses are never attacked with inflammation of the lungs from exposure to simple cold, for, that the turning of horses to grass without preparation, though it may render them emaciated, seldom produces the complaint in question. Mr. Feron also, who may be considered as a pupil of the veterinary college, is of opinion, that inflammation of the internal viscera proceeds from a sudden transition from a cold to a hot temperature, but seldom or never from a hot to a cold one. We are aware that these gentlemen have borrowed their theory from Dr. Beddoes, and it is of little consequence to our present purpose, whether it be correct or not.

The judgment to be formed with respect to the termination of this disease, which is always highly dangerous, will depend on the urgency of the symptoms, and on the changes that take place after the exhibition of the usual remedies. If the pulse becomes fuller and stronger after bleeding; if the breathing becomes less difficult; if the parts where blisters have been laid inflame soon, and the blisters rise well; and, in particular, if the horse lies down, and seems less distressed, we may hope that the danger is lessened; and if these favourable signs continue for 24 hours, we may consider a cure as pretty certain; but, if the pulse still continues small and oppressed, more especially, if it becomes quick and irregular; if the difficulty of breathing continues or increases; and if there is a rattling in the throat, with partial cold sweats and extreme dehydration; a fatal termination must be looked for, which will speedily take place, if the breath becomes cold or fetid. It is considered as a very unfavourable symptom when the horse appears insensible to external stimuli; as when blisters do not rise well, nor rowels easily suppurate.

In the cure of inflammation of the lungs, every thing will depend on the speedy adoption of the most various measures, and the first and principal remedy is bleeding. This should be performed as soon as possible, and to a greater extent than in most inflammatory diseases. It will scarcely be proper to take less than five or perhaps six quarts at first, and the bleeding must be repeated, though less copiously, some hours after, if a considerable remission of the symptoms does not take place. It must not be expected that the pulse will rise much after a second or third bleeding; but, if it is not considerably weakened, and if the oppressed feel of it is removed, we may be sure that the bleeding has not been carried too far. Another principal means of checking the internal inflammation is, to excite an inflammation externally near the seat of the complaint, by every means in our power. A large blister should be applied on each side of the chest, and to the inside of the fore legs; a rawel should be inserted below the chest, and if the symptoms are very urgent, another near the belly. Mr. Coleman recommends inflating the cellular membrane below the skin with air, so as to bring on an inflammation between the skin and muscles; and if this does not succeed, he advises that some stimulating fluid, such as oil of turpentine, be injected. We should suppose this carrying inflammation rather too near the lungs; but from some trials that Mr. Coleman has made, and some others of Mr. Feron, this method seems to have been attended with considerable advantage. In addition to these means, the fore legs should be well rubbed two or three times a day with oil of turpentine, or the liniment in No. 42 of the receipt. These are the external means that are chiefly to be relied on; and if these be followed up speedily, and with proper attention, there will be seldom any occasion for internal remedies. If these be given, they must be such as are calculated to cool the body, and to check inflammation, such as the drenches No. 22 and 26. Especially the latter, as it is necessary to keep the bowels open. Perhaps foxglove might here be given with advantage, as directed under that article, at 395. Mr. Feron recommends diuretics, and a ball composed of an ounce and a half of emetic tartar, a drachm of opium, and 3 or 20 grains of calomel. We do not know whether this is the practice of the veterinary college, but it appears to us to be inconsistent with the bleeding and other evacuants which are generally found most successful. As constiveness would tend to increase the inflammation of the lungs, symptoms, back-taking and the occasional use of mild
FARRIERY.

Part VI.

Inflammation of the Liver. Hepatitis.

We have no doubt that inflammation of the liver takes place occasionally in most of our domestic animals; and it is probably a more frequent disease than is generally supposed. Both species of it, viz. the acute and chronic, may appear in these animals, and it will appear presently, that the latter is a very common disease among sheep. Though dissection has clearly shown, that the liver in cows, horses, and sheep, has been affected with inflammation during the life of the animal, yet any account of the symptoms of this disease that is given us by the veterinary writers, is so obscure, that we cannot pretend to give any thing like a perspicuous history.

According to Mr. Blinie, this disease, considered as a distinct affection, is seldom met with in the horse, though, when great abdominal inflammation exists, the liver often partakes of the general disease. In the description of the symptoms, this author states that it is usually accompanied with costiveness, for the gland ceases to secrete the bile from its being in an inflamed state; and that bile which is secreted, is not poured into the intestines, but becomes deposited in the skin, producing jaundice, which is known by the yellowness of the eyes and the tongue. The pulse is generally full, hard, and frequent, but the pain not very intense. It would be difficult to detect it, unless by the symptoms of fever, accompanied with yellowness of the mouth and eyes. There would possibly be pain in the shoulder as in the human, in which case the horse might on trial be found lame.

It is easy to see, that this description is a fanciful picture of the disease, drawn from the analogy that the author supposes to exist between inflammation of the liver in man and the same disease in horses; and it is probably not to be extended more.

The writers on cattle medicine describe the symptoms of the disease in cattle to be a difficulty of breathing, evident marks of fever, yellowness of urine, a swelling about the short ribs, and an unusual distention about the barren or womb. Here the symptoms of an acute and chronic distemper seem to be confounded.

As for the symptoms of the disease in sheep, in whom it forms one of the varieties of rot, we have seen no account of them any further than as they are confounded with those of the other varieties of rot, and, as such, they will be noticed when we come to treat of the rot in general. If this disease could be detected in its acute state, the cure would probably not be difficult; but when it appears in the chronic form, it is, we believe, seldom removed.

When the bodies of such animals as have died of inflammation of the liver are opened, the liver has been found in various states of disease; sometimes it is harder and firmer than usual, and very frequently there are parts of it that are scirrhous and discoloured, resisting the knife when we attempt to cut through them. Sometimes the biliary ducts are almost bony, and there is commonly found in them, and sometimes in other parts of the liver, a species of worm called fluke; the fasciola hepatica.

Disease. clysters, will be requisite. In general, warm water, or
this with a little Glauber salt dissolved in it, will be
sufficient, as all heating purgatives would do harm.
The horse should be kept rather warm, should be
clothed, and should drink frequently of warm gruel.
Food will not be requisite, and, if set before him, he
would probably not touch it. Exercise of every kind
must be avoided, at least so long as the inflammatory
symptoms continue.

The most favorable termination of this complaint is
by resolution, when the inflammatory symptoms go
off without producing suppuration or ulceration of the
lungs; but sometimes this state is unattainable, an ulcer
is produced, and, if the matter is not thrown off, it
may either produce suffocation, or bring on hectic fever
and consumption. When it is found that a cough
remains after the inflammation has subsided, and a
quantity of mucus is thrown off, the evacuation of
this should be promoted by gentle expectorants, and
the horse must still be kept warm. Though the matter
may be completely expectorated, there will generally
remain a difficulty of breathing, or thick wind, when
inflammation of the lungs terminates by suppuration.
Sometimes there is left an anasarcan or dropsical state
of the lungs, and in these cases it is said that blue
virol and turpentine, to the amount of two drachms of
each, mixed into a ball, with a proper quantity of
linseed powder, and given every morning, have been
beneficial. It may also be proper to apply a blister
over the wind-pipe.

Inflammation of the lungs in cattle differs little in
symptoms, and nothing in the treatment, from that
which we have been describing in the horse.

The lungs of sheep are very frequently affected with
inflammation, which forms one of the diseases that has
been confounded under the name of rot. It most fre-
quently attacks young sheep, especially those of the
more delicate breeds; and it is most prevalent in damp
pastures, and during unfavourable seasons. The symp-
toms of this disease in sheep have not been well de-
scribed, but they probably differ from those in horses
and cattle, only in degree. It does not appear to be so
speedily fatal, although the animals seldom or never
recover from it. Towards the latter stage of the disease
there is considerable weakness; and at this time there ap-
ppears below the jaw an edematous swelling, containing
a quantity of fluid, which is easily evacuated by piercing
the tumour. This tumour is called the pock in Scot-
land. On opening the bodies of sheep that have died
of this species of rot, the lungs are found full of knots
or tubercles, similar to those which appear in human
subjects that have died of pulmonary consumption, and
sometimes the lungs appear mortified or rotten. The
liver, however, in these cases, is sound, which distin-
guishes this variety from the other diseases called rot.

We do not know that this disease admits of a cure in
sheep, though it might probably be prevented by hous-
ing them, or offering them shelter, at those seasons
when it is most likely to occur.

Inflammation of the lungs occurs sometimes in dogs,
but it does not seem to be very frequent in these ani-
mals. It requires pretty much the same treatment as
in the horse, except that the emetic tartar may be given
in such a quantity as to excite considerable sickness,
without vomiting. This would be improper, in the
horse, as it would be difficult to regulate the dose of
the medicine, so as not to produce such an irritation of
the stomach as might considerably increase the animal's
distress, and augment the difficulty of breathing.

The stomach may be inflamed, both in horses and cattle, from various causes; but this is a disease, the existence of which is not easily detected. Here also Mr Blaine has supplied the want of observed symptoms by analogy, and has supposed that there would probably be unsuccessful efforts to vomit; and, as the stomach is so essential an organ, the pulse would probably be affected even more than in inflammation of the bowels; that the animal would perhaps point to the left side about the tenth or eleventh rib; that there would be great distress evident in the countenance and manner, and that the loss of strength would be very great.

In cattle there are generally reckoned two species of inflammation of the stomach, one affecting the first stomach or paunch, and the other the third stomach or the manyplies. This latter is commonly denominated lake-burn. The symptoms of the disease in these animals are also very obscure, but they are probably similar to what have been described above.

If the reader looks back to No. 209, he will see detailed, a case that occurred to Mr Clark, in which inflammation of the stomach was observed, and detected after death; and though the symptoms there described are few, they are probably more characteristic of the disease in question, than any imaginary description which we can copy from writers who have never seen the complaint.

This disease is extremely dangerous, and will not admit of a cure, unless effectual means are taken at its commencement.

Inflammation of the stomach is commonly produced by some acrid irritating substance which the animal has swallowed, and this is the effect produced by most poisons. A large quantity of cold water drunk while the animal is in a violent perspiration, will also produce it. It not unfrequently accompanies inflammation of the bowels, which we are immediately to describe. It is said to be sometimes produced in cattle by the giving of too strong a dose of astringent medicines to cure the red water or bloody urine; and as we have seen in No. 409, it may sometimes be occasioned by bots.

The disease can only be cured by very copious bleeding, frequently repeated; by giving mucilaginous drinks, such as water gruel or linseed tea, applying a large blister just behind the short ribs, and the frequent administration of relaxing emetics. If poison has been swallowed, we must proceed as recommended under No. 407, though in most cases of inflammation of the stomach, it will be the most humane plan to effect a radical cure by shooting the animal through the head, or cutting his throat.


This is a disease, to which all the domestic animals in the several species are subject, but it is attended with somewhat different symptoms of the bowels.

It is generally preceded by more or less fever. In horses, the first remarkable symptoms that appear, are a great degree of restlessness, with loss of appetite, thirst, with considerable heat, and dryness of the mouth. The animal evidently labours under violent pain, and is perpetually lying down and getting up again, straining and stamping with his feet, with which he sometimes strikes his belly. When the belly is touched with the hand, the horse betrays extreme sensibility, and shrinks from the touch. The pulse is always increased in frequency, and is hard, giving the sensation of a cord below the finger. The skin feels unusually hot, all over the body, except at the ears, which are said to be cold. The tongue is commonly covered with a white fur. Costiveness is almost a constant symptom of this disease, and...
FARRIERY.

Part VI.

Diseases. till the inflammation is subdued, this continues very obstinate, or, if the animal dunges, it is in very small quantity, and the excrement is very hard. The urine is voided in very small quantities, and with great pain, especially towards the latter period of the disease. The symptoms go on with more or less rapidity, till the inflammation is subdued by the proper remedies, or till it terminate in the death of the horse.

Returning health may be expected when the heat of the body gradually lessens, while the pulse becomes full, regular, and of the natural frequency, when the horse dunges freely, and returns to his usual appetite, and cheerfulness. But when there appears a sudden relief from pain, with a soft, feeble, or irregular pulse, and a purging of offensive black matter comes on, mortification of the bowels has taken place, and the horse will expire in a few hours.

On opening the body, evident marks of high inflammation appear in many parts of the bowels, the outer or membraneous and muscular coats of which will be found red, and in some parts black. The inflammation is frequently found to have extended to other parts, as the stomach, liver, or bladder; to some of which the guts will be frequently found adhering. On opening into the cavity of the bowels, these will be found greatly distended with air, and the great guts loaded with hardened excrement; and sometimes the inner membrane will appear highly inflamed, or even corroded, shewing evident marks of its having suffered considerable irritation, from some acrid substance.

Inflammation of the bowels is distinguished from colic, by the frequency and cord-like feeling of the pulse, by the presence of fever, by the tenderness of the belly, and by there being little or no remission of the pain. It is said that in colic the horse rolls much on his back, but is not so apt to do this in inflammation of the bowels. It will be seen by and by, that a long protracted colic frequently terminates in inflammation.

Inflammation of the bowels may be produced by acrid or poisonous substances taken into the stomach. It has been sometimes produced by giving hellebore to horses, as a purge; and it is said to arise sometimes from giving purgatives at improper times, or in too large a dose. It is very commonly brought on by giving the horse cold water, when he is much fatigued, and so much overheated, as to be in a profuse sweat, or by dashing cold water upon him, by wading in cold water, or by standing in a draught of cold air, under similar circumstances of fatigue and sweating. Costiveness too long neglected, or entangled rupture, is also not an uncommon cause.

In the treatment of the inflammation of the bowels, as in all other internal inflammations, we must begin with copious and repeated bleeding, after which a free evacuation of the bowels must be attempted by back-raking and the injection of softening clysters, such as warm water-gruel, mixed with half an English pint of castor oil. All acrid clysters must be avoided, as they will only tend to increase the inflammatory affection of the bowels, and even Glauber salts and other saline purgatives are scarcely proper, from the irritation they may produce. After bleeding and evacuating the bowels, warm fomentations applied to the belly may be of service, and the clothes should be applied as hot as possible. After the fomentation, the belly may be rubbed with some stimulating liniment, such as oil of turpentine, or essence of mustard. Firing has been recommended below the belly, as also frequent friction with the curry-comb, so as to irritate the skin, and almost make it bleed. Probably no medicine should be given by the mouth, farther than softening, diluting drinks, such as warm water-gruel or linsed tea. Food at the beginning of the disease is out of the question; but when the inflammation is a little relieved, the horse may have a bran mash. The body should be kept warm by clothing, and all exercise should be avoided.

Inflammation of the bowels in sheep is called dry braxy in Scotland, and of this disease we have an excellent account in Mr Findlater's Survey of Peebles.

This disease is most fatal to young and robust sheep, about six or seven months old, called in many parts of the island hogs. It is more destructive upon some farms than others; and even upon these, in one season more than another. In a hog fence, or pasture capable of keeping 30 score of hogs, there is in some years a loss from three to four score. This is a very serious matter, as each of these would sell in the spring, or beginning of summer, for half a guinea or 15s. This disease begins at those times when inflammatory disorders are most apt to prevail, in the months of October and November, and is produced by the common causes of inflammation, cold, exertion, external injury, &c. During these months, slight frosts set in, and the ground in the morning is often covered with hoar frost, or what is called in some parts of Scotland raine. It is probable, that eating grass covered with hoar frost, may be one cause of the disorder. If so, moving the animals about, and preventing them from eating, until the frost is melted by the sun, may tend to prevent the disease.

This disease runs its course very rapidly. When the shepherd leaves his flock at night upon their laires, he sometimes observes a hog look dull, loitering behind, and restless; sometimes lying down and suddenly getting up again: and in the morning, he will often find it dead, or nearly so. At other times he will discover no apparent ailment among his flock; and in the morning, he may find one or two dead or dying. From this it appears that the disease is very acute.

This is further evinced by the appearances after death, when the carcases are opened. Their bellies are excessively swollen, and distended with a putrid air: the whole intestines being red and inflamed, gangrenous, and in some degree mortified. This putrid taint seems to be communicated to the whole carcase, as all the muscular parts, and fat, smell strongly of corruption. The hogs that die of this disease, are frequently fat and in good order, which shews that the disease is of short duration.

We have already mentioned the eating of grass, which is covered with hoar frost, as a very probable immediate cause of this disorder. But is there any predisposing cause?

In answer to this question, we shall adduce a fact which is well authenticated. Many parts of the western Highlands of Scotland, had been for ages occupied by horses and horned cattle. At the introduction of sheep into those districts, the best grass was that which had sprung from the tath and excrements of these animals. During many years after these districts were converted into sheep farms, braxy remained unknown. It crept in
in at last, and the severity of the disease was long in proportion to the length of time the pastures had been occupied by sheep.

From these we would infer that pasturing upon their own rath, is a predisposing cause of braxy among sheep; and that a frequent alteration of the species of stock, upon every sheep pasture, might serve to prevent the evil. This idea corresounds with the general laws of the Supreme Being, who certainly never intended that this earth should be monopolized by any particular species of animals; but has so ordered matters, that the happiness of individuals shall result from the happiness of the whole family of animated beings.

Hence it would appear a beneficial practice in store farmers, in place of one fence, to keep two or more enclosures of this description, and to change the stock upon them every season. This we know to be contrary to general practice, and that which is called the hogs fence, is carefully guarded against the intrusion of every other animal.

Lambs, immediately after they are weaned, are frequently sent to poor pasture, which is called burning them. Now this appears to be a very bad practice; for the consequence is, that they fall off considerably, before they get at the rich grass in the hog's fence, of which they eat too freely; and thus become disposed to the disease treated of. Children, and all domesticated animals, are carefully fed with nourishing food for a considerable time after they are weaned; and yet they fall off for some time. It would certainly be better to give the lambs the hogs fence at once, and use every precaution to prevent them from falling off.

As the disease is generally advanced to a dangerous height before it is observed, we fear that medicine affords but a very faint hope of cure. The disease being inflammatory, the shepherd should attempt to bleed the distressed creature as soon as possible; which he can easily do, by cutting off part of the tail, or by nicking it underneath, or by cutting off part of the ears. The animal should then be removed to a house or shed, and attempts made to produce evacuations. In brute animals, it is difficult to produce these by medicines administered by the mouth. The speediest and most effectual method, is by injections into the rectum or anus. Such injection may consist of a small handful of chamomile flowers, two spoonfuls of aniseeds, and as much caraway seeds; to be boiled slowly in a Scotch mutton or English pint of milk and water, until the half is evaporated. The liquor should then be strained off, and two tea spoonfuls of castor oil added, or if this is not at hand, the same quantity of sweet oil may be used. This should be administered warm by an injection bag and pipe, or by an elastic gum bottle with a pipe properly fitted. Nothing can be easier, than to give a sheep a fly without this way; and in all probability it will have a happy effect in evacuating the bowels and procuring relief.

If this does not appear very soon, it may be repeated another after, and a large spoonful of common salt added to the former ingredients. If, after all, the animal does not seem relieved, another clyster may be given, consisting of a small tea cupful of warm milk and water, to which are added from 20 to 25 drops of laudanum.

As there is a great distention of the stomach and bowels, arising from air or elastic vapours, generated in the intestines, Mr Walker of Cumberland, in a treatise he wrote upon the diseases of brute animals, has suggested a remedy for this disorder, which has often proved successful in his district. It consists in pushing down their throats a flexible tube, such as Dr Moore has recommended, and which has proved successful in relieving cows that had over-gorged themselves with red clover early in the season (see No. 405). This seems a probable means of affording temporary relief, and every shepherd that has the care of the hog flocks, should be furnished with one of these tubes, adapted to the size of the sheep, for trying the experiment upon those that labour under the disease.

In regard to the quality of pasture (adds Mr Findlater) as a cause of sickness, Tweeddale farmers seem of opinion that it arises from the foulness of the grass at the root in the hogs fences, which are never eaten bare. Some, therefore, take care to have the land to be saved for the hog fence, once eaten as bare as possible early in summer, by the black cattle upon the farm, or by old sheep.

It seems uncertain in Tweeddale, that land which has been in use to be pastured by elder sheep, when converted into a hog fence, is not liable for some time to produce sickness. Two accidental experiments occurring in which this practice took place, in consequence of new arrangements in the farms of Harehop in Eddystone parish, and of Lynne in Lynne parish, confirm this conclusion. It is further confirmed by an experiment of Mr Murray, tenant in Flemington mill. About 20 years ago, he bought in different parcels of lambs for hogs, and laid them upon the hog fence of his farm of Broughton-haup, in Broughton parish. In one of the parcels of much higher condition than the rest, the sickness broke out to such extent, that they were dying at the rate of two or three daily; so that the whole parcel seemed in imminent risk. He transferred this whole parcel to the farm of Fin gland in Newlands parish, where only old sheep were kept, putting them on some of the lower pasture of that farm, which had been hained for feeding the crock ewes, and transferring a proportional quantity of these ewes to Broughton-haup hog fence. Not one of the lambs died upon Fin gland. To the same effect, it deserves attention, that in small farms, not admitting of distinct hirling, where, of course, old and young sheep pasture mixed together, hogs are very little liable to sickness, though perhaps worse in other respects.

From November at smearing time till Christmas (1797), two facts with regard to the mode of cure have been stated to me, and which I am disposed to think authentic. In the farm of Drumelzier, parish of Drumelzier, three hogs (out of four upon which the experiment was tried) recovered, upon bleeding, and having poured down their throats, a decoction of tobacco; about a finger's length of twist tobacco boiled in water till the water has diminished to a gin, being the dose for each. In the farm of Broughton-haup, parish of Broughton, within the same space of time, nine or ten (out of 16 or 17 upon whom the experiment was made) recovered upon bleeding, and having an injection of tobacco smoke administered from a common tobacco pipe, by kindling the tobacco, inserting the pipe shank into the anus, and blowing: the experiment, however, was not so successful.
FARRIERY.

Diseases. In some later instances, I have long ago seen a ewe cured by bleeding, and injection of Glauber salts from a common clyster-bag and pipe. When brawny breaks out, it might be useful, where attainable, to lay the hogs, nightly, upon a dry ground, if the hog fence is wet, the chilliness of wet ground contributing no doubt to the production of inflammation. Clover faggot or turfs might be good preventatives, from inducing a lax habit.*

Findlater's Surgery.

II. DYSENTERY. Molten-grease, or Body-founder.


Dysentery is the other disease that, with catarrh, forms Dr Cullen's order of profusia; but as there are evident marks of inflammation of the bowels observed on inspecting the bodies of such animals as have died of this complaint, we have placed it immediately after inflammation of the bowels, in which we have followed M. Pinel and some other late writers.

This disease is not uncommon in the horse, and probably it is still more frequent in cattle and sheep. It very commonly begins with some degree of fever, as a trembling, dryness of the nose, loss of appetite, a great degree of weakness, drooping of the head and ears, sometimes a copious sweating, but more commonly dryness and heat of the skin. There is usually a shivering of the flanks, and the animal turns his head towards them, as if gripped. There are frequent deflections from the anus, but these seldom consist of the natural excrement, but of a mucous, slimy discharge, accompanied with a peculiar fatty substance, like soft suet. There is evidently much distress during these evacuations, and sometimes the fundament appears excoriated. It is not uncommon to see blood pass with the stools, generally in streaks, but sometimes in such a quantity as to tinge the whole discharge of a red colour; and in the latter stages of the disease there generally appear membranous, slimy substances, which have been compared to soaked leather. These substances have been supposed to be the inner membrane of the bowels that has been eroded and thrown off by the violence of the purging; but they are merely coagulable lymph, such as is very commonly thrown off from inflamed surfaces. The pulse, towards the beginning of the disease, is commonly hard and full, but as the complaint goes on, it becomes quick, small, and sometimes irregular. The animal is very stiff, and much averse to motion, and if the disease continues long, there usually comes on a swelling of the legs.

When animals that have died of this disease are dissected, the inner coat of the bowels is found inflamed, in some places covered with coagulable lymph, such as we have described as being thrown out in the discharge, and not unfrequently ulcerated in various parts, sometimes mortified and corroded.

This disease does not appear so dangerous among the inferior animals in this climate, as in warmer countries; but it sometimes proves fatal, or terminates in a weakness of the bowels and purging, that are not easily removed. If the fever is but little or soon abates, if the animal appears not to labour under much pain, and if the discharge of natural excrement soon returns, the disease will probably terminate favourably in a short time; but if there is great pain and fever, with excessive weakness, and if the mucous discharges continue very frequent, and mixed with much blood, the danger is considerable.

It is necessary to distinguish this complaint from the common purging or scouring, with which it is very generally confounded. It must therefore be observed, that in scouring, there is no fever, whereas this is common in dysentery; that the discharge in scouring, though thin, has almost always the appearance of excrement, is not bloody, and is scarcely ever mixed with fatty matter.

Dysentery is more common in hot weather, and in hot seasons, than at other times; but it is very commonly produced by the sudden application of cold, especially to the legs or belly, while the body is overheated and fatigued; hence swimming in autumn, drinking large quantities of cold water while in a profuse sweat, or other sudden changes from heat to cold, have commonly produced it. It is said to be frequently brought on by riding a horse very hard in hot weather. Mr Lawrence says that when a boy, he rode a horse that had a great deal of loose grass flesh about him, 21 miles in a warm summer morning, and thus brought on an attack of molten grease. It is also not an uncommon disease among post horses.

From the appearance of the fatty matter in the discharge that takes place in this complaint, the older writers on farriery were induced to give it the name of molten grease, conceiving that a principal part of the disease consisted in a melting down of the fat of the animal, which being conveyed by the absorbents into the circulation, is thrown out by the exhalants on the bowels, and carried off with the dung. Mr Blaine laughs very heartily at this idea, and seems to pride himself on the discovery, that what has been mistaken for fat, is nothing more than an increased secretion off the mucous of the intestines, and is as liable to a horse with little fat, as to one with much. Mr Lawrence, on the other hand, argues strenuously that this matter is really greasy, and says, that "with respect to the evidence of sense, had Mr Blaine ever seen a horse under the discharge of molten grease, he might have found on experiment, that part of the discharge in question is inflammatory and liquefiable, which are not the characters of albumen, but of real grease; and (continues Mr Lawrence) viewing the matter through the medium of experience, I can see no sort of improbability in a colligation of loose, subcutaneous, internal fat, by sudden inflammation, and its consequent effusion and discharge by an unusual emunctory. Gibson gives an instance which convinced him (apparently incredulous) before the possibility of a horse's grease being melted. He found the fat melted and turned into an oil, and drawn off from its proper cells into the blood vessels. He says farther, this disease is not unlike the greasy diarrhœas which happens to men." Not having ourselves seen a case of dysentery in horses, we are not prepared to decide the difference between these two diseases of the old and new school; but as Mr Lawrence is very worthy of credit in whatever has passed under his own observation, we have no doubt that this debased substance is of a fatty nature.

As it seems certain that dysentery is of an inflammatory nature, it is proper to begin the cure by bleeding, especially if the horse is plethoric, or if the pulse is full and hard. It will then be proper to clear the bowels...
by a laxative oyster, and to give internally a draught composed of five or six ounces of Glauber's salt dissolved in a quart of water-gruel, or the draught N° 26 of the receipts; and this may be repeated every three or four hours. This will probably, in the course of the day, produce a plentiful discharge of excrement, and when the bowels appear well cleared, the horse may have a warm bath, be covered up warm, and perhaps a perspiration will be brought on, which, if the disease is slight, will probably complete the cure. If the disease should continue, an English pint or pint and a half, of castor oil may be given, and clysters, composed of water-gruel, or starch boiled in water, should be given warm very frequently. When by these means a pretty copious discharge of excrement has been produced, the horse may have a ball composed of two drachms of opium, and half an ounce of ipecacuanha, or a draught of emetic tartar, washed down with a quart of good porter. If there is considerable pain, it may be advisable to foment the belly for half an hour at a time, with flannel's wet out of a warm decoction of poppy heads. During this treatment the horse should be kept clothed, and currents of air in the stable should be avoided. When the disease is subdued, as should be, it will probably remain very weak, it will be proper to revive him by nourishing diet, and cordial and strengthening remedies.

The appearances of dysentery in cattle are not unlike those that occur in the horse, only that perhaps in them there is not so much of the gross foment. The disease among these animals is commonly called far-del bound. The treatment is the same as above described.

This disease is not uncommon in sheep, by the name of breakshaw; but shepherds very commonly confound it with diarrhoea or purging. Mr Loch of Ruchan very properly distinguishes between them, and observes that the breakshaw is analogous to dysentery in the human species, and occurs most commonly in the end of wet summers. The discharge is thin and greenish (Mr Loch supposes from the wet grass becoming acid in the stomach, and turning the gall green); it is more or less mixed with blood, sometimes florid, sometimes black and gummous; the animal pines for a week or two, and dies, though sometimes be recovered. The cure commonly employed by Mr Loch's herd, is warm milk poured down the animal's throat; but Mr Loch proposes to try, in addition to this, nitre in half drachm doses, with chalk or some other absorbent powder, and 20 or 30 drops of leudanum twice or thrice a day, with frequent injections of warm milk and water. This plan seems best adapted to the latter stages of the disease. According to Mr Gillespie of Glenquich (quoted by Mr Findlater), this disease is often produced by over-heating, when the sheep are hunted by dogs, in folding them, &c. or when otherwise scared and terrified. It is stated by Mr Gillespie to be considerably infectious; and he considers tarrying part of the flock to be the best means of checking the infection, under the idea that the smell of the tar will overcome that of the contagion.

12. INFLAMMATION OF THE KIDNEYS. Nephritis. Strain of the Kidneys.

This disease is not uncommon among horses and cattle; but it is more frequent in the former, as they are more exposed to those causes that appear generally to produce it.

The symptoms of this disease in horses, are tolerably well-marked. The horse stands wide with his hind-legs, appears dull, and expresses considerable pain, often looking at his flanks. When pressure is made on his loins the horse flinches, and is evidently much distressed; the pulse is hard and full, and commonly more frequent than natural. When both kidneys are inflamed, little or no urine is secreted, and what little is evacuated is generally bloody; but when only one kidney is inflamed, the other continues to secrete urine, but the natural quantity is on the whole much diminished, and there is commonly considerable pain during the evacuation.

Inflammation of the kidneys is liable to be confounded with inflammation of the neck of the bladder; and the best means of distinguishing them, is to pass the hand up the fundament, by which the state of the bladder beneath may be easily ascertained. If the bladder be considerably distended with urine, the inflammation is almost certainly seated in the neck of the bladder, but if it be shrunk, or nearly empty, the disease is probably situated in the kidneys. It must be allowed, however, that this mark of discrimination will not hold good till the disease of the kidneys is pretty far advanced, as it very commonly happens that when a gland is inflamed, its secretion is at first increased. At the commencement of the disease, therefore, the symptoms which we have enumerated, especially the sensibility which the horse evinces on touching his loins, are chiefly to be depended on. It must be remarked that one of the kidneys has been found diseased, and even purulent, after death, when it shewed no marks of inflammation during life. This disease is attended with considerable danger, and unless the inflammation be speedily removed, matter will be formed, which, if it does not pass off by the urinary pipes into the bladder, will find a passage into the belly, or behind the peritoneum, and produce hectic fever and consumption, or the kidney may mortify, and death will soon follow.

The kidneys may become inflamed, either from external injury, or from irritating substances that pass through them in the course of the circulation. Inflammation of these organs is frequently produced by placing the saddle too far back upon the loins, and riding hard for a long time while it is in this position. It is sometimes the effect of throwing cold water upon the body while it is in a sweat; but according to Mr Blaine and Mr Fenon, it is most frequently produced by the indiscriminate use of strong diuretic medicines.

In the treatment of this disease, we must vigorously employ the means that we have so often recommended for the cure of internal inflammations; bleeding in its full extent, emollient oysters, and the production of external inflammation; but it is necessary in this disease to caution the practitioner against the use of blisters, as the matter of caustharides, when taken into the circulation, and carried to the kidneys, will considerably increase the inflammation and distress. A good substitute for blisters—of caustharides would be, to pour hot water on the loins, so as to raise a blister on each side, which, however cruel it may appear, could not produce so much pain, as the animal already feels from the disease. If
has been recommended, to excite a degree of inflammation in the external part of the loins, by means of firing; but probably the hot water will do as well, and is less painful. No medicine should be given by the mouth, that is in the least heating or irritating; and nitre, turpentine, balsam of copaiva, &c. are warmly recommended by most of the writers on farriery, would only serve to aggravate the disease. The horse may drink frequently of water gruel, linseed tea, or such other mild, mucilaginous liquors; and if he seems to require food, bran mash will be the most proper article of diet. If there is much constiveness, purgative clysers may be given, or in cases of necessity, six or seven drachms of socrorate aloe in a ball. All exercise must be avoided, and the horse should have a good bed of litter, on which he may lie down when fatigued.


The bladder may be inflamed either in its body, or in its neck, and the symptoms differ somewhat in these two varieties. When the body of the bladder is inflamed, there is produced such a degree of irritation, that the bladder becomes incapable of retaining its contents for any length of time; and the animal is perpetually making small quantities of urine. He also makes frequent attempts to dung. On passing the hand up the fundament, the bladder will be found very hot and sensible; and in this variety of the complaint, as in inflammation of the kidneys, it is empty and collapsed.

When the neck of the bladder is inflamed, there is at first a suppression of the urine, but after a time it is continually passing off in drops; and on examining the bladder by the fundament, it will be found more or less distended, according to the continuance of the complaint. There is usually considerable fever in both cases. The pulse is hard and full at the beginning of the disease, but after this has continued for some time, the pulse becomes small and oppressed.

Inflammation of the bladder takes place more frequently in male animals; but it is said to be sometimes produced in the latter, at least in mares, by passing some irritating substances up the urolith, in order to make them horny. Both cases of this disease are attended with considerable danger; but the latter is generally the most dangerous; but in a mare a cure is generally easier than in a horse.

The treatment of this complaint differs little from that of the inflammation of the kidneys, and chiefly consists in bleeding, the frequent use of softening astringents, low diet, and the production of external inflammation by any other means than the use of caustic acids. If the bladder be found considerably distended, it will be necessary to evacuate the urine, either by the means of a catheter, which may be easily passed up in a mare, or by making an opening into the bladder; for performing which in the male, Mr. Feron gives the following directions. "It happens that the urethra is so constructed, that it is not in our power to introduce an instrument immediately into the bladder, without performing an operation; for the urethra of the horse forms two curvatures or angles, before it reaches the bladder, and therefore it is not possible to introduce an instrument into the bladder, which will preserve its curvity all the way. We therefore introduce a staff of a pliable wood, or whalebone, to the angle at the os pubis, as near the rectum as possible with safety; we make a cut upon it, and then introduce the female catheter, or some similar tube, without however removing the staff to prevent our losing the incision, taking care to avoid the instrument's passing into the cellular membrane, instead of entering the bladder. If such an accident was likely to happen, it is advisable not to attempt the operation, but to continue and insist upon all the emollient remedies."

"We may also puncture the bladder with a trocar, by the rectum, or through the inferior part of the abdomen."

"In either case we are likewise directed by Mr. Coleman, to make the puncture as near the os pubis as possible, that we may not wound the peritoneum anteriorly. By this method the operation recommended through the rectum may be performed without exposing or opening the cavity of the abdomen."

"In the female an opening may be easily made into the bladder, with a trocar, introduced by the vagina. It has been recommended in the mare to throw up an injection of some oily or mucilaginous fluid, to supply the place of mucus, in soothing the bladder from the irritation of urine. As in the inflammation of the kidneys, every thing that can heat or irritate the urinary organs must be carefully avoided."


It is well known in most breeding countries, that a great many calves die every year, of an unknown disease, with which they are affected very shortly after birth. The common name which this disease receives in Scotland, is the cords; and while its fatal and widely extended effects are the subject of just regret, the disease itself is looked on as incurable, and no pains are taken to investigate its nature, symptoms, and causes, and no remedies suggested as a cure or preventive. Whatever be its nature, this disease is exceedingly dangerous, and an extremely rapid, terminating frequently in a night's time, which means of relief are commonly useless even before it is observed. Almost all calves, that are said to have died of the cords, appear, when they are opened up, exceedingly red, and the small leaders, or ligaments, are considerably swollen, and have some resemblance to strings passing through the internal parts, from which probably the disease has its name. Every symptom indicates a considerable degree of plethora, if not a very high degree of inflammation.

It is commonly observed, that calves are most liable to be affected during the first days, or weeks, after they are calved. If they existive five or six weeks, they are seldom in any danger.

Calves that suck their mothers, we believe, it will be found, are not so liable to the disease, as those who are fed by the hand.

The greatest number of calves who fall a sacrifice to this disease, if not the whole of them, are those who are closely confined to the house from their birth, without ever being exposed to the free open air without doors. It is a well known fact, that calves who are dropt without, and remain in the fields, are in little or no danger. Cows that are laid on to graze for beef frequently turn out to be in calf; and it is no uncommon thing to see them drop their calves in the midst of frost and snow, and yet those
Part VI. FARRIERY.

Diseases. These young creatures, if they can once get to their feet, without being frozen to the ground, are hearty and well. Calves, lambs, and foals, require exercise and fresh air; and nature directs them to take a great deal. It is astonishing to see with what force and vigour, (particularly the calf,) and how long, they will run. But this free, unconstrained, and severe exercise without doors, seems to be the very thing that makes them thrive, and to be necessary to their very existence.

The great object is to prevent this disease; and the following method of treating the new-born calves, practised by a correspondent of the Farmer’s Magazine, seems to be attended with complete success.

The time when this gentleman’s cows are bailed is regularly noted down in a book; and when they are near calving, they are watched frequently night and day. As soon as the calf is dropped, it is received into a large basket or skull, made of willows, with a handle at each end, and plenty of clean straw in it. It is then carried by two persons to the stall in the calf-house, where it is gently rubbed with straw. The calf-house is next to the cow-bye; and is fitted up with stalls like a stable, about three feet wide, and about five feet long. Every stall shuts in by itself, with a door and hinges, for fear of the calf lying back too far, to choke itself in its binding. As soon as the mother has had a little rest after calving, she is milked, and a little of the milk given to the calf as early as possible. If the weather is cold, and the mother long in giving milk, it is taken to the fire, and warmed in a pan until it is blood-warm, and then given to the calf; about six or eight gills, according to the size of the calf, and repeated four times in 24 hours. As the calf gathers strength, the quantity may be increased; but too much milk at one time is as bad as too little, until it is a month or six weeks old. When the calf is able to stand, it is tied to a stake; as it is more in the power of the servants to give it milk in that situation, than when going about loose. If a calf gets cold milk, it is sure to bring on a trembling; and the cords or some other malady follows; which has often seen exemplified amongst the neighbouring young stock.

15. FANCY. Le Farco, Fr.

We shall conclude this chapter with a brief account of two diseases; or rather, as it should seem, of two modifications of the same disease, that frequently take place in the horse, to whom they are almost peculiar; though something like them is occasionally found in other animals. We shall hereafter take notice of what farriers call the water fancy, which we consider as similar to ansaemia in the human body; but the disease we are about to describe, appears to be rather a peculiar inflammatory affection of the absorbent vessels below the skin. There seem to be two varieties of fancy, acute and chronic; and the latter is a malignant variety.

The commencement of fancy appears to be rather obscure, and probably it is seldom observed in the beginning of the inflammation. The first appearances that are described by writers, are a number of swellings that rise in almost every part of the body, particularly the head, neck, and extremities. The lymphatic vessels below the skin appear like knotted cords; and this appearance is found to be owing to a distention and inflammation that take place in these vessels, especially at their valves, where the knots are produced. As the disease proceeds, these knotted swellings burst, and ulcers are formed which are very difficult to heal. The formation of these ulcers may be considered as terminating the mild stage, and commencing the malignant form of the disease; in which the horse loses his appetite, grows lean and weak, and commonly has a degree of hectic fever. If the progress of the disease has not been arrested, a swelling takes place in the head and nose, and there comes on from the latter a copious discharge of a peculiar garlicky mucus, which shows that the disease has degenerated into glanders, under which name we shall proceed to describe it; and shall afterwards consider the nature, causes, and treatment of both.

16. GLANDERS. Le Mort, Fr.

According to Mr. Blaine, the usual symptoms of glanders are an increased secretion of the mucus of the nose, which is at first thick, and like the white of an egg. He has seen it continue so, while at other times it becomes purulent; but there is usually a degree of viscosity and smelliness about the matter, that as it were fixes the sides of the nostrils together, and is strongly characteristic of this disease. On examining the nostrils, there may generally be perceived a number of ulcerated surfaces, very similar to shanks and rakers that occur in the venereal disease. These ulcers do not always appear soon; but they are produced in all virulent cases, and never fail to appear when the disease terminates fatally. They are at first small, and disposed in lines along the lymphatic vessels; but as the ulceration proceeds, it becomes more extensive, till the whole inner surface of the nostrils is affected, and at length the bones of the nose are affected, and become carious. When the ulcers have continued for some time, the matter changes its glairy appearance, and becomes bloody and offensive; and this is more particularly the case when the bones become diseased. In the latter stages of the complaint, the emaciation and weakness of the animal are greatly increased; he becomes affected with a short tickling cough; the hair grows dry and harsh, and falls off on the slightest touch, and thus the horse gradually pine away.

Sometimes only one side of the head is affected, but more commonly both at the same time.

The best account of the appearances of glanders on dissection, has been given by M. Chabert, in a work which he published in 1785, on the means of ascertaining the existence of glanders, and of preventing their effects. From the numerous bodies which he opened, M. Chabert has drawn up the following general account of the morbid appearances.

The lungs are generally more affected than any other of the viscera; we find them often swelled and filled with hydatids, tubercles, and obstructions. The bronchial glands are very often swelled and ulcerated, and this is sometimes the only injury that we can perceive on dissection. The membrane that lines the bronchus and the wind-pipe, is most commonly inflamed and ulcerated; the bronchia are filled with a thick matter, that commonly resembles what the animal discharges by the nostrils. The internal surface of the bones that form the different cavities of the nose, and the gritty partition of the nostrils, are often carious, and covered with purulent matter; and the membrane which lines the
FARRiERY. Part VI.

554

Diseases.

nostrils is ulcerated. The spleen, the liver, and the kidneys, are also sometimes considerably diseased; and the ulcerated state of the kidneys, not unfrequently appears during life, by the purulent matter that is discharged with the urine. On opening the head, we sometimes find the brain softer and more sebaceus than in a healthy animal. There is often a great quantity of serum in its cavities, and the glands are much swelled.

The glanders is liable to be confounded with several of these diseases, in which an unusual discharge proceeds from the nostrils; as catarrh, strangles, and consumption; but chiefly with the two former. It may be distinguished from catarrh, by the absence of fever in the early stage; by the matter discharged from the nostrils being thick and glairy from the first; whereas, in catarrh, there is almost always considerable fever in the beginning, and the discharge is at first watery. In a common cold the general health is also more or less affected, and from the first there is usually a cough and loss of appetite; whereas, these symptoms scarcely ever come on in glanders, till the disease has subsisted for a considerable time. Glanders may be distinguished from strangles by the high fever which commences the latter, and by the swelling and speedy suppuration of the glands of the mouth and throat.

Of these two affections, glanders is the most dangerous; as farcy, when taken at its commencement, may frequently be removed; but we believe the instances of a perfect cure in glanders are very rare.

The causes of these complaints are very obscure. It is said that farcy may be brought on by the same causes that predispose to mange, as want of cleanliness, hard work, and low diet; and there is no doubt that this disease, as well as glanders, is contagious. Glanders, besides being produced by contagion, may also be the termination of several disorders, as of catarrh, strangles, and consumption, however different from these diseases in their commencement.

The nature of glanders is not well understood, although, of late, many ingenious men have investigated the subject, and made considerable discoveries. It is not certain when the disease was first known. Mr. Lawrence dates it from the same period with the Late Venerea; but there seems no doubt that the disease was known to the ancients, though we do not know by what name it was called. Vegetius speaks of a disease which he calls humituditas, which Mr. Blaine supposes to be the same with our glanders; but which the learned Camper considers as analogous to the morrain, see N° 466. Blondel, and after him Markham, give the following description of its rise, progress, and conclusion. "Of cold first comes the pose, (that is stoppage of the head), and the cough, and then the gander, and last of all the mourning of the chine." The two Messieurs Losayse, made, as we have seen, several discoveries with respect to glanders, especially the father, who, in 1749, demonstrated before the academy of sciences at Paris, that the seat of the disease is wholly in the pituitary membrane; and he proposed curing it by injecting the whole of this membrane through openings made with the trepan, into the frontal, nasal, and maxillary sinuses. Losayse divided the disease into several species; but it appears that all these may be reduced to two, the mild and malignant, or the chronic and acute; the chronic being that in which the running of the nose is trifling, and of a transparent colour, with no appearance of ulceration in the nostrils; while in the acute or malignant variety, there is considerable ulceration; the discharge is very offensive; there is a swelling below the under jaw, and the bones of the nose are carious.

The best of the English writers on farriery appear to have known little or nothing of the disease more than the symptoms. Dr. Bracken considered it as not contagious, and Gibson gives but a poor account of it, for which he seems indebted to Snape.

"The late professor of the veterinary college (says Mr. Blaine), published his remarks on this disease; but it is evident that he knew little or nothing relating to it, but what he gained from Losayse, and consequently his opinions offered nothing new. The present professor has prosecuted the inquiries relative to it much farther, and by an extensive course of experiment has thrown very considerable light on the nature of the disease; and though we are not yet much more successful in attempts at the cure, yet we have less reason to despair. By Mr. Coleman's experiments it is proved beyond a doubt that farcy and glanders are specifically the same disease, but affecting different parts: to establish this, horses have been inoculated with the matter of farcy, and glanders has been produced; which put the matter beyond a doubt. Further, Mr. Coleman produced ganders in a sound animal by the inoculation with the matter of glanders. This M. St. Bel asserted could not be done. Farcy has likewise been produced by the same means, but it appears that it was some time before it could be effected; but it has been produced by Mr. White. It cannot therefore be inferred, that because the farcy and glanders are so different in their apparent situations they are distinct diseases: every poison has its preference of parts; and likewise the same poison, under different modifications, affects different parts.

Mr. Coleman is of opinion, that in glanders, the whole circulating fluids are affected. To prove this, he bled an ass from the jugular vein till he was to all appearance dead, when he introduced the blood from the carotid artery of a horse labouring under glanders, till the ass was reanimated. In a few days the most malignant glanders appeared. I believe another ass was inoculated from this, which became glanderous. This experiment, I think, (adds Mr. Blaine), throws great light on this complaint, and indeed on pathology in general; and we may hence be led to hope, that internal remedies may be more useful than external, which have been thought to be the only means by which we could hope for a cure; for provided we could destroy the poison existing in the blood, and keeping up the action in the part; the action, or at least the specific part of it, might cease in the affected part, and we might induce a healing process by the usual means. As such, our only hope must consist in exciting a new action in the system, whereby the glanderous one will be suspended, till by the continuance of the new action the virus of glanders is completely expelled by the change the fluids naturally undergo.*

The treatment of these diseases will differ according to their state and degree of malignity. For the cure

of farcy, blisters are much extolled by Mr. Feron, and the actual cautery is very generally employed to destroy the swellings of the lymphatics, and to excise these vessels into greater action. To assist this purpose, diuretics are to be administered, and the horse should take as much exercise, especially draught labour, as he will bear without considerable fatigue. Two remedies have of late been employed internally, when the system becomes considerably affected; these are verdigrise, and corrosive sublimate. Mr. Feron directs the former to be given in the following manner. A ball composed of one draught of verdigrise, and a quarter of an ounce of common turpentine, is to be given every night and morning, gradually increasing the quantity of verdigrise till the horse can take from three drachsms to half an ounce in the course of the day. If the animal becomes costive, he is to have a clyster night and morning, and a purgative ball of seven drachsms of aloe, and half a draught of calomel, once a week. After having gone through a regular course of physic, he is to have the following balls. An ounce of green copperas (\( \text{Cu} \)) in powder is to be mixed up with Venice turpentine, and a sufficient quantity of linseed powder, to make eight balls, one of which is to be given every morning, while constiveness is to be avoided as before directed.

In giving the corrosive sublimate, we should begin with a small dose (see \textit{Stimulants}), and gradually increase it so long as the stomach will easily bear it. As mercury in some form seems to be the best remedy that can be employed in these affections, calomel, or the common blue pill, may be given instead of the corrosive sublimate, if the latter should occasion much disorder, or if the horse is very much weakened. During this course the animal must be supported by nourishing diet, but should frequently have a change of succulent vegetable food. Mr. Blaine speaks of a horse that was so far reduced (by glanders, we suppose) as not to be able to stand, and who was drawn into a field of tares, and suffered to take his chance; the consequence was, that when he had eaten all within his reach, he was able to rise and search for more, and eventually recovered.

The treatment recommended above has, it seems, often been successful in farcy, and the same internal remedies have been recommended in glanders, but we believe they have been employed with little success. Mr. Feron advises to draw blood in the beginning of glanders, while the disease is still local, and to keep the animal upon warm mashos of bran, putting the same into a nose-bag, for the purpose of fomenting the nostrils. He is then to go through a course of gentle physic, while strict attention is paid to the necessary direction of the food, exercise, dressing, cleanliness, and water. The water must be always warm, and made white with bran or gruel. After this course, he recommends balls made of opium, arsenic, and sulphur, or of extract of hemlock, calomel, &c., avoiding costiveness during their exhibition. He thinks it necessary to insert two rows of, one below the under jaw near the swelling, and another under the chest; and he recommends frequently syringing the nostrils with a lotion made of two ounces of spirit of wine, and the same quantity of vinegar, mixed with a gallon of water; or with a solution of corrosive sublimate. According to this gentleman, if the disorder is attacked in its infancy, it will generally submit to the above course of treatment; but if the disorder is so far advanced as to exhibit the symptoms of virulence, which we have described as constituting the acute or malignant stage of it, it will increase in opposition to all art, and it will be necessary to take away a life that every degree of assiduity would not render worth preservation.

As the farcy is probably contagious, and the glanders in most cases is certainly so, it is proper, as soon as a horse is affected with either of these diseases, to keep him in a separate stable, and to take care that he does not come near any other horses: and no part of his harness, or furniture, should be used for any other horse, till it has been well washed with soap and water, and exposed for a long time to the pure air.

Glanders is considered by Dr. Darwin, and some other writers, as a contagious catarrh, and in some cases it certainly is so; but when it is the consequence of farcy, or of dangerous chronic diseases, it appears to be an affection of a peculiar kind. Mr. Lawrence considers the glanders so perfectly incurable, that he recommends the \textit{collimakers knife} as the easiest, cheapest, and most infallible remedy.

\textbf{Chap. III. Of Lethargic or Comatose Diseases.}

1. \textbf{Apotheely.} Vertige, Fr. Staggers, Sleepy Stag-

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\text{Apotheely or Staggers}
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\textit{Apotheely} is one of the most comprehensive terms in farriery; and under it are confounded almost every affection of the brain, or all those diseases in which there take place giddiness, unusual heaviness, drowsiness, or convulsions. We have already seen the term applied to inflammation of the brain, and we have no doubt that many cases are described as \textit{staggers}, which are really instances of \textit{epilepsy}. Of this kind we consider the case so humorously related by Mr. Lawrence in his treatise on horses, vol. ii. p. 495. "Walking up Fleet-street, I observed a crowd of people wonderfully diverted with the agonies of a cart-horse beating himself almost to pieces, in, I think, the most violent convulsions I ever witnessed. He threw himself repeatedly upon the foot-path, and was very near going headlong into a shop," &c.

Mr. Feron, who in general keeps very clear of the errors of ordinary farriers, which he often ridicules with much success, has confounded inflammation of the brain and \textit{apoplexy}, under the general name of \textit{staggers}, considering them as both inflammatory, and merely modifications of the same disease. Even Mr. Blaine, who, as Mr. Lawrence expresses himself, seems upon every occasion eager to catch the \textit{dernier godt} of science, has described

\[ \textit{Copperas} \text{ of green copper: but we suppose this is merely a typographical error, for copperas, or sulphate of iron; and we have therefore ordered it by this name, as sulphate of iron is a good tonic, and may be very properly employed in this disease.} \]
Diseases. described stuggers under the name of lethargy, and does not even mention its identity with apoplexy in the human body.

We consider stuggers, properly so called, as the same with apoplexy; the appearances, the causes, and the treatment of both are the same, making allowance for some slight variations in the structure and economy of the different animals whom they affect.

This complaint sometimes comes on suddenly; but in general it is preceded by symptoms that mark a considerable determination of blood to the head, such as heaviness, drowsiness, insensibility, (see No. 317,) occasional fits of giddiness, (see No. 318,) and partial blindness, (see No. 321.) There seems no doubt that the horse is sometimes affected with headache, which appears by the animal’s hanging down his head and drooping his ears, by the eyes being dull and watery, by dropping of urine, and costiveness. These symptoms often precede an attack of apoplexy, though they are sometimes only signs of a disorder stomach.

When a fit of stuggers comes on, the animal falls suddenly, and is perhaps convulsed for a few minutes, but more commonly appears quite insensible. The pulse during the fit is usually slower than natural, and the respiration is laboured and laboured, and there is evidently an increased accumulation of blood in the vessels of the head. The animal remains for a longer or shorter time in the fit, and sometimes he never recovers; but, in general, in eight or ten minutes the fit goes off, and the animal rises. Sometimes after a fit of the stuggers, the animal appears for a time more active and lively than before; but very often he remains heavy and sleepy, especially after repeated attacks, and sometimes a paralytic affection of some of the limbs is the consequence of the fit.

Apoplexy may be distinguished from inflammation of the brain, by the fever, restlessness, and fiery appearance of the eyes, that never fail to usher in the latter complaint. We would distinguish it from epilepsy, by the foaming at the mouth, and strong convulsions, by which this latter is always accompanied.

An apoplectic fit may be the consequence of an overloaded or otherwise disorder stomach; and is an uncommon termination of several diseases, as epilepsy, locked jaw, &c. But it is generally the consequence of too much fullness of blood, brought on by a full diet, attended by idleness or want of exercise. It is more common to old than to young animals, especially such as have large heads and short necks. For the immediate and many of the exciting causes of this complaint, see Apoplexy, Medicine Index.

A fit of apoplexy is often produced in an animal that is predisposed to it, by some sudden or violent exertion, such as drawing a heavy load, &c.

The means of preventing apoplexy when an attack of it is threatened, have been already explained (in No. 317, 318, and 327). When a fit of apoplexy takes place, if the animal is full of blood, which generally happens, it will be proper to bleed, from the temporal artery, or jugular vein, to an extent proportioned to the state of the animal. If the animal appears weak, bleeding should not be attempted; but the determination of blood to the head may be effectually checked by making pressure upon the carotid artery, taking care at the same time, not to include the jugular veins. Mr Coleman recommends tying up the carotid arteries in dangerous cases of stuggers, and Mr Fenon says, that he has often repeated this experiment with success. The bowels should be emptied in the usual manner, as soon as possible; and a strong stimulating emetic should be injected. When the animal comes to himself, if fat and p lethoric, he should have a good strong purgative ball, and afterwards some gentle diuretic medicines. He should be kept quiet for some hours after the fit; but when the physic has properly wrought, he should have gentle exercise, which must be gradually increased, according as he is able to bear it; and great care should be taken to keep the bowels open, and to prevent too great an accumulation of blood.


The inferior animals sometimes become paralytic. The and we have seen that a palsy in the hind leg is one of the principal symptoms of the distemper in dogs. A paralytic disorder is not uncommon among sheep, and is called by the shepherds the shorter-ill. It sometimes arises from their having eaten some poisonous or narcotic plants, but is very generally the effect of great weakness produced by want of proper nourishment. The best remedy seems to be white vitriol, given three times a day; and the food should be of the most wholesome and nourishing kind.

We had intended in this chapter to consider pretty much at large, the various cases of suspended animation, or apsphyxia, such as drowning, hanging, suffocation from fixed air or other noxious gases, as torpor from cold; but this article has already swelled to an unexpected length, and we have yet much important matter on our hands. We must therefore refer our veterinary readers to the article Medicine; as the means to be there directed for restoring suspended animation in man will, with some little modification, apply to similar cases in the domestic animals.

Chap. IV. Of Spasmodic Diseases.

1. Locked Jaw. Tetanus. Stag-evil. Mal de Cerf. It has been remarked in No. 10, that horses are extremely subject to the locked jaw, which proves one of the most obstinate and fatal diseases by which they are affected. It seems also occasionally to appear among cattle, but it occurs to them much less frequently than to horses. We do not know that any writer has described this disease in the horse better than Mr Gibson, whose description we shall therefore copy, though it is expressed in rather an uncouth style.

"As soon as a horse is seized in this manner, his head is raised with his nose towards his rack, his ears pricked up, and his tail cocked, looking with an eagerness, as an hungry horse when hay is put down to him, or like an high-spirited one, when upon his mettle; in so much that those who are strangers to such things, when they see a horse stand in this manner, will scarce believe any thing of consequence sits him; and I have seen such persons greatly surprised when they have been told of the danger. But they are soon convinced, when they see other symptoms come on space; that his neck grows..."
grows stiff, cramped, and almost immovable; and if a horse in this condition lives a few days, several knots and ganglions will rise on the tendinous parts thereof; and all the muscles, both before and behind, will be so pulled and cramped and stretched, that he looks as if he was nailed to the pavement, with his legs stiff, wide, and straddling; his skin so tight on all parts of his body, that it is almost impossible to move it; and if trial be made to make him walk, he is ready to fall at every step, unless be be carefully supported; his eyes are so fixed with the inaction of the muscles, as gives him a deadness in his looks. He snorts and sneezes often, pants continually with shortness of breath; and this symptom increases till he drops down dead, which generally happens in a few days, unless some very sudden and effectual turn can be given to the distemper.

This disease is generally primary or idiopathic; but it is sometimes symptomatic. The pulse is not always much affected; there is seldom any fever, and the internal functions are seldom impaired till towards the latter stages of the disease.

We have not many accounts of the appearances that have been discovered on dissecting horses which have died of this disease. In two dissections by M. Hazard, the bowels within the belly, especially the large intestines, were considerably inflamed; the liver was full of black and fluid blood, and in one case a considerable quantity of blood had escaped into the cavity of the belly; the substance of the liver was very tender, as if it were decomposed or rotten. The other viscera of the belly, and the heart and lungs, were in their natural state. On opening the head, considerable marks of inflammation appeared in the brain, the choroid plexus was distended with blood, and in one case the maxillary and frontal sinuses of the right side were full of black blood; the dura mater was inflamed, and its vessels, as well as those of the brain, were turgid with blood; the ventricles of the brain contained a quantity of serous fluid. In one of the cases the inflammation had extended even to the periosteum on the right side, which was much redder than that on the left.

It is difficult to say whether the disease depended on an inflammatory affection of the brain, or whether this was the consequence of the violent spasm to contraction of the muscles during the height of the disease: but we are inclined to think the latter was the case.

Instances of recovery from this disease in horses are very rare; we shall presently give one from Mr. Gibson, which is rather remarkable. A cautious opinion ought therefore to be given in every case of locked-jaw.

This affection may be produced by various causes, particularly from wounds, where the nerve is partially divided; from cold, when the body is in a profuse sweat. It may arise also from internal irritation, as from worms, which, in Mr. Gibson’s opinion, are a very common cause of it. Probably it more frequently proceeds from wounds, as a puncture in the foot or any other part; and it has certainly often been brought on by the barbarous operations of docking and nicking. There seems no doubt that the brain is the principal seat of the affection.

In the treatment of locked jaw, it is necessary to use some vigorous measures as early as possible; but unhappily no method hitherto adopted has proved successful, even in a few cases. Opium, aconite, hellebore, &c. have been tried in the veterinary college in very large doses, but without any beneficial effects. From considering it as a disease of the brain, trepanning has been used, with the view of making pressure on the brain, and this has sometimes appeared to take off the spasm of the muscles; but as soon as the pressure was removed, the spasms returned with nearly equal violence. An infusion of tobacco, to the amount of two pounds, has been given by Mr. Coleman, but the symptoms appeared to be aggravated. Mr. Feron recommends bleeding, and immersing the animal in a warm bath at 90° of Fahrenheit, so as to keep the whole body covered with the water for two or three hours, which he has known to be successful; but the horse must afterwards be clothed and kept very warm. The most probable means to relieve the animal seem to be giving opium in large doses by way of clyster, frequently repeated, and rubbing the whole body frequently with some stimulating liniment, such as oil of turpentine and tincture of cantharides. Mr. Blaine recommends a clyster composed of a strong decoction of poppy heads, with two ounces of camphire dissolved in brandy; or if this be thought too expensive, one with two ounces of spirit of benzoin and four ounces of oil of turpentine, mixed with two or three yolks of eggs and a pint of cream. The cold bath is found one of the most effectual remedies in the human body, and we should conceive that it is more likely than any other means to do good in the horse; but it will be necessary to rub him as dry as possible after throwing the water over him.

If it is ascertained that the disease proceeds from a punctured or lacerated wound, it will be proper immediately to scarify the wounded part, so as, if possible, completely to divide the affected nerve, as in some cases where this has been done, the spasms have been removed. It must be confessed, however, that even this has frequently failed. If it has proceeded from a punctured wound in the foot, Mr. Blaine thinks it advisable to take up the nerves of that foot on each side; for though this might occasion temporary lameness, yet, if the horse were saved, this might be removed in a few weeks.

The following case related by Mr. Gibson, in his case, is very instructive; even though it should be contended that this cure was effected by nature, and not by Mr. Gibson’s remedies.

A young troop horse was suddenly seized with this kind of convulsion, which was first discovered as he was leading out to water, at the afternoon’s watering time. “I happened, (says Mr. Gibson), to be then present, and perceived him come reeling along with his nose turned out, his eyes fixed and immovable, with all the other signs that usually attend this fatal distemper; and when he came to the trough he could not reach the water because of the cramp and stiffness of his neck; and when it was held to him in a pail, could not drink, though he shewed an eagerness for it; his mouth being shut up so close, that it was scarce possible to put a knife between his teeth. When we found it impossible to administer any kind of medicine, till by rubbing his checks, jaws, and temples, and his whole neck, for a considerable time, we made a shift, with great difficulty, to thrust down part of a calomel ball, on the end of a small stick, and then to put into his nostrils a very small portion of a strong cephalic drink, thinking that by means
FARRIERY.

Part VI.

Diseases, to convey the ball downwards into his stomach, which however bad but little effect, any farther than this, that he had not such sudden fits and agitations as I have seen in others in the like circumstances, but continued more quiet; neither did his fever increase, as usually happens when the distemper is gaining ground; but all this while his mouth continued so much shut, that he could neither eat nor drink for three weeks; only by continually rubbing his jaws and neck, he would sometimes make a shift to such a handful of scalded bran, or sometimes a little oat-meal, moistened with warm water; but in so small a quantity, that it is possible he might have starved, if other methods had not been taken to keep him alive.

I have often observed that the forcing the jaws open by violent means, puts a horse into such agonies, that it rather increases than abates the symptoms; and therefore I contrived to give him both food and physic by the fundament, through a pipe fourteen inches long, by which he seemed to receive great benefit; for we could perceive the symptoms to abate daily. His flanks grew more quiet, he stood more still, and free from sudden fits and startings; all which symptoms are usual in the contusion and increase of the distemper. The oysters were contrived in the following manner.

"Roe, pennroyal, and chamomile flowers, of each a handful; savin and box, of each a handful; garlic, an ounce; castor and asafetida, of each half an ounce.

"In making this oyster, the herbs are to be boiled first, in two quarts of water, in a covered vessel, the space of ten or fifteen minutes, with the castor and asafetida out in small pieces, and tied in a rag; not only to save the castor from waste, but that it may be squeezed into several oysters. Then the garlic to be added and continued, close covered, over the fire the space of ten minutes longer; after this the liquor to be poured off into a pan, or any other convenient vessel; then add of linseed oil and treacle, of each four ounces, with half an ounce of unrectified oil of amber; the treacle and the oils are to be mixed with the decoction, when it is put into the bag.

"This oyster was repeated once a-day for a fortnight; and by way of diet, was given every day three or four quarts of milk, boiled with oat-meal and water, a bag with a long pipe being left in the stable for that purpose. He retained every thing that was administered that way, which he generally sucked up of himself without force. This perhaps was in some measure owing to the nature of this universal convulsion, which causes such irregular motions in the midriph and muscles of respiration, as in some measure inverts the natural motion of the gots; and for the same reason horses in this condition seldom dung, but stale often; and when they dung, it drops from them in a manner insensibly, and often no more than one or two balls at a time; and therefore as this horse could receive little or no sustenance by the mouth, I was determined to make trial how far he might receive nourishment by way of injection backwards; whether a thin diluted food thrown into the straight gut, and from thence over into the small gut, by the help of a long pipe, might not find a passage into the blood through the lacteals, especially the experiments of this kind made on the human body, both in administering food and physic, particularly in giving the bark, by way of cluster, in agues and intermitting fevers, which has been found successful where the stomach was not able to bear its austerity. It was upon this footing that I treated him in the manner I have described, which I imagined was not altogether without effect; for he scarce ate in three weeks what was sufficient to sustain him one day; so that it was impossible for him to have lived, had he not been supported by what was thrown into his bowels; and though by this means he lost his flesh very sensibly, yet he still retained a good deal of vigour and vivacity. He had two men constantly to look after him, and these relieved by others, who had orders to rub his whole body often, which greatly helped to relax his skin, and remove the crampness of his muscles; and though he had not for the first fortnight recovered the use of his jaws, yet we observed him daily to move with less stiffness, and often to liek in his manger, as if he craved after food. He also breathed with less difficulty, and had several other good signs. This encouraged me to try another experiment with opium, from the known quality of that drug in relaxing the animal fibres; which I therefore thought might be of service to remove the contractions of the muscles about his mouth and jaws, which all this while continued in some measure obstinate, and, without some powerful relief, might prove fatal, even though the original cause was in a great measure taken away; therefore I caused an ounce of crude opium to be dissolved in one of his oysters, which was followed with these circumstances, that the horse soon lay down, began to point his ears backwards and forwards, and could move his neck pretty freely, and his mouth was so far at liberty, that he took his drink with little or no difficulty, and could eat hay and bran sufficient to sustain him. He likewise moved his whole body so readily, that we could walk him an hour every day; and that I might follow what I imagined had been so successfully begun by the opiate oyster, I ordered him some days after an ounce of the common Matthew's pill, which contains about two drachms of opium, and the same quantity of asafetida, made into a ball, which was given at his mouth, and washed down with a balsam of guel, which was done with great ease, his mouth being grown pretty pliable. This ball being once more repeated, he recovered daily, being continued for some time in the use of the drinks, which were now administered only twice a-week, with a good rubbing; and as soon as he began to recover his flesh, he was gently purged. By these means he was perfectly cured, without any other ill effect than a blemish upon one eye, caused by the violent and strong contraction of the muscles during the convulsions, which indeed were as bad as any I ever saw, even where they proved the most fatal.

We have related the above case thus particularly, in the mother's own words, we have rarely seen a case of locked-jaw in horses so well described, both as to its progress and treatment. Whatever might have been the cause that produced the complaint in this horse, it was evident that it did not depend upon any congestion of blood in the head, and Gibson judged very properly in not employing bleeding, purging, and rowels, which appear to have been the indiscriminate practice of farriers in his time; and which might be very proper where the convulsions proceed originally from
FARRIERY.

3. Epilepsy, or Falling-sickness. Convulsions.

We have already stated our opinion, that several cases that are commonly called stagers are really instances of epilepsy, and we have no doubt that several strange convulsory disorders that are described as affecting domestic animals may be referred to the same head. Of this kind we consider the skipping complaint among lambs described by Mr Lawrence; "I remember in former days, (says he), on the borders of Suffolk, several scores of lambs were seized with an uncommon malady, leaping and jumping about the fold-yard in a strange manner; and a dung-heep being raised to the level of the caves of a low-tiled barn, a number of the lambs ran skipping up to the top of the roof, as though they had been possessed by more devils than Mary Magdalen, or even the nuns of Leasden. The whole parish wisely concluded they were bewitched, and a wretched and aged pauper became the object of their suspicions and their deadly hatred. I do not precisely recollect, but I fear the brutal, senseless, and infernal supposed preventive of witchcraft was resorted to, burning one of the poor animals alive." We should be disposed to account for so many animals being seized with it at once, on the principle of imitation, just as we have seen a number of children at school fall into fits from seeing one of their number affected with epilepsy. The treatment of this complaint must be regulated by the state of the body at that time. If this is phlethoric, bleeding, purging, and low diet, will be necessary; if it is weak, a strengthening plan must be adopted.

3. Canine Madness. Rabies Canina. La Rage, Fr.

Of this most dreadful malady, the nature of which is so little understood, and of which the cure still remains a desideratum in medicine, the accounts hitherto given are very imperfect.

Our principal object should certainly be to ascertain the origin and progress of the symptoms, as they appear in the dog, in whom the disease appears to originate. The account of these symptoms, as given by different authors, is exceedingly contradictory. The best account that we have seen is that of Meynell of Quorn in the county of Leicester, and which is published by Dr Arnold in his account of a case of hydrophobia. Before we give Mr Meynell's view of the symptoms, we shall quote a passage from that part of Mr Lawrence's treatise on horses, in which he speaks of canine madness. The passage is as follows. "The diagnostics of canine madness are, hunger and thirst, without power to eat or drink; trembling, eyes fierce and flaming, hanging of the ears and tail, which is bent inwards; lolling of the tongue, foaming, barking of the dog at his own shadow, panting, running a straight and heedless course against any thing in his way, biting with violence; other dogs fly him by instinct.

By comparing the above diagnostics with the following account of Mr Meynell's, it will be seen how little dependence is to be placed on the description of those who have not written from their own actual observation. We doubt not that Mr Lawrence derives his account from what he conceived to be the best information, and he is therefore not accountable for his errors.

According to Mr Meynell, the first symptoms of canine madness in dogs appears to be a failure of appetite in a small degree, that is, the dog does not eat his usual food with his usual eagerness, though, if better food be offered him, he may eat it greedily. A disposition to quarrel with other dogs comes on early in the disease. A total loss of appetite generally succeeds, though dogs sometimes eat and lap water the day before their death, which generally happens between seven and ten days after the first symptoms have appeared. A mad dog will not cry out on being struck, or show any sign of fear on being threatened; though he will, very late in the disease, appear sensible of kind treatment. A mad dog, in the height of the disorder, has a disposition to bite all other dogs, animals, or men. When not provoked, he usually attacks only such as come in his way; but having no fear, it is peculiarly dangerous to strike at or provoke him.

Mad dogs appear to be capable of communicating the infection early in the disorder, and as soon as they begin to quarrel with and bite other dogs.

The eyes of mad dogs do not look red or fierce, but dull, and have a peculiar appearance, which is easily distinguished by such as have been used to observe it, but which is not easy to be described.

Mad dogs never bark, but occasionally utter a most dismal and plaintive howl, expressive of extreme distress, and which they who have once heard can never forget. So that dogs may be known to be going mad without being seen, when only this dismal howl is heard from the kennel.

Mad dogs do not foam or froth at the mouth, but their lips and tongue appear dry and foul or slimy.

Mad dogs are generally sufficiently sensible to know those to whom they have been accustomed.

Mr Meynell is confident that dread of water is not a symptom of this disease in dogs.

Though mad dogs generally refuse both food and drink, in the latter stage of the disorder, yet they never show any abhorrence or dread of water, will pass through it without difficulty, and lap it eagerly to the last. But it is remarkable, that though they will lap water for a long time, and eagerly, and do not seem to experience any uneasiness from it; yet they do not appear to swallow a single drop of it; for however long they may continue lapping it, no diminution of quantity can be perceived.

He has never known a dog show symptoms of the disease in less time after the bite than ten days; and he has known many instances of dogs having died mad as late as eight months after the bite. The symptoms generally appear between three and eight weeks after the bite.

A dog had been bitten, and confined by accident,
and not from any suspicion of danger, for a whole year, so as to have no communication with any other dog all the time; and went mad at the end of that period.

Mr. Meynell makes the following additional observations. "I am persuaded that the disorder never originates from hot weather, putrid provisions, or from any other cause but the bite. For however dogs may have been confined, however fed, or whatever may have been the heat of the season, I never knew the disorder commence, without being able to trace it to that cause; and it was never introduced into the kennel but by the bite of a mad dog. I do not say that I am certain that the disorder never originated from any cause except the bite; but I say that I never knew a dog go mad that I had no reason to believe had been bitten.

"Some dogs, in the last stage of the disorder, have a locked jaw.

"I do not recollect ever to have heard a dog bark after I have perceived symptoms of madness upon him.

"I consider an unusual disposition to quarrel with other dogs as a certain sign of beginning madness; and it is the only one I know.

"I believe the disorder always comes on so gradually that mischief may be prevented by proper care.

"I believe after symptoms have ever appeared, they never go entirely off; and that the disease, though sometimes very slow in its progress, always terminates in death.

"Dogs known to have been bitten frequently escape, but I believe not so frequently as men.

"Almost all the mad dogs that I have seen have been confined.

"The hairs of a mad dog do not stand erect more than those of other dogs.

"I do not know that there is anything remarkable in the manner of a mad dog’s carrying his head or his tail.

"I do not know that there is anything fierce in the appearance of the eyes of a mad dog. I believe I should know a mad dog to be mad from the appearance of his eyes, but I cannot describe this appearance.

"I do not know that a dog in the beginning of this disorder, is disposed to sneak away growling, or to shun the society of other dogs; but if I observed any thing particular in the manner of a dog, I should certainly confine him.

"I do not believe that dogs are more afraid of a mad dog than they are of any other dog that seems disposed to attack them."

(Mr. Daniel was witness to an instance of this insane dread of a mad dog in other dogs, at Bradwell in Essex, where he was hunting with the reverend H. Bate Dudley. Mr. Dudley walked his hounds to the water to swim them; he had himself swim over to an island about a hundred yards from the shore, and most of the hounds had followed him, but some of them could not be compelled to do so. At this juncture an alarm of a mad dog was given, who had been pursued many miles, and done variety of mischief in his progress; he seized one of the hounds that would not go into the water, and the remainder, to the number of seven or eight, immediately upon his approach to them, took to the water, and swam across to those in the island.)

* Daniel’s Rural Sports.

"There are two kinds of madness, both of which I have known to originate from the bite of the same dog. Among huntsmen, one is known by the name of raging, the other by that of dumb madness. In dumb madness, the nether jaw drops, and fixes; the tongue hangs out of the mouth, and slaver drops from it. In raging madness, I believe the mouth is shut, except when the dog snaps or howls, and that no moisture drops from it."

The following facts and observations upon the consequences of the madness among Earl Fitzwilliam’s hounds, perhaps mark the attack and symptoms of this disorder more accurately than any other description of a similar accident.

In the night of the 8th of June 1791, the man who slept in the kennel was unusually disturbed by the hounds fighting; he got up to quiet them several times, and always found the same hound quarrelling. Noticing the riotous behaviour of this particular hound, and at the same time an appearance of stupidity in him, he was induced to suppose that he was going mad, and accordingly confined him in a place by himself, after which the pack was quiet the remainder of the night. When the huntsman came to the kennel in the morning, he was told what passed, and the supposed mad hound shewn to him; his appearance was suspicious; some meat was given to him, part of which he ate, although there was an apparent difficulty in swallowing. Two days passed in suspense, but at the end of the third day his disorder was confirmed; and at the end of the fifth day he died mad. Immediate preparations were made for confining 42 couples of hounds separately, until the month of September, which was rigidly adhered to. By this means, Mr. Hopkinson, a medical gentleman of Peterborough, had an opportunity wherein he very skilfully and exactly minutely the symptoms and progress of this disease.

Six hounds went mad in the following order.

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<td>July 1st.</td>
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<td>November 10th.</td>
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<td>6</td>
<td>December 8th.</td>
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The hounds were first taken from their chains in September, and exercised for about half an hour together, not more than four or five couple at a time, and not trusted out of the sight of the attendant. When this exercise was over, they were again confined separately, and fed at separate troughs. In the beginning of October, they were taken out ten couple at a time; at the latter end of that month, twenty couple; still observing the same caution with respect to separate confinement after they returned from exercise. In the beginning of November they were hunted, but were chained up, as at first, after hunting, until the third week of that month, when they were let loose in different apartments of one, two, three, four, and five couple together. This regulation was continued till the month of June 1792, as the huntsman, who had had much experience in this disease, did not deem them safe under a year.

The only remedy employed was mercurial ointment; and all the hounds, except the bitches that were in whelp,
whelp, underwent two frictions, so as to produce in some
of them a violent salivation.
Mr Hopkinson remarks, that from the above state-
ment it seems that the disorder is as virulent, as to the
power of inoculation (by which process it is always
communicated) at its commencement, as at the ad-
vanced stage of it; for all the six dogs that went mad were
probably infected on the 8th of June, within a few hours
of each other.
It is a common opinion, that when a dog is bitten by
one that is mad, a few weeks confinement, sea-bathing,
or the popular nostrums, are either of them sufficient to
prevent his taking the disease, and from spreading its
miscellaneous effects; but in this case, there was a fair
opportunity of proving that there is no security after
six months, perhaps not after twelve; that mercury has
no certain power to prevent it; and it appears that the
huntsman had repeatedly employed all the popular rem-
edies, without any effect whatever. He had also observ-
ed nearly the same progress of the disease in several packs
of hounds, where no expense had been spared, for every
medicine in use, sea-bathing, &c. In the present in-
stance, there was this remarkable difference, that no
internal medicine had been given, and the huntsman
never knew fewer hounds attacked with the disease.

The result of the huntsman’s experience in the pre-
ventive plan is therefore in favour of a separate con-
finement; and yet the remark he had depended on medicine,
and on the above plan of treatment, the disease had
made dreadful havoc.
There is no reason to suppose that the bound which
first went mad, was not bitten by any other dog, but
that it was in him a spontaneous disease. The whole
pack were examined very attentively, and bites found
upon four couple, one of which was seen fighting with
the mad bound twice; he underwent a longer confine-
ment than the rest; however, none of them were
attacked by the disease, and it is singular that no bites
were discovered upon the six hounds that went mad.
The infection taking place or not, is therefore per-
haps the resultant chance; yet, although no bites were
perceived upon the bounds which went mad, there is every
ground to believe they were bitten, but that the wounds
being small, were concealed by the hair. Mr Daniel
suggests, that most probably there were bites within
side of the lips or jaws, where the venomous saliva
might be more fatally and quickly absorbed into the
bodily system, than where the teeth had to penetrate through
the thick outer skin of the dog.
Mr Hopkinson continues his remarks with respect
to the symptoms of madness in dogs, and states that
those which distinguish the attack of the hydrophobia,
are in general a loathing of food, although this is not
universal, as they will sometimes eat solid food, but re-
fuse liquid. The first and only symptom that N°3.
had of the disease, was eating his own excrement when
food stood by him; the feeder knowing this to be con-
trary to what the dog would do if he were well, be in-
mediately confided him. For a day or two he was in
some doubt whether his suspicions were well founded;
but he proved right, for the dog died raving mad upon
the fifth day.

At the commencement of the disorder, the mad dog
has a particular tendency (if loose) to lick and smell
the penis and fundament of another dog; this should
he looked upon as a very suspicious symptom. The Dis.
seases speaks of this as an almost never falling
out.

There seems for the first two or three days to be in-
tervals of sense; and during that time they usually rec-
ognize their master, their eyes look clear and well,
their tongues moist, and of the proper colour; but if a
dog is loose at this time, he will in general be more
resentful of the thing he meets with. He will sometimes, during
this stage of the disease, leave his home for several hours,
spread his disorder by biting men and beasts, and return
home again. The mad dog, when confined, seldom
survives the fifth day from the first attack; if suffered
to run about, there is reason to believe his death is hast-
tened by a day or two. At the end of the third or
fourth day, his appearance is much altered, his eyes are
sunk, his tongue black and dry, he makes horrid how-
lings, and seems much disturbed; indeed the concluding
scene is dreadful to witness. In the first stage of the
canine madness, it is difficult for a person not con-
versant with the disposition of dogs in general, and of
the mad dog in particular, to ascertain whether the dog is
really mad or not; even Lord Fitzwilliam’s huntsman
was doubtful for a day or two respecting the bound men-
tioned in this account, as being the first attacked with
the disease; however, in the advanced stage of it, no
one can be mistaken.

It is the generally received opinion, that mad dogs
will not take the water; but in the summer of 1795,
there occurred in the neighbourhood of Petersborough,
two instances of mad dogs, when closely pursued, swim-
ing a large navigable river. A doubt might have aris-
en, as to their being mad, but that two hogs went mad
from the bite of one, and the other was pursued for
many miles by Lord Fitzwilliam’s huntsman, who, from
his experience in the disease, was not likely to be
mistaken. Both dogs completely swam the river 9.

Of all the remedies that have been employed for the
cure of this dreadful disorder, none seems so likely to,
be successful as the cold bath. This remedy was re-
commended about 200 years ago by the Beigneur d’Es-
parron, in his “Fauconnerie,” and he gives a curious
instance of its success in the cure of a mad dog. “I
will relate (says he), what happened to a gentleman
of my acquaintance. He discovered that some of his
dogs had been bitten by a mad dog; and after some
time, several of them betrayed symptoms of the disease.
These he ordered to be killed; but it happened that
one which was a great favourite was seized, and he de-
sired his servants to throw him into the river. By
chance, the dog in coming up from the bottom, got
entangled in the roots of a tree by the cord with which
he had been tied, but in such a manner that his nose
just remained above the water. In this situation he re-
mained for three days, at the end of which period he
got loose and returned to the house, to the great as-
tonishment of his master; and here I afterwards saw
him, as cheerful and healthy as before. I have no
doubt (continues d’Esparron) that if mad dogs could be
plunged into water without danger of their biting, they
would all recover; and I believe that if the same prac-
tice were pursued with men, which might easily be done,
many an unfortunate wretch might be saved. The
danger of being bitten might be prevented by first put-
ing a muzzle on the animal, and he might then be re-
Another writer, Defoilleux, who published a work on hunting in 1839, recommends plunging into cold water any dog as soon as it has been bitten, for the purpose of preserving him from the effects of the disease.

As the effect of remedies when the complaint once appears is so uncertain, it should be our principal object to use all the preventive means in our power. When, therefore, it is discovered that an animal has been bitten by one that is mad, the wounded part should immediately be cut out, where this can be done with safety, or at least should be deeply scurfed to the very bottom of the bite. The wound should then be repeatedly washed with soap and water, or with a solution of soda poured upon it in a stream from a considerable height; and afterwards the wound should be scurfed to the bottom with a hot iron; or where this cannot conveniently be done, a quantity of aquafortis, or oil of vitriol, should be poured into it, so as to destroy all the remains of the virus or poison. If the part bitten be the ear, it should be cut off and seared. After these means, it will be more easy to plunge the animal once or twice in cold water, or where convenient into the sea; and he should be strictly watched, that if these means should have proved unsuccessful, the earliest appearance of the disease may be perceived.

Dr Arnold, to whom we are indebted for Mr Meynell's account of the symptoms of madness in dogs, gives the following advice with respect to the method of treating a dog that is suspected of being mad.

Though every dog that is bitten does not receive the disorder, yet, as the time of its appearance after the bite is very uncertain, and as a great proportion of those that are bitten do actually receive it, and as there is no criterion by which we can ascertain whether a dog has or has not received the infection, but the breaking out of the disorder, it is earnestly to be wished that all owners of dogs would immediately destroy, or secure for a great length of time, every dog known, or but subjected, to have been bitten by a mad dog.

It is not customary to be wished, that all persons possessing dogs would immediately tie up or destroy such of their dogs, whether known to be bitten or not, as shall begin to be disordered in any way, of which the nature and cause is not perfectly obvious; and especially if there be the smallest reason to suspect that the dog was bitten, and that the disorder is really an insipient madness.

It is still more to be wished that they would immediately destroy all dogs known to be in any state of madness, if it be at the same time known that they have not yet bitten any other animal, and particularly no person whatsoever; and that no dog that has bitten any animal or person be destroyed as a mad dog if it can be avoided, but that every dog be secured and tied up, that it may be certainly known whether he be mad or not. If he has the symptoms of confirmed madness, they will plainly discover themselves, and he will die in ten days at least; and if he is not, he may be safely discharged in the space of a fortnight, and the person bitten will be freed from the most distressing apprehensions.

Before we dismiss the subject of canine madness, it will be expected that we should take some notice of the operation of worming dogs, so celebrated among huntsmen and breeders of dogs, as a supposed preventative of this dreadful malady. This operation is so old as the days of Pliny, and has ever since been more or less esteemed among the vulgar. But whether the operation itself, nor its effect, seem to have been well understood. The idea of a worm being lodged in the tongue of the puppy, the extraction of which is to prevent the animal from going mad, is truly ridiculous; and as such has been deservedly laughed at by sensible people in all ages. But though it is neither a worm that is extracted, nor is the extraction a preventative of madness, it seems, however, pretty well ascertained, that the performing of this operation is productive of considerable advantage, in preventing the dog from doing mischief, even though he should run mad. It seems that its dogs who have been wormed, and are afterwards seared with hydrophobia, the tongue tends to such a degree as to prevent the animal from closing his jaws upon the object which he attempts to bite.

The following observations of a late ingenious and entertaining writer on the subject are entitled to much attention.

Very strong proofs have been adduced of its utility; nor is it natural to imagine, that so easy and effectual an operation would have been omitted, had no more virtue been attributed to it than it really possesses; nor whereas it failed, the absolute prevention of madness was said to be the consequence; whereas the fact was and is, that tainting out the worms hath nothing to do with annihilating the disease, although it will certainly hinder the dog, seared with it, from doing any hurt to man or beast. A late author asserts, he had three dogs, that were wormed, bit by mad dogs at three several periods, yet, notwithstanding they all died mad, they did not bite to do any mischief; that being determined to make a full experiment, he shot one of the dogs up in a kennel, and put to him a dog he did not value; the mad dog often rose at the other to bite him, but his tongue so swelled, that he could not make his teeth meet. The dog was kept in the kennel until the mad one died, and was purposely reserved for two years afterwards, to note the effects, but he never ailed any thing, although no remedies were applied to check any infection that might have been received from the contact of the mad dog.

Mr Daniel has had various opportunities of proving the usefulness of worming, and instance three of the most striking instances, under the hope of inducing its general practice.

A terrier bitch went mad that was kept in the kennel with 40 couple of hounds; not a single one was bitten, nor was she seen to offer to bite. The bitch being of a peculiar sort, every attention was paid to her, and the gradations of the disease, (which were extremely rapid) minutely noted. The hydrophobia was fast approaching before she was separated from the hounds, and she died the second day after. At first warm milk was placed before her, which she attempted to lap, but the therapist refused its functions; from this period she never tried to eat or drink, seldom rose up, or even moved; the tongue swelled, and long before her death the jaws were disordered by it.

A spaniel was observed to be seized by a strange dog, and was bit in the lip; the servant who ran up to
part them, narrowly escaped, as the dog twice flew at him; a few minutes after the dog had quitted the yard, the people who had pursued gave notice of the dog’s madness, who had made terrible havoc in a course of ten miles from whence he had set off. The spaniel was a great favourite, had medicine applied, and every precaution taken; upon the fourteenth day he appeared to be on the day following he endeavoured to lap milk, but could swallow none; from that time the tongue began to swell, he moved himself but seldom, and on the third day he died. For many hours previous to his death, the tongue was so enlarged, that the fangs or canine teeth could not meet each other by upwards of an inch.

The hounds were some years after parted with, and were sold in lots. A madness broke out in the kennel of the gentleman who purchased many of them; and although several of these hounds were bitten and went mad, only one of them ever attempted to bite, and that was a hound from the duke of Portland’s, who, in the operation of worming, had the worm broke by his struggling, and was so troublesome that one half of it was suffered to remain; the others all died with symptoms similar to the terrier and spaniel, viz. a violent swelling of the tongue, and a stupor rendering them nearly motionless, and both which symptoms seemed to increase with the disease.

The idea that worming prevents a dog from receiving the infection when bitten should be exploded; but the foregoing facts show how far it may be recommended for the restriction of a malady horrid in its effects where a human being is concerned, and which to the sportsman and the farmer is attended with such dangerous and expensive consequences.

We cannot pretend to say, what it is that the wormers of dogs take away from the tongue; but we cannot suppose, that Mr. Daniel, though he calls it a worm, really believes that it is so. The following are his directions for performing the operation.

"The worming of whelps should be previous to their being sent out to quarters; this operation is to be performed with a lancet, to slit the thin skin which immediately covers the worm; a small awl is then to be introduced under the centre of the worm, to raise it up; the further end of the worm will with very little force make its appearance, and with a cloth taking hold of that end, the other will be drawn out easily. Care must be taken that the whole of the worm comes away without breaking; and it rarely breaks, unless cut into by the lancet, or wounded by the awl."

4. COLIC. Colica. Spasmodic or Flatulent Colic, Gripes, Bats, Fret, or Guillen. Tranché, Fr.

This is one of the most painful disorders with which horses are affected; and it seems to occasion them as much distress as inflammation in the bowels, with which it is very commonly confounded by ordinary farriees.

In this disease the horse expresses his pain, by frequently lying down and rolling on his back, and after having remained a short time in this position, starting up again. The hair is staring, and there are sometimes cold sweats. He frequently makes attempts to stale, looks anxiously at his flanks, and sometimes strikes his belly with his hind foot. There is seldom any fever in this disease; and when it does occur, it is only after the disease has existed for some time. The pulse is seldom affected; but when the pain is very great, it is a little quicker than natural. The belly commonly feels hard and tense. Colic is almost always accompanied with consistence, though griping pains not unfrequently attend severe scouring.

If the above symptoms are attentively examined, they will commonly serve to distinguish this disease from inflammation of the bowels. It is generally observed, that the pain in colic returns only at intervals, and the extremities are seldom cold. It must not be overlooked, however, that when colic continues for a considerable time, it may terminate in inflammation, so that the distinguishing symptoms mentioned here and in No. 497. are to be depended on, only in the early stage of the disease.

Cattle are extremely subject to colic; but it is said to be more common in young than in old cattle. The symptoms do not differ from what we have described, only that it is said, that these animals, when affected with gripes, strike their heads and horns against every thing in their way.

Colic is easily removed, when the proper remedies are employed, before any symptoms of inflammation mark their appearance; but if the remedies be delayed till inflammation takes place, the cure is very precarious. Colic is very commonly the consequence of neglected costiveness, and by this it is always increased. It may be ascribed to improper food, especially such as is apt to produce flatulence or sourness in the stomach or bowels; by drinking cold water immediately after eating; and by exposure to cold, during violent sweating.

As it is not always easy to distinguish flatulent colic from inflammation, it is the safest plan to begin the treatment by bleeding, to the extent of three or four English quarts; and the appearance of the blood will generally inform us whether it will be necessary to repeat the operation. See No. 152. The next circumstance to be attended to, is the evacuation of the bowels by back-raking and softening clysters. In general, after this operation, a large quantity of air will be evacuated, and considerable relief will be afforded. After these means have been employed, some stimulating aromatics, such as oil of turpentine, oil of aniseed, essence of peppermint, or some of the other stimulants enumerated in No. 285, and 286, should be given by the mouth; and if these do not procure relief, it will be proper to give a ball containing half an ounce of calomel, and immediately after it, a drench of peppermint water, with five or six drachms of laudanum. The cure will be considerably assisted by rubbing the belly gently with a warm cloth; and the animal should be gently trotted, for a considerable time, while led by the halter. Warm fomentations to the belly have been recommended; but if there is a considerable accumulation of air in the stomach and bowels, these would do harm by increasing the expansion of the air, and thus adding to the animal’s distress; for it must be remembered, that a horse cannot easily belch up wind by the mouth; and where there is any obstruction backwards, every thing that can increase the expansion...
expansion of the confined air, must do harm. On the contrary, every thing that is capable of diminishing the volume of air, may probably relieve the pain. It might be worth while to try how far the application of cold to the belly would be attended with advantage; and this might easily and safely be effected, by bathing the belly with strong spirit of wine, which speedily evaporating, will considerably diminish the temperature of the belly. It will be proper, where the disease continues obstinate, to administer warm softening oysters, every hour or two; as well for the purpose of obviating costiveness, as for removing the spasmodic constriction of the bowels. We are assured, that where most other means have failed in procuring relief in flatulent colic, this has been obtained by means of the smoke of tobacco drawn up the fundament. The simplest way of administering this remedy, is to introduce the small end of a tobacco pipe, after having filled the bowl and lighted it; when the smoke will insensibly be drawn up by the action of the horse’s bowels.

_Our domestic animals are sometimes affected with dropsy; and this may be either diffused through the cellular membrane below the skin; or the water may be contained within one or more of the cavities, as the head, the chest, and the belly._

External dropsy, or what medical writers call _asarco_, and farriers _water-farcy_, is not common, unless it accompanies a dyspeptic collection within the body. It sometimes afflicts particular parts, as the legs, the sheath, or the lips; and at other times it is diffused over the whole cellular membrane. It is known by the swelling of the part, which is cold, and retains the impression of the finger for some time. The urine is generally more sparing and of a deeper colour than is natural; and the animal appears considerably weak. This disease, when it has proceeded to any considerable height, and when the animal is much debilitated, is not easily removed; but when it is slight and of no long standing, it will in general yield to remedies.

The cure of general dropsy is to be attempted by the use of diuretic medicines, accompanied with a nourishing diet, gentle exercise, and frequent friction all over the body, especially over those parts where the accumulation of fluid is situated. The action of the diuretics must be assisted by a sufficient quantity of drink; and it will be proper to give the animal some of the more powerful strengthening remedies, such as white vitriol, oak bark, logwood, &c.

**L. Dropsy of the Head. Hydrocephalus. Sturdy Turmsick.**

Dropsy of the head seldom affects horses or cattle; but a peculiar collection of water in the head is very common among sheep, in whom it is called the _Sturdy or Turmsick_. One of the best accounts of this disease that we have seen is that which is given in the second edition appendix to Mr Findlater’s Survey of Peebles, which we shall give nearly in the words of the author.

This disease is peculiarly incident to young sheep, or hoggs, of a year or eighteen months old. It consists of a collection of water generally formed upon the external surface of the brain, immediately below the skull; and sometimes, though not often, in the centre or ventricles of the brain. When the water forms in the last-mentioned parts, we apprehend it is almost universally mortal.

The disorder is first discovered, by the animal not keeping up with the rest of the flock, and by its appearing dull and stupid. It is afterwards observed to go round in a giddy manner; and at length it appears blind, and the pupil of the eye seems wide and relaxed. It may continue a long time in this situation before it dies; and it is believed that sheep sometimes recover of this disease without any thing being done for them. They are often in good order when they die, as they continue to feed tolerably well, until near the last period.

Though some recover, with or without means, perhaps it may be most advisable to kill them early in the disease, provided they be in good order; as this local distemper does not affect the vision.

When the collection of water is on the outside of the brain, it is often cured by thrusting a sharp wire up the animal’s nostrils, until it reaches the water, and opens a passage for it to run off. In other cases, it is cured by an operation which some shepherds perform very dexterously. The water is contained in a bladder, or vesicle, (a _hidastid_) generally about the size of a walnut. The part of the skull immediately above where it is situated, feels softer than the other parts. This the shepherd discovers, by pressing with his thumb and fingers, upon different parts of the fore and upper parts of the skull. The bone here has become thinner, and feels soft; from which he is certain that the watery collection is formed. After the disease has gone on a considerable time, and he judges it ripe for the operation, he raises the scalpel, and lays the bone bare to a sufficient breadth, with a sharp knife; he then discovers more accurately the extent of the thin soft part of the bone, and with a strong and sharp-pointed knife, he makes a circular incision in the skull, raises up, and takes out the part. He then sees the clear thin bladder underneath, which he lays hold of with a small hook, or the point of a needle, and gently draws it out; taking all possible care that it be not broken, or the water spilled, which would prove unfavourable to recovery. He finds a considerable hollow in the brain where the bag was situated, over which he brings the flap of skin that was raised, so as to cover it as neatly as possible. Over the whole, he applies a plaster of tar, and leaves the rest to nature. This operation frequently proves successful.

Mr Findlater remarks, that in Tweeddale, one case in three, where a perforation is made by the pointed wire, or the trepan, usually ends favourably. Of late it has been the custom among the shepherds of that district, to bore into the skull of sheep affected with the sturdy, with a common gimlet; and however rough or apparently dangerous the operation, it seems frequently to prove successful. The operation is made by boring from the root of the nostrils, in an oblique
direction to the root of the horn on the opposite side of the head.

2. WATER in the CHEST. Hydrothorax.

This complaint appears but seldom in the inferior animals: but it may take place from excessive debility and according to Mr. Blaine, it is sometimes the consequence of inflammation in the lungs. Here however this writer is probably mistaken, and confounds water in the chest with empyema, or a collection of matter within the chest which is not an uncommon termination of pneumonia.

When dropsy in the chest does occur, the animal labours under a difficulty of breathing, especially when lying down; and the pulse is feeble, and commonly irregular. The urine is scanty and high coloured. If the collection of water is pretty considerable, it may be perceived by the sound that is produced, when the chest is struck with the hand; but this is often a deceitful sign, and should not be tried till a long time after the animal has drunk; as, for some time after drinking, the water that remains in the stomach will, when the ribs are struck, produce a sound that might lead us to suppose there was water in the chest.

This complaint commonly proves fatal, both in man and animals, and probably there is no means of cure, except by evacuating the water, by an opening into the chest; an operation which is always precarious, and commonly as dangerous as the disease which it is intended to relieve. If it is determined however to try the experiment, the opening should be made between the seventh and eighth rib, near the breast bone, on that side of the chest where the water is supposed to be accumulated. In making the opening, the skin should be drawn tight towards the edge of the seventh rib; when a cut is to be made in the place above directed, with a sharp knife, not cutting too boldly, but rather scratching with the point of the knife, till the skin and the muscles are completely divided. After this, a pipe must be introduced through the opening, and fastened by a bandage round the animal; some soft linen or a piece of sponge being placed over the opening, after as much water as possible has run off, to suck up the remaining moisture, and exclude the air.

3. WATER in the BELLY. Ascites.

This is the most common species of dropsy, and is known by the general symptoms of dropsy that have been described in N° 319. and 320. attended with an unusual swelling of the belly; while the skin is cold, and very tight. When the belly is struck with one hand, while the other is held upon the opposite side, a fluctuation may be perceived, much more distinctly than in the last species.

It is brought on by the usual causes of dropsy that we have already mentioned, and it is not an uncommon consequence of jaundice and other chronic disorders. It is not quite so dangerous as dropsy in the chest, but it is very apt to return after having been removed.

The treatment should be begun with diuretics, and now and then a mercurial purge, while the body is strengthened by tonic medicines, nourishing diet, and gentle exercise. If the accumulation of water becomes very great, it may be easily-evacuated, by making a puncture into the belly, and introducing a pipe as in the last case. Mr. Lawrence has gone into the mistake generally committed, of supposing that little drink should be given in cases of dropsy. It is now well ascertained that moderate drinking considerably increases the efficacy of diuretic medicines.

CHAP. VI. Of ANOMALOUS DISEASES.

1. DIABETES. Profuse Staining, or Pissing-evil.

It sometimes happens, that horses or cattle make a profuse much greater quantity of urine than is natural; so that staining the quantity evacuated exceeds the quantity of fluid drunk by the animal. Probably this disease occurs more frequently among cattle than among horses, though it is scarcely mentioned by the writers on cattle medicine, and the account that is given of it by veterinary writers is extremely imperfect. Mr. Blaine describes the urine, as being five or six times the natural quantity, as milky or watery, and depositing a sediment which has the taste and appearance of sugar. As we have never observed a case of this disease in horses or cattle, we cannot say how far this description of the urine is correct; but if the urine evacuated in diabetes resembles the human urine in the same disease, it is clear and almost colourless, has the smell and taste of honey, deposits little sediment, but on being evaporated, leaves a thick substance like treacle.

Considerable thirst accompanies this disease: and when it has continued long, the animal becomes extremely weak and emaciated. The skin is usually dry and harsh, the pulse is small and quick, and the appetite in the early part of the disease is much increased.

This complaint commonly proves fatal; few instances of a recovery having been observed in man; and we do not know that any successful case in any of the domestic animals is on record.

The causes of diabetes are very obscure, especially in the inferior animals; it seems to be the consequence of great weakness, and some unusual action of the digestive organs. The various theories that have been given in explanation of this disease, as far as relates to the human body, will be noticed in the article Medicine; and if we shall meet with an opportunity of examining the disease in horses or cattle, we shall endeavour to give a more accurate account of it, under VETERINARY ART.

In the treatment of diabetes in horses, &c., the method proposed by Dr. Rollo for the cure of this disease in man, has been recommended, and we believe adopted, by Mr. Coleman; with what success we cannot say. This method consists in making the animal abstain as much as possible from vegetable food; and giving him broth and balls made of flesh, mixed up with paste of wheat flour. He should have as little drink as possible. Astringent remedies are commonly employed in these cases, such as Japan earth, slum, white vitriol, morosite of iron, oak bark. See receipts, N° 29.

2. BLACK-QUARTER, QUARTER-FL, or BLACK SPLAID.

There is a disease that proves very fatal in some districts to calves or cattle of a year or two old, the nature of which is little understood, but it seems nearly allied
Mr Lawrence considers the disease as appearing under various forms, to which he gives the following names; shew of blood; vomit of blood; blood in the back; blood in the legs, or crateuch; blain in the tongue, or overflow of blood; striking-in, or rising of the blood; higham, or iron-striking; joint murrain, or garget; black quarter; quarter-evil; black leg.

We have given as a synonym the name of black spald, because we consider the disease so called in Scotland, as nearly, if not entirely, the same with the black quarter of the writers on cattle medicine. As we have not seen the disease, we shall copy what Mr Lawrence says of it, in his treatise on cattle.

"All our animals, oxen, sheep, and pigs, I have observed, are subject to sanguineous effusion or overflow of the blood, on being put, in a low and weak state, to rich or succulent keep. They very commonly drop on a sudden, and die in the blood, as it is termed; when the carcases putrefy almost immediately, and are totally lost. Pigs which die in this way, have their skins so universally suffused with the blood, that they appear enveloped, or rather shrouded, in Morocco leather. In oxen, chiefly young cattle, nature commonly finds a vent for the disease, in an eruption on the leg, quarter, or shoulder, attended with pneumatisms or a collection of air in the cellular membrane, or, as it is commonly termed, between the flesh and the skin; whence the crepitating or cracking noise, which is heard on pressure. Another termination of the disease, is by a deposition of matter upon the joints, whence the term of joint garget or murrain. I know not whether I am correct in referring the crateuch to this class, which is said, in Scotland, to be a swelling and lameness in the legs; but the old writers particularly mention blood in the legs. Blain or garget in the tongue, attended with inflammation and vesicles or blisters in that part, is said to be a symptom of the disease, and also to arise from heat and fever.

"This disease has swept off great numbers of yearling and two-year-old cattle, and become indeed endemial in certain districts, where any such scourge was unknown, it is said, previously to the introduction of artificial grasses, with the full feeding on which the animals become surfeited: thus the improvise of good produces evil. The breeders being alarmed at the ravages occasioned by this murrain, which generally carried off the forwardest and best of the cattle, no wonder that the fertile brains of cow-doctors were put into intestine motion, and that the ideas of the favourite engines, the knife or fire, were whirled uppermost. In effect, some skilful leech introduced the following most extraordinary operation, as a preventive of the disease in question; which I apprehend in the contemplation, either of physiology or common-seomology, could have no better prophylactic or preventive view, than shaving the animal would have; which I beg leave to recommend in the stead, as at least free from cruelty. The frightened beast is cast, bound to a stake, all his four legs are cut open from the claws upwards to the height of several inches, in order to find among the tendons and ligaments a strong blood vessel of a bluish colour, which said offending vessel, guilty of the original sin of producing joint murrain, being caught with a crooked needle, is cut away. It is great pity, for the sake of hypotbalastic uniformity, that the above-said blue blood-veess had not been called a worm, when the brains of so many of our cattle folk have been infested with worms from very high antiquity."

After much jocose, but rather coarse ridicule of me, methods that have been proposed for the cure of this disease, Mr Lawrence thus proceeds. "Prevention of this malady is the only cure worth notice; because, after the attack, the very nature of the case renders all remedy either uncertain, or of very little profit, even if successful, on account of the expence of time and money. With this view the young cattle must not be pushed so forward in condition; and indeed the same precaution may be useful in some degree, with respect to the full aged. A piece of short or inferior keep should be reserved, as a digesting place, in which the cattle may be occasionally turned to empty and exercise themselves. Those observed to advance very fast may be bled monthly for several months: of the efficacy of this practice, however, I have by no means so good an opinion as that of giving medicines which prevent internal obstruction. I am well aware of the difficulty, or rather total impracticability, of such measures with a number of cattle in the field, or I am convinced, that occasional purges, or alternative medicines, would prevent those diseases which seem to take their rise in over repletion and accumulation. Six draughts, daily, of equal parts sulphur and antimony, in fine powder, would be sufficient for a young beast; but to be of any permanent use, it must be continued at least a month; or salt might be of use. Howelling also might be an efficacious preventative. Keep two rows or setons open in each beast during several months."

In the 5th vol. of the Farmer's Magazine is the following communication from a practical farmer respecting the cure of this complaint.

"The first cure for this complaint that I ever saw performed, was on an old cow, about a half years of age. As he was going in the plough, I observed him a little lame in one of the hinder feet. At first I thought he had trampled upon a stone; but as it still grew worse, I soon suspected it was the quarter-ill; the more so, as there was a good year-old died of that disorder three weeks before. By the time he was got to the byre, the crakling between the skin and the flesh was very perceptible on the top joint of the off-side hinder leg. As our blacksmith had some skill among live stock, he was instantly sent for. The first thing he did was to take a little blood from a vein in the neck. He then pulled the skin from the flesh on the side that seemed most pained, still keeping the beast walking as much as possible. He then caused cold water to be poured in large quantities on the part affected, still rubbing and keeping the skin loose on the affected part. Finding the skin to adhere much to the flesh, he then made three cuts with a penknife, two inches long, into which he rubbed salt and water. In this manner he continued four hours: the one time driving his hand, and warming on water, rubbing in salt, and loosening the skin from the flesh. By this time he was not near so cripple, and began to take his food. We were ordered, however, to keep him in motion all night, and in the morning he was well for his food, and never had any more signs of the disease. Since that time I have followed the blacksmith's practice, and have often been successful. Only instead of pouring water on the place, I fasten a rope..."
VI.

FARRIERY.

—rope about the beast’s head, and take it to a deep pool, causing it to swim up and down, and drive it frequently, giving it an ounce or half an ounce of laudanum, according to the size or age of the beast, but I never did cut the skin. I have good reason to believe that the above method has been the means of curing several of my young cattle, as I never saw any that took that disease, and no means used for their recovery, but died; those I opened, had all the blood collected in the affected quarter. I find it more difficult to cure in the fore quarters than in the hinder, and if it seize the bowels, I hardly think that it will cure by any means.


The name of the rot in sheep, and the ravages that are annually made by it among the flocks of most sheep districts, are familiar to every one; but little pains have been taken to fix the precise meaning of the word, and the particular disease, to denote which it should be exclusively employed. Some of those who appear to have paid particular attention to the subject, have yet followed the example of shepherds and farmers, in confounding under the name of rot, several diseases which differ considerably in their nature, causes, and method of treatment. Two medical men who have lately published; the one, Dr Dickson, on the General Management of Sheep, as connected with practical agriculture; the other, Dr Harrison, on this particular subject of the rot, have still considered it as one disease. In the second appendix to Mr Findlater’s Surgery of People, and in the fourth number of the Edinburgh Medical and Surgical Journal, the distinction of the rot into three different morbid affections is, however, clearly marked; and there seems no doubt that these three diseases are very similar to consumption, hepaticis or inflammation of the liver, and scurry, in the human body. The first of those which we have briefly noticed in No. 450, under the name of pulmonic rot, is distinguished by cough, hectic fever, wasting of flesh, and in many cases by the formation of a watery swelling below the chin. The second, mentioned by the name of hepatic rot in No. 453, is characterized by a degree of fever accompanied by inflammation, and thickening of the outer coat of the liver, or some diseased state of the biliary ducts or pipes, connected with the presence of flakes in the liver, if not sometimes produced by them. The third species has been called general rot, as in this the whole system is more or less affected; true rot, because it appears to be the most common of the three, and to be that to which the name seems more particularly applicable; and hydroptic rot; because, if the animal is suffered to live, the disease commonly terminates in partial or general dropsy. This species is what we are now to consider; and after having given as clear an account of it as we can collect from the descriptions that have been lately published, we shall make a few observations on the causes, treatment, and prevention of the rot in general, endeavouring as much as possible to discriminate between the three varieties.

It is probable that the first symptoms of the rot have seldom been observed. The earliest marks of the disease of which writers give an account, are, falling of in flesh, and unusual dullness and heaviness. The flesh feels loose and flabby, especially about the loins; and if pressure is made about the hips, a cracking is sometimes perceptible. It is said that those who are accustomed to handle the cars and legs of sheep, may in the earliest stage of rot discover symptoms of low fever, but probably this is only the case in pulmonic and hepatic rot. Now, on soon afterwards, the countenance looks pale, as do the gums and tongue. On parting the fleece, the skin is found to have lost its fine rosy colour, and is become of a pale red. As the disease advances, the skin appears depilated with yellow and black spots. The eyes have a peculiar appearance; they lose their lustre, and look like the eyes of dead fish. Mr Findlater says, that in Tweeddale, the principal mark of rottenness is taken from the appearance of the eye in the corner next the nose, when the eyeball is turned so as to look away from the nose; as the flesh that adjoins to the eyeball below the eyelids, in the corner next the nose, is in a sound sheep of a florid red colour: whereas, in a rotten sheep, the flesh is of a dull appearance, and of a yellowish red colour, resembling that of a rotten egg, when the white and the yolk are confounded together. When the disease has continued long, the breath becomes fetid, the gums spongy, the teeth and sometimes the horns loose, the animal is commonly affected with a souring, the fleece looks torn and ragged, and the whole separates from the skin with a slight pull. Great weakness and anæmia attend the latter stage of the disease; and these continually increase till the animal dies, or till dropsy comes on, which always terminates fatally.

The principal appearance on dissection is presented by the liver, which is found in various states, according to the progress or severity of the disease. When a sheep is killed a few days after contracting the rot, the thin edge of the small lobe of the liver appears of a transparent white or bluish colour, and this colour spreads to a greater extent according to the severity of the complaint. Sometimes it does not extend more than an inch from the edge; at others it occupies a considerable part of the lobe. In severe cases, the whole external coat of the liver is found diseased, commonly assuming an opaque colour interspersed with lines or patches of a darker red. The upper end of the liver is sometimes found speckled like the back of a toad, to which it is said to bear a striking resemblance. Very commonly the liver is found full of hard knots, and sometimes there are ulcers in various parts of it. Are not some of these appearances peculiar to the hepatic rot? When the liver of a sheep affected with the rot is boiled, it loses its consistency, and breaks down into small pieces; whereas it is well known that a sound liver becomes, by the same process, firm and solid. When sheep have died suddenly, in the first stage of this disorder, there may commonly be discovered a quantity of wheyish-coloured fluid in the cavity of the belly; and in these cases the outside of the liver is generally covered with a coat of coagulable lymph. This is one of the appearances described by Dr Harrison; and is similar to what is often observed in the belly of animals that have died of dropsy in the belly.

In stating the causes and treatment of general rot, we...
Eight causes have been assigned for the production of rot, viz.

1. A vitiated dew. It is stated in the Survey of Lincolnshire, that a shepherd, who, when young, was shepherd's boy to an old man who lived at Nettlem near Lincoln, a place famous for the rot, declared his persuasion that sheep took the rot, only in a morning before the dew was well off. His master's sheep always kept his flock in fold till the dew was gone, and with only this attention his sheep were kept sound when all his neighbours lost their flocks. Dr Harrison remarks, that if this cause were just, the rot should appear equally on all lands.

2. The disease has been attributed to a crust or earthy sediment that adheres to the grass after wet weather, or after the overflowing of running water.

3. It has been supposed to be owing to the luxuriant and quick growing herbage that is produced in hot moist seasons. But all luxuriant pastures do not produce the rot.

4. It has been attributed to the sheep grazing on some particular herbs, such as the butterwort (Pinguicula vulgaris), the white rot (Hydrocotyle vulgaris), round-leaved sundew (Drosera rotundifolia), and long-leaved sundew (Drosera longifolia); but these plants do not grow on every rotting soil.

5. The disorder has been impputed to fluxes in the liver. We have already stated our opinion, that fluxes may produce the hepatic rot.

6. The rot has been supposed to depend on the infection of sheep-pox. This opinion seems to have arisen from a confusion of terms.

7. M. Daubenton considered the disease to be produced by poverty of food, and too much water. There is no doubt that these causes commonly produce the last species of rot which we have mentioned.

8. Dr Harrison is of opinion that the rot is always Dr Harrison's Inquiry.

The following facts with respect to the production of rot, considered as a general disease, are chiefly taken from Dr Harrison's Inquiry.

Poor, clayey, and loamy lands are most subject to rot.

Grounds that are always dry, or always under water, and such as are always sufficiently wet to preserve a constant running of water, were never known to suffer from the rot.

Ponds of living water are equally safe; but when attempts to drain lands have been made, and have not fully succeeded, sheep which feed on such lands are very much exposed to the rot.

Grounds newly laid down for pasture, or ploughed fields that have been exhausted by repeated crops, where the sward is thin, and where the water remains in plashes for want of proper outlets, are peculiarly subject to the rot.

Marshes that are overflowed by the sea, and boggy situations, especially in Ireland, are seldom known to rot.

Lands that have been limed, and many soils that are chiefly composed of calcareous matter, are considered as very likely to produce the rot.

Ewes that are with lamb, or are giving suck, are less liable than other sheep to be affected with the rot.

3
INDEX.

A

ABORTION, No. 462

Absorbents, 293, b, c, f.

Absorption, morbid symptoms of, 304

Abruptus, a writer on farriery, 27

Age of a horse, mode of ascertaining, 102

Alexander's, Mr, probang, 493

Aces, 275, c.

Alternatives, 285

Alum, 281, a, 293, a.

Ammonia, 338

Ammoniac, gum, 265, a.

Anatomy necessary to a farriery, 13

Ancestrum, 431

Anger-berries, 326

Aniseed, 285, c.

Anodyne, 289

receipts for,

Antalkalines, 293, a, i, k.

Antimonial powder, 263, b, 267, d.

Antimony, 263, a, 267, c.

butter of, 293, c.

calm or oxide of, 267, e.

Antiseptics, 285, 293, a, d, k, f.

Antispasmodics, 285

receipts for,

Anxiety, 314

Vol. VIII. Part II.

Appetite, loss of,

Aromatic, 285

Arteries, wounds of, 430

Asafetida, 265, b.

Asarabacca, 275, a.

Ascarides, 473

Acidis, 523

Astringents,

receipts for,

Back-raking,

sinew, claw or strain of,

rupture of,

Balls, directions for preparing,

administering,

cordial,

Bars of the horse's hoof, 265, d, 269, a, 285, a.

Barm, 64

Barlett's work on farriery, 518

Baths,

Bays, oil of, 295, f.

Bistort, No. 281, b.

Black quarter, or black spald, 525

Bladder, inflammation of, 502

Blaine's instructions for studying farriery, 19

works on veterinary medicine, 91

Bleeding, 159

place of performing,

cases requiring, 165

cautions respecting, 166

danger of a ligation in,

the blood to be saved, 160

securing the orifice, 163

in the temporal artery, 164

topic, 167

Blindness, 319

partial, 321

total, 322

moon, 324

Blisters, 285, f.

Blew in cattle, 404

Blundeville's work on horses, 56

Boog-spavin, 366

Boardman's dictionary, 83

Body-founder, 499

Bones of the horse's foot, 114

Bots, 409, 412

- Bourgeac's
FARRIERY.

Cold, common, \( \text{No} 485 \)
Coleman, Mr., appointed professor of the veterinary college, 75
works of, 77
artificial frog, 156
method of treating wounds in the joints, 331
Colon of the horse, 112
Colic, 518
inflammatory, 497
Colomella's writings on farriery, 34
Contracted feet, 383
Cooling remedies, 279
receipts for, 280
Cardinals, 285
Cords, 375
Corns, 503
Coronary ligament, 129
Cornea, opacity of, 335
Costiveness, 457
Cough, chronic, 436
Cows, delivery of, 187
London mode of feeding, 237
Cottages, 206
pox, originates in grease, 479
Cropping, 179
Crest of the horse's hoof, 122
Culley's work on cattle, 89
Cummis, 285, 0.
Curb, 372
Cutting, 391

D
Daniel's Rural Sports, 94
remarks on the worring of dogs, 517
Dark ages, state of farriery in the, 186
Delivery, 186
of cows in cross positions, in cases of preternatural obstruction, 188
Denny's work on horses, 80
Depression of spirit, 315
Diabetes, 544
Diarhœa, 452
Dickson's practical agriculture, 93
Diet of domestic animals, 218
Digestion, morbid, symptoms of, 393
Diseases of man and animals similar, 10
classification of, 312
Distemper in dogs, 487
Diarritics, 269
receipts for, 270
Docking, first used in England, 176
absurdity of, 177
how performed, 178
Dogs, food of, 298
vegetable food, 240
oatmeal, 234
barley-meal, 242
Dog kennels. See Kennel.
Dowring's work on cattle, 87
Drenches, directions for preparing, administering, 254

Dressing of horses, 58
Dropey of the beast, of the enter, 65
belly, 77
Drouinisme, 56
Dysentery, 59

Ears of horses should be kept med., 45
Eggs, 56
Eleacompone, 59
Emetics, 62
powder for dogs, 65
Emetick tartar, 64
Emollients, receipts for, 67
Enquiries to be made by her, 59
Epidemy, 72
Epithelpiasia, See Simian
Epsom salt, 49
Errhines, 59
Eves mode of rearing cubs, 70
Ether, 49
Exemelus, a writer on farriery, 72
Excavation, morbid, symptoms of, 73
Exercice, 73
Expectorant, 74
receipts for, 74
Eyes, inflammation of, glass, sound, marks of, 74
F
Falling of the fundament, of the penis, 77
womb, 79
False quarter, 80
Farry, water, 80

Farrery, origin of the term, extended application defined, importance of, to farriery, to farmers' &c. gentlemen, to medical men, much indebted to men, knowledge required in practice of, instructions for means of improving. early history of progress of, in Great Britain, in France, 78

Fatigue, 242
Feeders of dogs, duties of, 242
Feeding, feed, 242
Fennel, 87
Feron's works on farriery, 254
Fever, inflammatory, 255
putrid, 255
# Index.

<table>
<thead>
<tr>
<th>Term</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Findlater's survey of Pooleys, remarks on sheep shelter</td>
<td>209</td>
</tr>
<tr>
<td>Firing</td>
<td>174</td>
</tr>
<tr>
<td>Flux</td>
<td>452</td>
</tr>
<tr>
<td>Fly in sheep</td>
<td>336</td>
</tr>
<tr>
<td>Fog-sickness</td>
<td>404</td>
</tr>
<tr>
<td>Fomentations</td>
<td>261</td>
</tr>
<tr>
<td>Food of horses</td>
<td>219</td>
</tr>
<tr>
<td>beans</td>
<td>221</td>
</tr>
<tr>
<td>carrots</td>
<td>223</td>
</tr>
<tr>
<td>times of feeding</td>
<td>223</td>
</tr>
<tr>
<td>hay</td>
<td>224</td>
</tr>
<tr>
<td>oat straw</td>
<td>227</td>
</tr>
<tr>
<td>ground corn</td>
<td>228</td>
</tr>
<tr>
<td>of cattle</td>
<td>230</td>
</tr>
<tr>
<td>dogs</td>
<td>238</td>
</tr>
<tr>
<td>preparation of</td>
<td>243</td>
</tr>
<tr>
<td>administration of</td>
<td>245</td>
</tr>
<tr>
<td>Foot of the horse, anatomy of, its importance</td>
<td>443</td>
</tr>
<tr>
<td>Fowls</td>
<td>386</td>
</tr>
<tr>
<td>Founder</td>
<td>378</td>
</tr>
<tr>
<td>body</td>
<td>499</td>
</tr>
<tr>
<td>Forglove</td>
<td>389, a.</td>
</tr>
<tr>
<td>Fractures</td>
<td>361</td>
</tr>
<tr>
<td>of the haunch-bone</td>
<td>362</td>
</tr>
<tr>
<td>Freeman's work on the foot of the horse</td>
<td>82</td>
</tr>
<tr>
<td>First</td>
<td>518</td>
</tr>
<tr>
<td>Flog of the horse's foot</td>
<td>125</td>
</tr>
<tr>
<td>does not support the weight of the horse</td>
<td>126</td>
</tr>
<tr>
<td>importance of its receiving pressure</td>
<td>127</td>
</tr>
<tr>
<td>Coleman's artificial</td>
<td>156</td>
</tr>
<tr>
<td>Fundament, falling of</td>
<td>420</td>
</tr>
</tbody>
</table>

# FARRIERY.

<table>
<thead>
<tr>
<th>Term</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gunammoniac, arabic, dragnet</td>
<td>265, a. 277, c. 277, d.</td>
</tr>
<tr>
<td>Gutta percha</td>
<td>323</td>
</tr>
<tr>
<td>Habitation of domestic animals</td>
<td>190</td>
</tr>
<tr>
<td>Harrison on the rot</td>
<td>95</td>
</tr>
<tr>
<td>Hartzum, theory of the rot in sheep</td>
<td>530</td>
</tr>
<tr>
<td>Hastey's on sheep</td>
<td>51</td>
</tr>
<tr>
<td>Hay, beefed, much relied on by horses and cattle</td>
<td>224</td>
</tr>
<tr>
<td>Hellictor, white,</td>
<td>281, f.</td>
</tr>
<tr>
<td>Hamlock</td>
<td>280, 6.</td>
</tr>
<tr>
<td>Henbane</td>
<td>280, c.</td>
</tr>
<tr>
<td>Hiebound</td>
<td>328</td>
</tr>
<tr>
<td>Hierocles, a writer on farriery</td>
<td>27</td>
</tr>
<tr>
<td>History of farriery, importance of</td>
<td>22</td>
</tr>
<tr>
<td>Hocks, or haukes</td>
<td>428</td>
</tr>
<tr>
<td>Hosp of the horse</td>
<td>121</td>
</tr>
<tr>
<td>Horse,</td>
<td>436</td>
</tr>
<tr>
<td>Hop,</td>
<td>289, d.</td>
</tr>
<tr>
<td>Horse, skeleton of</td>
<td>99</td>
</tr>
<tr>
<td>symptoms of, in dogs, as related by Meynell</td>
<td>513</td>
</tr>
<tr>
<td>progress of, among a pack of hounds</td>
<td>514</td>
</tr>
<tr>
<td>effect of immersion in curing</td>
<td>515</td>
</tr>
<tr>
<td>prevention of</td>
<td>516</td>
</tr>
<tr>
<td>Hygiene, importance of</td>
<td>17</td>
</tr>
<tr>
<td>I</td>
<td></td>
</tr>
<tr>
<td>Jalap,</td>
<td>273, e.</td>
</tr>
<tr>
<td>Japan earth</td>
<td>281, e.</td>
</tr>
<tr>
<td>Juvenile</td>
<td>441</td>
</tr>
<tr>
<td>Jaw, locked</td>
<td>509</td>
</tr>
<tr>
<td>Jejunum and ilium of the horse little different from the human</td>
<td>109</td>
</tr>
<tr>
<td>Jenner's account of cow-pox</td>
<td>478</td>
</tr>
<tr>
<td>Immersion, effects of, in curing canine madness</td>
<td>515</td>
</tr>
<tr>
<td>Ignition</td>
<td>450</td>
</tr>
<tr>
<td>Indifference</td>
<td>459</td>
</tr>
<tr>
<td>Indigestion, acute</td>
<td>406</td>
</tr>
<tr>
<td>Inflammation of the brain, eye, lungs, liver, stomach, intestines, kidneys</td>
<td>483, 501</td>
</tr>
<tr>
<td>Inflammation of the bladder</td>
<td>502</td>
</tr>
<tr>
<td>Influenza</td>
<td>486</td>
</tr>
<tr>
<td>Insensibility</td>
<td>317</td>
</tr>
<tr>
<td>Intestines of the horse, small, large</td>
<td>108 110</td>
</tr>
<tr>
<td>inflammation of</td>
<td>497</td>
</tr>
<tr>
<td>Iron, muriate of</td>
<td>281, d.</td>
</tr>
<tr>
<td>Iron</td>
<td>330</td>
</tr>
<tr>
<td>Kennel, construction of</td>
<td>210</td>
</tr>
<tr>
<td>duke of Richmond's</td>
<td>211</td>
</tr>
<tr>
<td>size of</td>
<td>212</td>
</tr>
<tr>
<td>lodging room of</td>
<td>214</td>
</tr>
<tr>
<td>doors of</td>
<td>215</td>
</tr>
<tr>
<td>inner court of</td>
<td>216</td>
</tr>
<tr>
<td>Kidneys, inflammation of</td>
<td>501</td>
</tr>
<tr>
<td>Kino</td>
<td>281, f.</td>
</tr>
<tr>
<td>L</td>
<td></td>
</tr>
<tr>
<td>Laffosse, sen. work on farriery, method of shoeing, jun. works on farriery</td>
<td>48 335 39</td>
</tr>
<tr>
<td>Lake-burn</td>
<td>496</td>
</tr>
<tr>
<td>Lameness</td>
<td>343</td>
</tr>
<tr>
<td>Lampas</td>
<td>401</td>
</tr>
<tr>
<td>Lard, hog's</td>
<td>277, e.</td>
</tr>
<tr>
<td>Lawrence's, John, proposal for improving veterinary practice, works</td>
<td>21 86</td>
</tr>
<tr>
<td>Rich. works on horses</td>
<td>86</td>
</tr>
<tr>
<td>Lawson's food for horses and cattle</td>
<td>229</td>
</tr>
<tr>
<td>Laying's works on murrain</td>
<td>67</td>
</tr>
<tr>
<td>account of</td>
<td>472</td>
</tr>
<tr>
<td>Lead, sugar of, white</td>
<td>279, d. 395, d.</td>
</tr>
<tr>
<td>Leanness</td>
<td>422</td>
</tr>
<tr>
<td>Lice and fleas</td>
<td>335</td>
</tr>
<tr>
<td>Ligaments of the horse's foot</td>
<td>120</td>
</tr>
<tr>
<td>injuries of</td>
<td>315</td>
</tr>
<tr>
<td>Ligature in bleeding, danger of</td>
<td>160</td>
</tr>
<tr>
<td>Lights, rising of the</td>
<td>489</td>
</tr>
<tr>
<td>Lime</td>
<td>353, c.</td>
</tr>
<tr>
<td>Linne's Pan Suecicus</td>
<td>52</td>
</tr>
<tr>
<td>Linseed</td>
<td>277, f.</td>
</tr>
<tr>
<td>Liquorice</td>
<td>277, 8.</td>
</tr>
<tr>
<td>Liver, inflammation of</td>
<td>392</td>
</tr>
<tr>
<td>Louts</td>
<td></td>
</tr>
<tr>
<td>Loosness</td>
<td>452</td>
</tr>
<tr>
<td>Long</td>
<td>450</td>
</tr>
<tr>
<td>Loy's experiments on the connexion of grease with cow-pox</td>
<td>479</td>
</tr>
<tr>
<td>Lumbrie</td>
<td>412</td>
</tr>
<tr>
<td>Lungs, inflammation of the</td>
<td>419</td>
</tr>
<tr>
<td>M</td>
<td></td>
</tr>
<tr>
<td>Mallenders and saltenders</td>
<td>237</td>
</tr>
<tr>
<td>Mange in horses</td>
<td>330</td>
</tr>
<tr>
<td>cattle</td>
<td>331</td>
</tr>
<tr>
<td>sheep</td>
<td>332</td>
</tr>
<tr>
<td>dogs</td>
<td>333</td>
</tr>
<tr>
<td>treatment of</td>
<td>334</td>
</tr>
<tr>
<td>Marsham's works on farriery</td>
<td>58</td>
</tr>
<tr>
<td>Marshmellowes</td>
<td>277, 4.</td>
</tr>
<tr>
<td>Materia</td>
<td></td>
</tr>
</tbody>
</table>
FAIRIERY.

Eastern bone, small, 117
Poulet's work on murrains, 45
Pelt rot, 340
Pembroke's, Lord, work on horses, 69
remarks on shoeing, 137
Pepper, 285, c. c.
Peppermint, 285, b. b.
Peruvian bark, 238, g.
Petegoniuss, a writer on farriery, 27
Peripneumonia, 489
Phrenes, 485
Physiology necessary to a farrier, 13
Piaining in lambs, 455
Pissing-evil, 524
of blood, 450
Plahora, 427
Pleurisy, 489
Poison, 407
Pole-evil, 395
Pomegranate, 281, i.
Poppy, 289, f.
Potash, 269, d.
Powders, 251
Fox, sheep, 477
cow, 478
Promiscuous, 285, n.
Practice of farriery, 19
Precipitate, red, 338
Puckeridge, 434
Pulse in different animals, 425
method of feeling,
Pummiced feet, 358
Purges, 270
absurdity of giving to horses
indiscriminately, 271
should not be preceded by
strong exercise, 272
receipts for,

Purging in horses, 442
in cattle, 453
in calves, 454
in lambs, 455
in dogs, 456

Quarter-ill, 525
Quasnia, 283, f.
Quitter, 347
R.
Rectum of the horse, 113
Refrigerants, 229
Respiration, morbid, symptoms of, 306
Restlessness, 314
Reynier's work on cattle, 51
Rheumatism, 488
Richmond's, duke of, kennel, 211
Riding's veterinary pathology, 79
Ring-bone, 373
Roarer, 436, 437
Ronden's work on farriery, 41
Rostrum, 269, e.

Rot, pulmonary, 490
hepatic, 493
pel, 340
foot, 387
general, 526

Index.

Rowels, mode of making, 168
situations proper for, 169
when improper, 170

Rossier's work on animals, 44
Ruelli's collection on farriery, 27
Ruin's anatomy of the horse, 30
Rupture, 419

S
St Bel, M. account of, 73
Sal ammoniac, 279, q.
Indicas, 201, c.
Salt, common, 273, s. 285, e. 201, d.
spirit of, 279, c. 203, h.
steel, 283, d.

Sandcracks, 385
Saunier's work on horses, 49
Savage's work on murrain, 34
Scab, 331, 332
Secretion, morbid, symptoms of, 307
Sensation, morbid, symptoms of, 301
Sensibility, morbid, 311
Sedatives. See Anodynes.

Sennaidbones, 116
Setons described, 171
use of, 171
mode of introducing, 173

Sheep cote, 109

Shoeing horses, principles of, 139, 140
origin of, 137
common method of, 133
its defects, 134
Lafosse's method, 132
Osmer's do., 136
Lord Pembroke's do., 137
Clark's do., 138
Coleman's do., 139, 154
Morecroft's do., 155
shoe to be adapted to the hoof, 144
changes to be made gradually, 146
Coleman's ordinary shoe, 152
of oxen, 157

Shoulder-slip, 354
Sinagogues, 276
Silver, 293, g.

Sinclair's, Sir J. remarks on cattle, 232
Skeleton of the horse described, 99
Stopping the calf or foal, 461
Snape's anatomy of the horse, 61

Sores or scabul, 435

Soap, 269, f. 273, g.

Sole of the hoof, horny, 123
sensible, 128

Soley's work on farriery, 23
Sough, 483
Spinus, 366, 371, 433
Spaying, 184
Sprits, 285, d. d.
Spleents, 370
Squill, 265, h.

Stables should be dry and elevated, 191
double, improper, 193
should not be low in the roof, 194
stalls of, 195
flooring of, 196
Stables,
FARRIERY.

Teeth of the horse described, 109
Temporal artery, mode of opening, 164
Tenon's account of sheep-pox, 257
Theomenes, a writer on farriery, 27
Thorougbred, 367
Thorter, 508
Thrash, running, 384
Ticks, 337
Tin, 291
Tobacco, 269, 275
Tongues, 283
Topical bleeding, 367
Tormentil, 281
Tread, 180
Trimming horses ears absurd, 346
Turbithe mineral, 263, c.
Turpin, 318
Turpentine, 269, a. 285, 8.

Tinct of London, established
examinating committee of, 76
method of shoeing in, 139
Vinegar, 279, 293, 2
Vitellus work on veterinary medicine, 43
Vitriol, blue, 283, 2
white, 281, m.
Vitriotic acid, 279, 2. 281, 2.

U
Urethra, 394
Urine, incontinence of, 443
Urine, suppression of, 444
from distention of the bladder, 443
bloody, 459
W
Warble, 338
Warts, 326
Water, red, 430
black, 451
Weight of horse, 449
for a coach horse, 350
for a saddle horse, 351

Wheat given to horses on the continent, 220
White's work on the veterinary art, 81
Wind, broken, 437
thick, 438

Wind-galls, 365
Withers, insidious, 396
Womb, falling of the, 461
Worms, 408
Worm medicines, 291

Worms, 338
Worming of dogs, 517
Wounds, 348

X
Xenophon's work on horsemanship, 30

Y
Yeasts, 393, 4

Z
Zinc, 295, 5.

FAR

Farthing. FARTHING, a small English copper coin, amounting to one-fourth of a penny. It was anciently called farthing, as being the fourth of the integer or penny.

Farthing of Gold, a coin used in ancient times, containing in value the fourth part of a noble, or 20d. silver. It is mentioned in the stat. 5 Hen. V. cap. 7. where it is enacted, that there shall be good and just weight of the noble, half-noble, and farthing of gold.

Farthing of Land seems to differ from Farrindale. For in a survey-book of the name of West-Hapton in Devonshire, there is an entry thus: A. B. holds six farthings of land at 126l. per annum. So that Farthing, the farthing of land must have been a considerable quantity, far more than a rood.

FASCES, in Roman antiquity, axes tied up together with rods or staves, and borne before the Roman magistrates as a badge of their office and authority.

According to Florus, the use of the fascs was introduced by the elder Tarquin, the fifth king of Rome; and were then the mark of the sovereign dignity. In after times they were borne before the consuls, but by turns only, each his day; they had each of them 12, borne by as many licenti. These fascs consisted of branches,
branches of elm; having in the middle a securis or axe, the head of which stood out beyond the rest. Publiola took the axe out of the fasces, as Piatarch assures us, to remove from the people all occasion of terror. After the consuls, the pretors assumed the fasces. In the government of the decemvirs, it was the practice at first for only one of them to have the fasces. Afterwards, each of them had twelve after the manner of the kings.

When the magistrates who by right had the axes carried before them, had a mind to show some deference to the people, or some person of singular merit, they either sent away the lectors, or commanded them to lower the fasces before them, which was called submitttere fasces. Many instances of this occur in Roman history.

FASCETS, in the art of making glass, are the irons thrust into the mouths of bottles, in order to convey them to the annealing tower.

FASCIA, in antiquity, a thin sash which the Roman women wrapped round their bodies, next to the skin, in order to make them slender. Something of this sort seems also to have been in use amongst the Grecian ladies, if we can depend upon the representation given by Terence, Eun. act ii. sc. 4.

Haud simulai est virginum nostrarum, quas matres student
Demissis humeris esse—vingt corpore, ut gracies iunt.

FASCIA, in Architecture, signifies any flat member having a considerable breadth and but a small projection, as the band of an architrave, lambier, &c. In brick buildings, the jettings out of the brick beyond the windows in the several stories except the highest are called fascias or fascie.

FASCIA Later, in Anatomy, a muscle of the leg, called also semi-membranous. See Anatomy, Table of the Muscles.

FASCIA, in Astronomy, the belts seen on the disk of the superior planets, Mars, Jupiter, and Saturn.—See Astronomy, parasim.

FASCIALIS, in Anatomy, one of the muscles of the thigh, called sartorius. See Anatomy, Table of the Muscles.

FASCINATION, from the Greek fascinare, to fascinate or bewitch, a sort of witchcraft supposed to operate either by the eye or the tongue. Ancient writers distinguish two sorts of fascination, one performed by looking, or the efficacy of the eye. Such is that spoken of by Virgil in his third eclogue:

Nescio quis teneros occlus mihi fascinat agnos. The second by words, and especially by malignant praises. Such is that mentioned by the same poet in his seventh eclogue:

Aut, si ultra placitum laudavit, baccare frontem
Cingite, ne voti noceat mala lingua futura.

Horace alludes to both kinds in his first book of epistles:

Non istic obliquo oculo mea commoda quisquam
Limat, non odio obscuro, mortuque venenat.

FASCINATION of serpents, a faculty which these animals are supposed to possess of attracting birds from the air, and making them their prey. See Ophiology.

FASCINES, in Fortification, faggots of small wood, of about a foot diameter, and six feet long, bound in the middle, and at both ends. They are used in raising batteries, making chandeliers, in filling up the moat to facilitate the passage to the wall, in binding the ramparts where the earth is bad; and in making parapets of trenches to screen the men. Some of them are dipped in melted pitch or tar; and, being set on fire, serve to burn the enemy’s lodgments or other works.

In corrupt Latin fascemnia, fascemnia, and fasciaca, &c. are used to signify the pales, fascines, &c. used to enclose ancient castles, &c.

FASCIOLA, the FLUKE OR GOURD WORM, a genus belonging to the order of vermex intestina. See Helminthology.

FASHION-Pieces, in the sea-language, the utmost or bindmost timbers of a ship, which terminate the breadth, and form the shape of the stern. They are united to the stern-post, and to the extremity of the wing-transom, by a rabit, and a number of strong nails or spikes driven from without.

FAST, in general, denotes the abstinence from food, (see FASTING); but in some particular cases it is used for such abstinence on a religious account.

Religious fasting has been practiced by most nations from the remotest antiquity. Some divines even pretend its origin was in the earthly paradise, where our first parents were forbidden to eat of the tree of knowledge. But though this seems carrying the matter too far, it is certain that the Jewish church has observed fasts ever since its first institution. Nor were the neighboring heathens, viz. the Egyptians, Phoenicians, and Assyrians, without their fasts. The Egyptians, according to Herodotus, sacrificed a cow to Isis, after having prepared themselves by fasting and prayer; a custom which he likewise ascribes to the women of Cyrene.

Porphyry affirms, that the Egyptians, before their stated sacrifices, always rested a great many days, sometimes for six weeks; and that the least behaved to be for seven days; during all which time the priests and devotees not only abstained from flesh, fish, wine, and oil; but even from bread, and all kinds of pulse. These austerities were communicated by them to the Greeks, who observed their fasts much in the same manner. The Athenians had the Eleusinian and Themophorian fasts, the observation of which was very rigorous, especially among the women, who spent one whole day sitting on the ground in a mournful dress, without taking any nourishment. In the island of Crete, the priests of Jupiter were obliged to abstain all their lives from fish, flesh, and baked meats. Apuleius informs us, that whoever had a mind to be initiated in the mysteries of Cybele were obliged to prepare themselves by fasting ten days; and, in short, all the pagan deities, whether male or female, required this duty of those that desired to be initiated into their mysteries, of their priests and priestesses that gave the oracles, and of those who came to consult them.

Among the heathens fasting was also practised before some of their military enterprises. Aristotle informs us, that the Lacedaemonians having resolved to succour a city of the allies, ordained a fast throughout the
Fasting has always been reckoned a particular duty among philosophers and religious people, some of whom have carried their abstinence to an incredible length. At Rome it was practised by kings and emperors themselves. Numa Pompilius, Julius Caesar, Augustus, Vespasian, and others, we are told, had their stated fast days: and Julian the apostate was so exact in this observance as to outdo the priests themselves, and even the most rigid philosophers. The Pythagoreans kept a continual fast; but with this difference, that they believed the use of fish to be equally unlawful with that of flesh. But their constant temperance, they also frequently fasted rigidly for a very long time. In this respect, however, they were all outdone by their master Pythagoras, who continued his fasts for no less than 50 days together. Even Apollonius Tyaneus, one of his most famous disciples, could never come up to him in the length of his fasts, though they greatly exceeded those of the ordinary Pythagoreans. The Gymnosophists, or Brahmins of the east, are also very remarkable for their severe fastings; and the Chinese, according to Father Le Comte, have also their stated fasts, with forms of prayer for preserving them from barrenness, inundations, earthquakes, &c. The Mahometans too, who possess so large a part of Asia, are very remarkable for the strict observance of their fasts; and the exactness of their devotions in this respect is extraordinary.

Fasting was often used by the heathens for superstitious purposes; sometimes to procure the interpretation of dreams; at others, to be an antidote against their pernicious consequences. A piece of superstition prevails to this day among the Jews, who, though expressly forbidden to fast on Sabbath days, think themselves at liberty to dispense with this duty when they happen to have frightful and unlucky dreams the night preceding, that threatened them with great misfortunes. On these occasions they observe a formal fast the whole day; and at night the patient, having invited three of his friends, addresses himself to them seven times in a very solemn manner, saying, "May the dream I have had prove a lucky one!" And his friends answer as many times, "Amen, may it be lucky, and God make it so!" After which, in order to encourage him, they conclude the ceremony with those words of Ecclesiastes, "Go eat thy bread with joy;" and then set themselves down to table. They have also added several fasts not commanded in the law of Moses, particularly three, in memory of some distresses their nation has suffered at different times. The abstinence of the ancient Jews commonly lasted 27 or 28 hours at a time; beginning before sunset, and not ending till some hours after sunset next day. On these days they were obliged to wear white robes in token of grief and repentance; to cover themselves with sackcloth, or their worst clothes; to lie on ashes; to sprinkle themselves with ash and water, and on their head, &c. Some spent the whole night and day following the temple or synagogue, in prayers and other devotions, barefooted, with a scourge in their hands, of which they sometimes made a good use in order to raise their zeal. Lastly, in order to complete their abstinence, at night they were to eat nothing but a little bread dipped in water, with some salt for seasoning; except they chose to add to their repast some bitter herbs and pulse.

The ancients, both Jews and Pagans, had also their fasts for purifying the body, particularly the priests and such as were any way employed at the altars; for when nocturnal disorders happened to these, it was unlawful for them to approach the next day, which they were bound to employ in purifying themselves. On this account at great festivals, where their ministry could not be dispens'd with, it was usual for them, on the eve thereof, not only to fast, but also to abstain from sleep, for the greater centrality. For this purpose the high priest had under officers to wake him, if overtaken with sleep; against which other preservatives were also made use of.

FASTERMANS, or FASTING-MEN, q. d. homines abstinentes, was used in our ancient customs for men in repute and substance; or rather for pledges, sureties, or bondsmen; who, according to the Saxon polity, were fast bound to answer for one another's peaceable behaviour.

FASTI, in Roman antiquity, the calendar wherein were expressed the several days of the year, with their feasts, games, and other ceremonies.

There were two sorts of fasti, the greater and less: the former being distinguished by the appellation fasti magistriales, and the latter by that of fasti calendares.

1. The fasti calendares, which were properly and primarily called fasti, are defined by Festus Pompeius in his books containing a description of the whole year: i.e. ephemerides, or diaries, distinguishing the several kinds of days, fasti, profesti, fasti nefasti, &c. The author of these was Numa, who committed the care and direction of the fasti to the pontifex maximus, whom the people used to consult on every occasion. This custom hold till the year of Rome 450, when C. Flavius, secretary to the pontifices, exposed in the forum a list of all the days on which it was lawful to work; which was so acceptable to the people, that they made him curule edile.

These lesser fasti, or fasti calendares, were of two kinds, urbani and rustici.

The fasti urbani, or fasti of the city, were those which obtained or were observed in the city. Some will have them thus called, because they were exposed publicly in divers parts of the city; though by the various inscriptions or gravings thereof on antique stones, one would imagine that private persons had them likewise in their houses. Ovid undertook to illustrate these fasti urbani, and comment on them, in his Libri Fastorum.
Fastorum, whereof we have the first six books still remaining; the last six, if ever they were written, being lost.

In the fasti rustici, or country fasti, were expressed the several days, feasts, &c. to be observed by the country people: for as they were taken up in tilling the ground, fewer feasts, sacrifices, ceremonies, and holidays, were enjoined them than the inhabitants of cities; and they had also some peculiar ones not observed at Rome. These rustic fasti contained little more than the ceremonies of the kalends, nones, and ides; the feasts, signs of the zodiac, increase and decrease of the days, the tutelary gods of each month, and certain directions for rural works to be performed each month.

2. In the greater fasti, or fasti magistrates, were expressed the several feasts, with every thing relating to the gods, religion, and the magistrates; the emperors, their birth-days, offices, days consecrated to them, and feasts and ceremonies established in their honour, or for their prosperity, &c. With a number of such circumstances did flattery at length swell the fasti; when they became denominated Magni, to distinguish them from the bare kalendars, or fasti kalendraes.

Fasti was also a chronicle or register of time, where-in the several years were denoted by the respective consuls, with the principal events that happened during their consulates; these were called also fasti consulares, or consular fasti.

Fasti, or Dies Fasti, also denoted court days. The word fasti, fastorum, is formed of the verb furii, "to speak," because during those days the courts were opened, causes might be heard, and the pretor was allowed fari, to pronounce the three words, do, dico, addico: The other days wherein this was prohibited were called nefasti: thus Ovid,

Ile nefastus est, per quem tria verba silentur:
Fastus est, quern legis liceat agi.

These dies fasti were noted in the calendar by the letter F: but observe, that there were some days ex parte fasti, partly fasti, partly nefasti; i.e. justice might be distributed at certain times of the day, and not at others. These days were called intercisi, and were marked in the calendar thus; F. F. Fastos primo, where justice might be demanded during the first part of that day.

Fasting, the abstaining from food. See Fast.

Many wonderful stories have been told of extraordinary fasting; great numbers of which undoubtedly must be false. Others, however, we have on very good authority, of which some are mentioned under the article ABSTINENCE. Another we have in the

Fast ing Woman. A full account of this very uncommon case is given in the Phil. Trans. Vol. LXVII. Part I. the substance of which follows: The woman, whose name was Janet McLeod, an inhabitant of the parish of Kincardine in Ross-shire, continued healthy till she was 15 years of age, when she had a pretty severe epileptic fit; after this she had an interval of health for four years, and then another epileptic fit which continued a whole day and a night. A few days afterwards she was seized with a fever, which continued with violence several weeks, and from which she did not perfectly recover for some months. At this time she lost the use of her eyelids; so that she was under a necessity of keeping them open with the fingers of one hand, whenever she wanted to look about her. In other respects she continued in pretty good health; only she never had any appearance of menses, but periodically spit up blood in pretty large quantities, and at the same time vomited from the nose. This discharge continued several years; but at last it ceased: and soon after she had a third epileptic fit, and after that a fever from which she recovered very slowly. Six weeks after the crisis, she stole out of the house unknown to her parents, who were busy in their harvest work, and bound the sheaves of a ridge before she was observed. In the evening she took to her bed, complaining much of her heart (most probably her stomach, according to the phraseology of that country) and her head. From that time she never rose for five years, but was occasionally lifted out of bed. She seldom spoke a word, and took so little food that it seemed scarce sufficient to support a sucking infant. Even this small quantity was taken by compulsion; and at last, about Whitsunday 1763, she totally refused every kind of food or drink. Her jaw now became so fast locked, that it was with the greatest difficulty her father was able to open her teeth a little, in order to feed her with a small quantity of gruel or whey; but of this so much generally ran out at the corners of her mouth, that they could not be sensible any had been swallowed. About this time they got some water from a noted medicinal spring in Brae-Mar, some of which they attempted to make her swallow, but without effect. They continued their trials, however, for three mornings; rubbing her throat with the water, which ran out at the corners of her mouth. On the third morning during the operation, she cried out, "Give me more water; and swallowed with ease all that remained in the bottle. She spoke no more intelligibly for a year; though she continued to mutter some words, which her parents only understood, for 14 days. She continued to reject all kinds of food and drink, till June 1765. At this time her sister thought, by some signs she made, that she wanted her jaws opened; and this being done, not without violence, she called intelligibly for a drink, and drank with ease about an English pint of water. Her father then asked her why she would not make some signs when she wanted a drink? to which she answered, why should she when she had no desire. It was now supposed that she had regained the faculty of speech; and her jaws were kept open for about three weeks by means of a wedge. But in four or five days she became totally silent, and the wedge was removed because it made her lips sore. She still, however, continued sensible; and when her eyelids were opened, knew every body, as could be guessed from the signs she made.

By continuing their attempts to force open her jaws, two of the under foreteeth were driven out; and of this opening her parents endeavoured to avail themselves by putting some thin nourishing drink into her mouth, but without effect, as it always returned by the corners. Sometimes they thought of thrusting a little dough of oatmeal through this gap of the teeth, which she would retain a few seconds, and then return with something like a straining to vomit, without one particle
The doctor paid his first visit in the month of October; and five years afterwards, viz. in October 1772, was induced to pay her a second visit, by hearing that she was recovering, and had begun to eat and drink. The account given him was most extraordinary. Her parents one day returning from their country labours (having left their daughter fixed to her bed as usual), were greatly surprised to find her sitting upon her hams, on the side of the house opposite to her bed place, spinning with her mother's distaff. All the food she took at that time was only to crumble a little oat or barley cake in the palm of her hand, as if to feed a chicken. She put little crumbs of this into the gap of her teeth; rolled them about for some time in her mouth; and then sucked out of the palm of her hand a little water, whey, or milk; and this only once or twice a day, and even that by compulsion. She never attempted to speak; her jaws were fast locked, and her eyes shut. On opening her eyelids, the balls were found to be turned up under the edge of the os frontis; her countenance was ghastly, her complexion pale, and her whole person emaciated. She seemed sensible, and tractable in everything except in taking food. This she did with the utmost reluctance, and even cried before she yielded. The great change of her looks Dr. Mackenzie attributed to her spinning flax on the distaff, which exhausted too much of the saliva; and therefore he recommended to her parents to confine her totally to the spinning of wool. In 1775, she was visited again, and found to be greatly improved in her looks as well as strength; her food was also considerably increased in quantity; though even then she did not take more than would be sufficient to sustain an infant of two years of age.

The following remarkable instances of animals being able to live long without food, are related by Sir William Hamilton, in his account of the late earthquakes in Italy (Phil. Trans. vol. lxxii.). “At Soriano (says he), two fattened hogs that had remained buried under a heap of ruins, were taken out alive the 42d day; they were lean and weak, but soon recovered. Again, “At Messina two mules belonging to the dux de Belviso remained under a heap of ruins, one of them 22 days, and the other 23 days; they would not eat for some days, but drank water plentifully, and are now recovered. There are numberless instances of dogs remaining many days in the same situation; and a hen belonging to the British vice-consul at Messina, that had been locked up under the ruins of his house, was taken out the 22d day, and is now recovered; it did not eat for some days, but drank freely; it was emaciated, and showed little signs of life at first. From these instances, and those related before of the hogs at Soriano, and several others of the same kind that have been related to me, but which being less remarkable I omit, one may conclude, that long fasting is always attended with great thirst, and total loss of appetite.”

An instance of a similar kind, not less remarkable than either of the two preceding, we find in the Gentleman's Magazine for January 1785, communicated by a correspondent, as follows: “During the heavy snow which fell in the night of the 7th of January 1776, a parcel of sheep belonging to Mr. John Welley, of Matlock, in Derbyshire, which were pastured on that part of the East Moor that lies within the manor of Matlock, were covered with the drifted snow: in the course of a day or two all the sheep that were covered with the snow were found again, except two, which were consequently given up as lost; but on the 14th of February following (some time after the break of the snow in the valleys, and 38 days after the fall), as a servant was walking over a large parcel of drifted snow which remained on the declivity of a hill, a dog he had with him discovered one of the two sheep that had been lost, by wending (or scenting) it through a small aperture which the breath of the sheep had made in the snow; the servant thereupon dug away the snow, and released the captive from its prison; it immediately ran to a neighbouring spring, at which it drank for a considerable time, and afterwards rejoined its old companions as though no such sad accident had befallen it. On inspecting the place where it was found, it appeared to have stood between two large stones which lay parallel with each other at about two feet and a half distance, and probably were the means of protecting it from the great weight of the snow, which in that place lay several yards thick: from the number of stones around it, it did not appear that the sheep had been able to pick up any food during its confinement. Soon afterwards its owner removed it to some low lands; but as it had nearly lost its appetite, it was fed with bread and milk for some time: in about a fortnight after its enlargement it lost its sight and wool: but in a few weeks afterwards they both returned again, and in the course of the following summer it was quite recovered. The remaining sheep was found dead about a week after the discovery of the other.”

In the same publication is recorded the death of Mr. Seppell for one Caleb Elliot, a visionary enthusiast, who, in his 70s, having fasted 40 days, and actually survived 16 without food, having obstinately refused sustenance of every kind.

FASOLF, Sir John, a valiant and renowned English officer, a knight banneret and of the Garter, who served in France under Henry IV. V. and VI. was descended from an ancient family in Norfolk, and was born about the year 1377. He was as much distinguished for his virtue at home, as for his valour abroad; and became no less amiable in his private, than he had been admirable in his public character. He died in 1457, upwards of 80 years of age, as we
FAT

learn from his noted contemporary William Caxton the first English printer. By an unaccountable mistake it has been asserted, that Shakespeare's Falstaff was drawn to ridicule this great man; and this has made judicious biographers more studious to preserve his reputation.

FAT, an oily concrete substance, deposited in different parts of animal bodies. See BOTANY Index.

Strong exercise, preternatural heat, an acrimonious state of the juices, and other like causes, by which the oily parts of the blood are attenuated, resolved, or evacuated, prevent the generation of fat; labours of the mind also have this effect, as well as labour or intemperance of the body. Hence rest and plentiful food are sufficient to fatten brutes; but with men it is often otherwise. It is surprising how soon some birds grow fat; ortolans, it is said, in 24 hours, and larks still sooner.

Fats may be divided, from their consistence, into three kinds: (1.) The soft and thin, which grows perfectly liquid in a very small heat; (2.) The thick and consistent, which liquefy less readily; and, (3.) The hard and firm, which require a still stronger heat to melt them. The first is called Friguard; the second is called Adipas; and the third, Adept, as taken from the animal, and Scherum, or Schus, when freed from the skins, &c. This use of the names, however, is not constant, some employing them differently.

A great number of fats have been kept in the shops, for making ointments, plasters, and other medicinal compositions; as hog's lard, the fat of the boar, the fox, the hare, dog, wild cat, Alpine mouse, beaver; that of hens, ducks, geese, storks; of the whale, pike, serpents, vipers, &c. as also human fat. In regard to all these kinds of substances, however, much depends upon the manner of purifying or trying, and of keeping them.

To obtain fat pure, it must be cut into pieces, and cleansed from the interposed membranes and vessels. It must then be cleansed from its gelatinous matter by washing with water, till the water comes from it clear and insipid; it is afterwards to be melted with a moderate heat in a proper vessel with a little water; and it is to be kept thus melted till the water is entirely evaporated, which is known by the disconsonance of the boiling, which is caused by the water only, and which lasts till not a drop of it remains; yet it is afterwards to be put into an earthen pot, where it fixes; then it is exceedingly white, sufficiently pure for the purposes of pharmacy or chemical examination.

Fat thus purified has very little taste, and a weak, but peculiar smell. For its analysis and chemical properties, see CHEMISTRY Index.

One of the chief uses of fat probably is, to receive into its composition, to blunt and correct a great part of the acids of the aliment, and which are more than are requisite to the composition of the nutritious juice, or which nature could not otherwise expel. This is certain, that the greater the quantity of aliments taken by healthy animals, above what is necessary for their nourishment and reproduction, the fatter they become. Hence animals which are castrated, which are not much exercised, or which are come to an age, when the loss and production of the seminal fluid is less, and which at the same time consume much succulent ali-

ment, generally become fatter, and sometimes exceedingly so.

Although fat be very different from truly animalized substances, and appears not easily convertible into nutritive juices, it being generally difficult of digestion, and apt to become rank, as butter does in the stomachs of many persons; yet in certain cases it serves to the nourishment and repair of the body. Animals certainly become lean, and live upon their fat, when they have too little food, and when they have diseases which prevent digestion and the production of the nutritive juice; and in those cases the fatter animals hold out longer than the leaner. The fat appears to be then absorbed by the vessels designed for this use, and to be transformed into nutritive juice.

FAT, in the sea language, signifies the same with broad. Thus a ship is said to have a fat quarter, if the trusting in or tuck of her quarter be deep.

FAT likewise denotes an uncertain measure of capacity. Thus a fat of an glass contains from 8 to 4 hundred weight to 2 hundred weight; a fat of unbound books, half a man's or four bales of wire, from 20 to 25 hundred weight; and of yarn, from 220 to 221 barrels.

FAT, or VAT, is used also for several utensils; as 1. A great wooden vessel, employed for measuring of mall, and containing a quarter or eight bushels. 2. A large brewing vessel, used by brewers to run their wort in. 3. A leaden pan or vessel for the making of salt at Drifworth.

FATA MORGANA; a very singular phenomenon, mentioned by different philosophical writers and travellers, particularly by Bredone and Sabinhurme. They inform us that it is seen in the straits of Messana, and sometimes denominated the castles of the Fairy Morgana. The accounts of this phenomenon differ considerably from each other, and travellers are not unanimous as to the causes which are necessary for its production. It would perhaps be difficult to determine how far the imagination of those who have spoken of it may be considered capable of producing astonishment, yet the actual existence of such a phenomenon admits of no dispute.

The first chapter of Minnasi, in his dissertation on the Fatia Morgana, speaks of this phenomenon in the following manner. When the rays of the sun strike from that point whence its incident ray forms an angle of 45° on the sea of Reggio, and the bright surface of the water in the bay is not disturbed either by the wind or the current, the spectator being placed on an eminence of the city, with his back to the sun and his face to the sea; on a sudden there appear in the water, as in a catoptric theatre, various multiplied objects, that is to say, numberless series of pilasters, arches, castles well delineated, regular columns, lofty towers, superb palaces, with balconies and windows, extended avenues of trees, delightful plains with herds and flocks, armies of men on foot and horseback, and many other strange images, in their natural colours and proper actions, passing rapidly in succession along the surface of the sea during the whole of the short period of time while the above-mentioned causes remain.

But if, in addition to the circumstances before described, the atmosphere be highly impregnated with vapour and dense exhalations, not previously dispelled by the action of the wind or waves, or modified by the sea,
it then happens that in this vapour, as in a curtain extended along the channel to the height of about 30 palms, and nearly down to the sea, the observer will behold the scene of the same objects not only reflected from the surface of the sea, but likewise in the air, though not so distinct or well defined as the former objects from these.

If the air be slightly hazy and opaque, and at the same time dewy and adapted to form the iris, then the above-mentioned objects will appear only at the surface of the sea, as in the first case, but all vividly coloured, or fringed with red, green, blue, and other prismatic colours.

From this account of Minasi it appears, that there are three different species of Fata Morgana; the first appearing at the surface of the sea, denominated the Marine Morgana; the second in the air, called the Aerial Morgana, and the third only at the surface of the sea, or Morgana fringed with prismatic colours. The same ingenious author attempted to trace the etymology of the word Morgana, which he thinks is derived from magia, tristis, and gama, latititas officio. This splendid sight affects all descriptions of men with such joy, that they run towards the sea, exclaiming Morgana, Morgan! This etymology of Minasi may seem at first view to be a contradiction in terms; but it will appear most natural, when we consider the joy which the Morgana inspires, and the corresponding sorrow or dejection which must be felt when it vanishes away. Our author informs us, that he beheld this magnificent appearance three times, and would rather behold it again than the most superb theatrical exhibition in the world.

In his physical and astronomical remarks on this phenomenon, he observes that the sea in the straits of Messina exhibits the appearance of a large inclined spectulum; that, in the alternate current or tide which flows and returns in the straits for six hours each way, and is constantly attended by an opposite current along shore to the medium distance of about half a league, there are many eddies and irregularities at the time of the change of its direction; and that the Morgana usually appears at this period. He describes the effects produced by it to the supposed inclination of the surface of the sea, and its subdivision into different planes by the contrary eddies. The effects produced in the air he considers as the result of saline and other effluvia suspended in the air. These appearances are produced by a calm sea, and one or more strata of superincumbent air differing in refractive, and consequently in reflective power, rather than from any considerable change in the surface of the water, with the laws of which we are much better acquainted than with those of the atmosphere.

To the above account we shall add the following, given by M. Hausl, whose judgment and veracity render his authority highly respectable. "In fine summer days, when the weather is calm, there arises above the great current a vapour, which acquires a certain density, so as to form in the atmosphere horizontal prisms, whose sides are disposed in such a manner, that when they come to their proper degree of perfection, they reflect and represent successively, for some time (like a moveable mirror), the objects on the coast or in the adjacent country. They exhibit by turns the city and suburbs of Messina, trees, animals, men, and mountains. They are certainly beautiful aerial moving pictures. There are sometimes two or three prisms, equally perfect; and they continue in this state eight or ten minutes. After this, some shining inequalities are observed upon the surface of the prism, which render confused to the eye the objects which had been before so accurately delineated, and the picture vanishes. The vapour forms other combinations, and is dispersed in air. Different accounts have been given of this singular appearance; which for my part I attribute to a bitumen that issues from certain rocks at the bottom of the sea, and which is often seen to cover part of its surface in the strait of Messina. The sublimate parts of the bitumen being attenuated, combined, and exhaled with the aqueous globules that are raised by the air, and formed into bodies of vapour, give to this condensed vapour more consistence; and contribute, by their smooth and polished particles, to the formation of a kind of aerial crystal, which receives the light, reflects it to the eye, and transmits to it all the luminous points which colour the objects exhibited in this phenomenon, and render them visible."

FATE (fatum), denotes an inevitable necessity depending upon a superior cause. The word is formed à fando, "from speaking," and primarily implies the same with effatum, viz. a word or decree pronounced by God; or a fixed sentence whereby the Deity has prescribed the order of things, and allotted to every person what shall befal him.

The Greeks called it áρκαπλα, as it were a chain or necessary series of things indissolubly linked together. It is also used to express a certain unavoidable designation of things, by which all agents, both necessary and voluntary, are arrayed and directed to their ends. See NECESSITY.

In this last sense, fate is distinguished into, 1. Astrological fate, arising from the influence and position of the heavenly bodies; which (it was supposed) gave laws both to the elements and mixed bodies, and to the wills of men. 2. Stoical fate, defined by Cicero an order or series of causes, wherein, cause being linked to cause, each produces another, and thus all things flow from one prime cause. To this fate the Stoics subject even the gods.

Fate is divided by later authors into physical and divine. Physical fate is an order and series of natural causes appropriated to their effects. By this fate it is that fire warms, bodies communicate motion to each other, &c. and the effects of it are all the events and phenomena of nature. 2. Divine fate is what is more usually called Providence. See PROVIDENCE.

FATES, in Mythology. See PARCE.

FATHIMITES, FATEMITEs, or FATHIMITES, the descendants of Mahomet by Fatema, or Fatima, his daughter. They never enjoyed the caliphate of Mecca or Bagdad, but reigned in Barbary and Egypt. See the history of these countries.

FATHER, a term of relation denoting a person who hath begot a child. See PARENT and CHILD.

By the laws of Romulus, a father had an unlimited power over his children. Amongst the Lacedaemonians, as we learn from Aristotle's Politics, the father of three children was excused from the duty of mounting guard for the security of the city; and a father of four children was exempted from every public burden. The Paphian law, amongst the Romans, granted many valuable privileges to the fathers of three children;
Her marriage with Faunus procured her the name of Faune, and her knowledge of futurities, that of Faunus and Fortunus. It is said that she never saw a man after her marriage with Faunus, and that her uncommon chastity occasioned her being ranked among the gods after death. She is the same, according to some, as Bona Matre.

FAUNALIA, in antiquity, Roman feasts celebrated in honour of the god Faunus, who was the same among the Romans with the Pan of the Greeks.

The Faunalia were held on the day of the nones of December; i.e. on the fifth day of that month. The principal sacrifice was a roe-bock; or rather, according to Horace, a kid, attended with libations of wine and burning of incense. It was properly a country festival, being performed in the fields and villages with peculiar joy and devotion. Horace gives us a very gay description thereof in the 18th ode of his third book:

—_Tener pleno cadit hexas anno:_
Larga nec desunt Veneris sodali,
Vina craterae: vetus ara multo
_Fumax odor._

Struvius in his Roman calendar marks the feast of Faunus on the day of the ides of February, which is the 30th day of that month; and the Faunalia be places on the fifth of the ides of December, or the 9th of that month: and in chap. ix. he shows, that there really were two Faunalia; the one in February, mentioned by Ovid, Fast. lib. iv. ver. 246, the other on the 9th of December, mentioned by Horace in the place just cited.

FAUNS, (FAUNI), among the ancients, were a species of demi-gods inhabiting the forests; called also _Sylvans_ (Sylvani), and little differing from the Satyrs. They delighted more particularly in vineyards; and they generally appear as attendants of Bacchus, in the representations of Bacchaneal feasts and processions. They were represented as half men, half goats, having the horns, ears, feet, and tail of a goat, a very flat nose, and the rest human. Though the Fauns were held for demi-gods, yet they were supposed to die after a long life. Arnobius shows that their father or chief, Faunus himself, lived only 120 years.

FAUNUS, in fabulous history, a son of Picos who reigned in Italy about 1300 years before the Augustan age. His bravery, as well as wisdom, have given rise to the tradition that he was son of Mars. His great popularity, and his fondness for agriculture, made his subjects revere him as one of their country deities after death. He was represented with all the equipage of the satyrs, and was consulted to give oracles.

FAVONIUS, amongst the Romans, the wind which blew directly from the west.

FAVORINUS, an ancient orator and philosopher of Gaul, who flourished under the emperor Adrian, and taught with high reputation both at Athens and Rome. Many works are attributed to him; among the rest, a Greek miscellaneous history often quoted by Diogenes Laertius.

FAUSTUS. See FUST.

FAWKE, FRANCIS, an ingenious poet, had his school education at Leeds; from whence he was transplanted to Jesus College, Cambridge, where he took the degrees in arts. Entering early into holy orders,
he settled first at Bramham in Yorkshire, near the elegant seat of that name (Mr Lane's), which he celebrated in verse in 1745, in a 4to pamphlet anonymous. His first poetical publications were, Gawen Douglas's Description of May and Winter modernized. Removing afterwards to the curacy of Croydon in Surrey, he recommended himself to the notice of Archbishop Herring, then resident there on account of his health, to whom, besides other pieces, he addressed an ode on his recovery in 1754, printed in Mrs Dodgley's collection. In consequence, his grace collated him in 1755 to the vicarage of Orpington, in the county of Kent; and Mr. Fawkes lamented his patron's death in 1757 in a pathetic elegy styled Aurelia, first printed with his grace's seven sermons, in 1762. He married about the same time Miss Perrier of Leed's, in April 1774, by the late Dr. Plumtre's favour, he exchanged his vicarage for the rectorcy of Hayes. He was also one of the chaplains to the princess dowager of Wales. He published a volume of poems by subscription in 1765; the Poetical Calendar 1763; and Poetical Magazine 1764, in conjunction with Mr. Woty; Partridge Shooting, an elegy, to the honourable Ch. Yorke, 1767, 4to; and a Family Bible, with notes, in 4to, a compilation. But his great strength lay in translation, in which, since Pope, few have equalled him. Witness his fragments of Menander (in his Poems); his works of Anacreon, Sappho, Bias, Moschus, and Musaeus, 12mo, 1760; his Idylliums of Theocritus, by subscription, 8vo, 1767; and his Aragonias of Apollonius Rhodius, by subscription also (a posthumous publication, completed by the Reverend Mr. Maes of Emanuel College, Cambridge), 8vo, 1780. He died August 26, 1777.

FAWN, among sportmen, a buck or doe of the first year; or the young one of the buck's breed in its first year.

FE, Fo, or Fb, the name of the chief god of the Chinese, whom they adore as the sovereign of heaven. They represent him shining all in light, with his hands hid under his robes, to show that his power does all things invisibly. He has at his right hand the famous Confucius, and at his left Lanza or Lanza, chief of the second sect of their religion.

FEAL, a provincial term for sod or turf.

FEAL-DYKES, a cheap sort of fence common in Scotland; built with feal or sod dug up by the spade from the surface of grass ground, consisting of the upper mould rendered tough and coherent by the matted roots of the grass thickly interwoven with it. If only a very thin bit of the upper surface is pared off with a paring spade, the pieces are called divots. These being of a firmer consistence, are more durable when built into dykes than feal, but much more expensive also.

FEALTY, in Law, an oath taken on the admittance of any tenant, to be true to the lord of whom he holds his land: by this oath the tenant holds in the freest manner, on account that all who have fee hold per fidem et fiduciam, that is, by fealty at the least. This fealty, at the first creation of it, bound the tenant to fidelity, the breach of which was the loss of his fee. It has been divided into general and special; general, that which is to be performed by every subject to his prince; and special, required only of such as, in respect of their fee, are tied by oath to their lords. To all manner of tenures, except tenancy at will, and frank-almoign, fealty is incident, though it chiefly belongs to copyhold estates held in fee and for life. The form of this oath, by stat. 17 Edw. II. is to run as follows: "I A. B. will be to you, my lord D. true and faithful, and bear to you faith for the lands and tenements which I hold of you; and I will truly do and perform the customs and services that I ought to do to you. So help me God."

FEAR, one of the passions of the human mind (see PASSION). It is defined as apprehension of impending evil, attended with a desire of avoiding it. Fear in the extreme is called fright or terror. See FRIGHT.

FEAR, in Scripture, is used in various senses. The fear of God is either filial or servile. The filial fear is a holy affection or gracious habit in the soul, whereby it is inclined to obey all God's commandments, and to hate and avoid evil. Servile or servile fear is the consequence of guilt; it is a judicial impression from the sad thoughts of the provoked majesty of heaven; it is an alarm within that disturbs the rest of a sinner. Though this fear be in wicked men, yet it often proves corroborative to faith and repentance.

Fear is likewise used for the object of fear. Thus it is said, "the fear of Issac," to describe the God whom Isaac feared; (Gen. xxxi. 24.), and in Prov. v. 16. "I will mock when your fear cometh," that is, the calamity you feared. God says, that he will send his fear before his people; that is, a dread wrought by him, in order to terrify and destroy the inhabitants of Canaan.

FEAR (Matus, Pavor, or Timor), was defined by the Pagans. Tullius Hostilius brought the worship of this deity to Rome. The Ephori of Sparta erected a temple to Fear, near their tribunal, to strike an awe into those who approached it. Fear was likewise worshipped at Corinth. The poets did not forget this imaginary deity. Virgil places her in the entrance of hell, in company with diseases, old age, &c. Æs. vi. 273. Ovid places her in the retinue of Tisiphone one of the furies, Met. iv. 483.

FEAST, or FESTIVAL, in a religious sense, is a ceremony of feasting and thanksgiving. The word is formed of the Latin festum, which some derive a fersest, "to keep holiday;" others from the Greek, "I feast or entertain," of σέρανθος, "the hearth, fire."

Feasts, and the ceremonies thereof, have made great part of the religion of almost all nations and sects; witness those of the Greeks, Romans, Hebrews, Christians, and Mahometans.

The first feasts among the Greeks were celebrated in solemn assemblies of the whole nation, on occasion of their games, as the Olympic, the Pythian, the Isthmian, and Nemean: in process of time they had many others, the principal of which are enumerated in the course of this work.

The Romans also had abundance of stated feasts in honour of their deities and heroes; such were the Saturnalia, Cerialia, Lupercalia, Liberalia, Neptunalia, Consualia, Portunalia, Vinalia, Pallia, Divalia, &c. See SATURNALIA, &c.

They had also feasts instituted occasionally; as Car-
The principal feasts of the Jews were the feast of trumpets, that of the expiation, of tabernacles, of the dedication, of the passover, of pentecost, and that of purification. See Expiation, &c.

The modern Jews have other feasts marked in their calendar, of modern institution. The Mahometans, besides their weekly feast or Sabbath, which is kept on Friday, have two solemn feasts, the first of which is called the Feast of Victims, and celebrated on the tenth day of the last month of their year; and the second called Barum. The Chinese have two solemn feasts in the year, in the memory of Confucius, besides others of less note on the other days of the year.

Feasts among us are either immovable or movable.

Immovable Feasts are those that are constantly celebrated on the same day of the year; the principal of these are Christmas day or the Nativity, the Circumcision, Epiphany, Candlemas or the Purification, Lady Day or the Annunciation, called also the Incarnation and Conception, All Saints and All Souls; besides the days of the several Apostles, St. Thomas, St. Paul, &c. which with us are feasts, though not feriae. See each feast under its proper article.

Movable Feasts are those which are not confined to the same day of the year. Of these the principal is Easter, which gives law to all the rest, all of them following, and keeping their proper distances from it; such as Palm-Sunday, Good-Friday, Ash-Wednesday, Sexagesima, Ascension Day, Pentecost, and Trinity-Sunday. See Easter, Sexagesima, Pentecost, Trinity, &c.

The four feasts which the English laws take special notice of are, the Annunciation of the blessed Virgin Mary or Lady Day, the 25th of March; the nativity of St. John the Baptist, held on the 24th of June; the Feast of St. Michael the Archangel, on the 29th of September; and that of St. Thomas the Apostle, on the 21st of December: on which quarter days rent on leases is usually reserved to be paid (5 and 6 Edw. VI. cap. 3. 3 Jac. I. cap. 1. 12 Car. II. cap. 30.).

Besides these feasts, which are general, and enjoined by the church, there are others local and occasional, enjoined by the magistrate, or voluntarily set on foot by the people; such are the days of thanksgiving for delivery from wars, plagues, &c. Such also are the vigils or wakes in commemorating the dedications of particular churches. See Vigil, &c.

The prodigious increase of feast days in the Christian church commenced towards the close of the fourth century, and was occasioned by the discovery that was then made of the remains of martyrs and other holy men, for the commemoration of whom they were established. These, instead of being set apart for pious exercises, were abused in idolatry, voluptuousness, and criminal practices. Many of them were instituted on a pagan model, and perverted to similar purposes.

Feast of Death, or Feast of Souls, a solemn religious ceremony in use among the savages of America; some of whom thus testify their respect for the deceased every eight years; and others, as the Hurons and Iroquois, every ten years.

The day of this ceremony is appointed by public order; and nothing is omitted, that it may be celebrated with the utmost pomp and magnificence. The neighbouring tribes are invited to be present, and to join in the solemnity. At this time all who have died since the last solemn occasion are taken out of their graves; those who have been interred at the greatest distance from the villages are diligently sought for, and brought to this great rendezvous of carcases.

It is not difficult to conceive the horror of this general disINTERMENT; but it cannot be described in a more lively manner than it is done by Lafliau, to whom we are indebted for the most authentic account of those nations.

"Without question (says he); the opening of these tombs displays one of the most striking scenes that can be conceived; this humbling portrait of human misery, in so many images of death, wherein she seems to take a pleasure to paint herself in a thousand various shapes of horror, in the several carcases, according to the degree in which corruption has prevailed over them, or the manner in which it has attacked them. Some appear dry and withered; others have a sort of parchment upon their bodies; some look as if they were barked and smoked, without any appearance of rottenness; some are just turning towards the point of putrefaction; whilst others are all swimming with worms, and drowned in corruption. I knew not which sought to strike us most, the horror of so shocking a sight, or the tender piety and affection of those poor people toward their departed friends; for nothing deserves our admiration more than that eager diligence and attention with which they discharge this melancholy duty of their tenderness; gathering up carefully even the smallest bones, handling the carcases, disgustful as they are, with every thing loathsome, cleansing them from the worms, and carrying them upon their shoulders through tiresome journeys of several days, without being discouraged from the offensiveness of the smell, and without suffering any other emotions to arise than those of regret, for having lost persons who were so dear to them in their lives, and so lamented in their death."

"They bring them into their cottages, where they prepare a feast in honour of the dead; during which their great actions are celebrated, and all the tender intercourses which took place between them and their friends are piously called to mind. The strangers, who have come sometimes many hundred miles to be present on the occasion, join in the tender condolence; and the women, by frightful shrieks, demonstrate that they are pierced with the sharpest sorrow. Then the dead bodies are carried from the cabins for the general re-interment. A great pit is dug in the ground, and thither,
the distinctions introduced by policy or prejudice, and
disposes men to regard one another as brethren. It is
here that people feel the equality established by nature;
here they forget the evils of life; they extinguish their
hatred, and make their enmities cease. For this reason
Aristotle considers as a breach of the social principle
that custom of the Egyptians of eating apart, and
praises the convivial habits established by Minos and
Lycurgus.

The Persians generally deliberated on business at
the table, but never determined or put their determinations
in execution except in the morning before having
eaten.

When the Germans, says Tacitus, wanted to recon-
cile enemies, to make alliances, to name chiefs, or to
treat of war and peace, it was during the repast that
they took counsel; a time in which the mind is most
open to the impressions of simple truth, or most easily
animated to great attempts. These artless people
during the conviviality of the feast spoke without dis-
guise. Next day they weighed the counsels of the for-
er evening; they deliberated at a time when they
were not disposed to feign, and took their resolution
when they were least liable to be deceived.

People of rank among the Rhodians, by a funda-
mental law of the state, were obliged to dine daily with
those who had the management of affairs, in order to
deliberate with them concerning such things as were
necessary or useful for the country; and on this ac-
count the principal ministers of the kingdom were ob-
liged to keep open table for all who could be of use

to the state.

Among the Romans, the place where they supped
was generally the vestibule, that a more retired part of
the house might not encourage licentiousness and dis-
order. There were several laws that restricted their
meals to those vestibules.

When luxury reigned at Rome, they had superb
halls for their entertainments. Lucullus had many,
each of which bore the name of some deity; and this
name was a mark which indicated to the servants the
expense of the entertainment. The expense of a sup-
per in Lucullus' hall of Apollo amounted to 50,000
drachmae.

The hall in which Nero feasted, by the circular mo-
tion of its walls and ceiling, imitated the revolutions
of the heavens, and represented the different seasons of
the year, changing at every course, and showering
down flowers and perfumes on the guests.

The Romans did not, as we do, use but one table
at their feasts; they had generally two; the first was
for the services of animal food, which was afterwards
removed, and another introduced with fruits; at this
last they sang, and poured out their libations. The
Greeks and eastern nations had the same custom, and
even the Jews in their solemn feasts and at sacrific-es.

The Romans, in the time of Nera, had tables made
of citron wood brought from Mauritisin; they were
varnished with purple and gold, and were raised on
feet of carved ivory. It is said that they were more
precious than gold. Dion Cassius affirms that Senec-
a had 500 of these, which he made use of one after an-
other; and Tertullian tells us that Cicero had but one.
The Romans chose the king of the feast by a throw of
the dice.
FEA [584 d]

We learn from Herodotus that the ancients had neither cups nor bowls, but that they drank out of little horns tipped with silver or gold.

Under the reign of Charles V. of France, the custom of placing the lights upon the table was not yet introduced. A number of domestics held the candles in their hands during the whole time of the feast.

The Greeks and Romans kept a domestic for the purpose of reading during their meals and feasts. Sometimes the chief of the family himself performed the office of reader; and history informs us, that the emperor Severus often read while his family ate. The time of reading was generally at supper; and guests were invited to a reading as they were now a-days to play cards.

The Greeks, in their flourishing times, did not profane, according to their own expression, the holiness of the table; but rather adorned it with ingenuous and elegant conversation: they proposed moral topics, of which Plutarch has preserved a collection.

Ancient philosophers remark, that heroes rarely assembled convivially without bringing affairs of consequence into discourse, or deliberating upon those that regarded either present events or future contingencies. The Scythians, whom we meet with the most, used to make the strings of their bows resound, lest their warlike virtues might be enfeebled or lost in this season of pleasure.

When Rome was corrupted with luxury, singers, dancers, musicians, stage-players, and people that told pleasant tales, were brought into the hall to amuse the guests.

Plutarch informs us, that Caesar, after his triumphs, treated the Roman people at 22,000 tables: and by calculation it would seem that there were at these tables upwards of 200,000 persons.

At the end of the feast the Romans drank out of a large cup as often as there were letters in the name of their mistresses.

Feasting seems to have been the chief delight of the Germans, Gauls, Britons, and all the other Celtic nations; in which they indulged themselves to the utmost, as often as they had an opportunity. Among these nations (says an author who had carefully studied their manners) there is no public assembly, either for civil or religious purposes, duly held; no birthday, marriage, or funeral, properly celebrated; no treaty of peace or alliance rightly cemented, without a great feast.

It was by frequent entertainments of this kind that the great men or chiefstains gained the affections and rewarded the services of their followers; and those who made the greatest feasts were sure to be most popular, and to have the greatest retinue. These feasts (in which plenty was more regarded than elegance) lasted commonly several days, and the guests seldom retired until they had consumed all the provisions and exhausted all the liquors. Athenæus describes an entertainment that was given by Arcamnes, a very wealthy prince in Gaul, which continued a whole year without interruption, and at which all the people of Gaul, and even all strangers who passed through that country, were made welcome. At these feasts they sometimes consulted about the most important affairs of state, and formed resolutions relating to peace and war; imagining that men spoke their real sentiments with the greatest freedom, and were apt to form the boldest designs, when their spirits were exhilarated with the pleasures of the table. The conversations at those entertainments very frequently turned on the great exploits which the guests themselves or their ancestors had performed in war; which sometimes occasioned quarrels and even bloodshed. It was at a feast that the two illustrious British princes, Caiaphas and Oscar, quarreled about their own bravery, and that of their ancestors, and fell by mutual wounds, (Ossian, vol. ii. p. 8, &c.).

As to the drink used at those feasts, particularly in Britain, it seems probable, that before the introduction of agriculture into the island, mead, or honey diluted with water, was the only strong liquor known to its inhabitants, as it was to many other ancient nations in the same circumstances. This continued to be a favourite beverage among the ancient Britons, and their posterity long after they had become acquainted with other liquors. The mead-maker was the eleventh person in dignity in the courts of the ancient princes of Wales, and took place of the physician. The following ancient law of that principality shows how much this liquor was esteemed by the British princes—

There are three things in the court which must be communicated to the king before they are made known to any other person: 1. Every sentence of the judge; 2. Every new song; and, 3. Every case of mead.

This was perhaps the liquor which is called by Ossian the joy and strength of shells, with which his heroes were so much delighted.—After the introduction of agriculture, ale or beer became the most general drink of all the British nations who practised that art, as it had long been of all the Celtic people on the continent (see ALX). If the Phœnicians or Greeks imported any wine into Britain, it was only in very small quantities; that most generous liquor being very little known in this island before it was conquered by the Romans. The drinking vessels of the Gauls, Britons, and other Celtic nations, were, for the most part, made of the horns of oxen and other animals; but those of the Caledonians consisted of large shells, which are still used by some of their posterity in the Highlands of Scotland.

The dishes in which the meat was served up were either of wood or wicker, or a kind of baskets made of osiers. These last were most used by the Britons, as they very much excelled in the art of making them both for their own use and for exportation. The guests sat in a circle upon the ground, with a little hay, grass, or the skin of some animal under them. A low table or stool was set before each person, with the portion of meat allotted to him upon it. In this distribution, they never neglected to set the largest and best pieces before those who were most distinguished for their rank, their exploits, or their riches. Every guest took the meat set before him in his hands, and tearing it with his teeth, fed upon it in the best manner he could. If any one found difficulty in separating any part of his meat with his hands and teeth, he made use of a large knife, that lay in a particular place for the benefit of the whole company. Servants, or young boys and girls, the children of the family, stood behind the guests, ready to help them to drink or any thing they wanted.
As the ancient Britons greatly excelled and very much delighted in music, all their feasts were accompanied with the joys of song, and the music of harps.

In the words of Ossian, "whenver the feast of shells is prepared, the songs of birds arise. The voice of sprightly mirth is heard. The trembling harps of joy are strong. They sing the battles of heroes, or the heaving breasts of love."

Some of the poems of that illustrious British bard appear to have been composed in order to be sung by the hundred harps of Dingal at the feast of Selma. Many of the songs of the harps sung and played at the feasts of the ancient Britons, were of a grave and solemn strain, celebrating the brave actions of the guests, or of the heroes of other times; but these were sometimes intermixed with more sprightly and cheerful airs, to which the youth of both sexes danced, for the entertainment of the company.

It has been often observed by authors, that there is no nation in the world comes near the English in the magnificence of their feasts. Those made at our coronations, instalments, consecrations, &c. transcend the belief of all foreigners; and yet it is doubted whether those now in use are comparable to those of our forefathers.

William the Conqueror, after he was peaceably settled on the throne of England, sent agents into different countries, to collect the most admired and rare dishes for his table; by which means, says John of Salisbury, this island, which is naturally productive of plenty and variety of provisions, was overlaid with every thing that could instrum a luxurious appetite.

The same writer tells us, that he was present at an entertainment which lasted from three o'clock in the afternoon to midnight; at which delicacies were served up, which had been brought from Constantinople, Babylon, Alexandria, Palestine, Tripoli, Syria, and Phoenicia. These delicacies, we may presume, were very expensive. Thomas Becket, if we may believe his historian, Fitz-Stephen, gave 5l. equivalent to 7s. 3d. at present, for one dish of eels. The sumptuous entertainments which the kings of England, and of other countries, gave to their nobles and prelates, at the festivals of Christmas, Easter, and Whitsuntide, in which they spent a great part of their revenues, contributed very much to diffuse a taste for profuse and expensive banqueting. It was natural for a proud and wealthy baron to imitate in his own castle the entertainments he had seen in the palace of his prince. Many of the clergy too, both seculars and regulars, being very rich, kept excellent tables. The monks of St. Withins, at Winchester, made a formal complaint to Henry II. against their abbot, for taking away three of the rich dishes they used to have every day at dinner. The monks of Canterbury were still more luxurious: for they had at least 15 dishes every day, besides a dessert; and these dishes were dressed with spices and sauces; which excited the appetite as well as pleased the taste.

Great men had some kinds of provisions at their tables that are not now to be found in Britain. When Henry II. entertained his own court, the great officers of his army, with all the kings and great men of Ireland, in Dublin, at the feast of Christmas A.D. 1171, the Irish princes and chiefstains were quite astonished at the profusion and variety of provisions which they beheld, and were with difficulty prevailed upon by Henry to eat the flesh of cranes, a kind of food to which they had not been accustomed. In the remaining monuments of this period, we meet with the names of several dishes, as dellegroot, maupigynnu, karumype, &c. the composition of which is now unknown.

The coronation feast of Edward III. cost 28l. 3s. 4d. equivalent to about 40,000l. of our money. At the installation of Ralph abbot of St. Augustine, Canterbury, A.D. 1305, 500 guests were entertained with a dinner, consisting of 3000 dishes, which cost 28l. 5s. equal in efficacy to 4300l. in our times. "It would require a long treatise (says Matthew Paris) to describe the astonishing splendour, magnificence, and festivity with which the nuptials of Richard earl of Cornwall, and Ciccia daughter of Reimund earl of Provence, were celebrated at London, A.D. 1243. To give the reader some idea of it, in a few words, above 30,000 dishes were served up at the marriage dinner." The nuptials of Alexander III. of Scotland, and the princess Margaret of England, were solemnized at York, A.D. 1251, with still greater pomp and profusion. "If I attempted (says the same historian) to display all the grandeur of this solemnity,—the numbers of the noble and illustrious guests,—the richness and variety of the dresses,—the sumptuousness of the feasts,—the multitudes of the minstrels, minstrels, and others whose business it was to amuse and divert the company, those of my readers who were not present would find that I was imposition upon their credulity." The following enumeration will enable them to form a judgment of the whole. The archbishop of York made the king of England a present of 60 fat oxen, which made only one article of provision for the marriage feast, and were all consumed at that entertainment.

The marriage feast of Henry IV. and his queen Jane of Navarre, consisted of six courses; three of flesh and fowls, and three of fish. All these courses were accompanied and adorned with sutilities, as they were called. These sutilities were figures in pastry, of men, women, beasts, birds, &c. placed on the table to be admired, but not touched. Each figure had a label affixed to it; containing some wise or witty saying, suited to the occasion of the feast, which was the reason they were called sutilities. The installation feast of George Neville, archbishop of York and chancellor of England, exceeded all others in splendour and expense, and in the number and quality of the guests. The reader may form some idea of the magnificence of this from the following list of provisions prepared for it. In wheat, quarters, 300; in ale, tunns, 300; in wine, tunns, 100; in ipocras, pipes, 1; in oxen, 104; in wild bulls, 61; in mutton, 1000; in veals, 304; in porks, 304; in swans, 400; in geese, 2000; in capons, 1000; in pigs, 2000; in plovers, 400; in quails, 1200; in fowls, called rees, 2400; in peacocks, 104; in mallards and teal, 4000; in cranes, 204; in kids, 204; in chieken, 2000; in pigeons, 2000; in conins, 4000; in bitters, 204; in herons, 400; in pheasants, 200; in partridges, 500; in woodcocks, 400; in curlews, 100; in egrits, 1000; in stags, bucks, and roes, 500 and more; in pasties 4 E.
of venison, cold, 4000; in parted dishes of jelly, 1000; in plain dishes of jelly, 3000; in cold tartes, baked, 4000; in cold custards, baked, 3000; in hot pasties of venison, 1500; in hot custards, 2000; in pikes and creams, 308; in porpoises and seals, 12; spices, regared delicate, and waters, plenty. No turkeys are mentioned in this enormous bill of fare, because they were not then known in England. Cranes, herons, shaws, porpoises, and seals, are seldom seen at modern entertainments.

One of the most expensive singularities attending the royal feasts in those days consisted in what they called interments. These were representations of battles, sieges, &c. introduced between the courses for the amusement of the guests. The French excelled in exhibitions of this kind. At a dinner given by Charles V. of France to the emperor Charles IV. A.D. 1378, the following interment was exhibited: A ship with masts, sails, and rigging, was seen first: she had for colours the arms of the city of Jerusalem; Godfrey de Beaulion appeared upon deck, accompanied by several knights armed capa-pena: the ship advanced into the middle of the hall, without the machine which moved it being perceptible. Then the city of Jerusalem appeared, with all its towers lined with Saracens. The ship approached the city; the Christians landed, and began the assault; the besieged made a good defence: several scaling ladders were thrown down; but at length the city was taken. Interments at ordinary banquets consisted of certain delicate dishes introduced between the courses, and designed rather for gratifying the taste than for satisfying hunger.

At those feasts, besides the ordinary drinks, ale and cider, there were great quantities of wines of various kinds. Of these last, the following lines of a poet who wrote in the fourth century, contain an ample enumeration.

Ye shall have rumney and malespine, Both ypocrasse and vernage wyne; Mountresse and wyne of Greke, Both algrafe and despice eke, Antichoce and bastarde, Pyment also, and garmarde, Wyne of Greke and Muscadell, Both clare, pyment, and Bochall.

Some of these liquors, as ypocrasse, pyment, and claret, were compounded of wine, honey, and spices of different kinds, and in different proportions.

FEATHER, in Physiology, a general name for the covering of birds; it being common to all the animals of this class to have their whole body, or at least the greatest part of it, covered with feathers or plumage. See Ornithology Index.

Feathers make a considerable article in commerce, particularly those of the ostrich, heron, swan, peacock, goose, &c. for plumes, ornaments of the head, filling of beds, writing pens, &c.

Geese are plucked in some parts of Great Britain five times in the year; and in cold seasons many of them die by this barbarous custom. Those feathers that are brought from Somersetshire are esteemed the best, and those from Ireland the worst.

Eider down* is imported from Denmark; the ducks

that supply it being inhabitants of Hudson's Bay, Feath
Greenland, Iceland, and Norway. Our own islands 1
west of Scotland breed numbers of these birds, which

turn out a profitable branch of trade to the poor
inhabitants. Hudson's Bay also furnishes very fine
feathers, supposed to be of the goose kind. The down
of the swan is brought from Danze. The same place
also sends us great quantities of the feathers of the cock
and hen. The London poulterers sell a great quantity
of the feathers of those birds, and of ducks and turkey:

those of ducks being a weaker feather, are inferior
to those of the goose; and turkey's feathers are the worst
of any. The best method of using feathers is to lay
them in a room, in an exposure to the sun; and when
dried to put them in bags, and beat them well with
poles to get the dirt off.

FEBRIFUGE, an appellation given to such medicines
as mitigate or remove a fever.

FEBRUARY, in Chronology, the second month of
Nume's year, and under the protection of the god
Neptune. This month is not found in the calender
of Romans, but was added to the year by Numa. It
had its name from Februn, Februns, or Feburcia, all names
of Juno, who presided over the purification of women;
and in this month the Lupercalia were held in honour
of Juno, and women were purified by the priests of Pan
Lycos at that festival. See Lupercalia.

February, in a common year, consists only of 28
days; but in the bissextile year it has 29, on account
of the intercalary day added that year.

FEORIALES, or FOEICIALES, an order of priests or
officers, consisting of 20 persons, among the ancient
Romans, appointed to proclaim war, negotiate peace,
&c.

Festus derives the word from ferta, "I strike;" as
ferti fatus signifieth "to conclude a treaty;" and
accordingly, instead of feciales, he would have written
feriales. Others derive it from fertus, which was an-
ciently written fato; or from fides, "faith." Others
from facio, feci, "I make," &c. because they made
war and peace. Vossius chooses to derive it from
fata, of the verb fari, "to speak;" in which sense
the feciales should be the same with oratori, which
sentiment is also confirmed by the authority of Varro,
who says they were called indifferentely feciales and
oratores.

The feciales were a sort of heralds, who, when the
Romans had any dispute with their neighbours, were
sent first to demand the thing intended to be unsealed,
or require satisfaction for the injury alleged to be done.
If an answer was not returned by them that was satis-
factory to the people and the senate, they were dispatch-
ed again to declare war, and the like in treating for
peace; the feciales being the only persons appointed to
negotiate between the senate, &c. and the enemy.

Plutarch in the life of Numa, and Haliacarnassus
(lib. ii.), observes, that they were first instituted by
that prince. The latter adds, that they were first chos-
en out of the best families in Rome; that their office,
which was reputed a sort of sacerdotium, or priesthood,
only ended with their life; that their persons were
sacred and inviolable, as those of other priests; that they
were even charged to see the republic did not declare
war unjustly; that they were to receive the complaints
and
and remonstrances of nations who pretended to have been any way injured by the Romans; that if those complaints were found just, they were to seize the criminals, and deliver them up to those they had offended; that they were invested with the rights and privileges of ambassadors; that they concluded treaties of peace and alliance, and took care they were executed; and, lastly, abolished them, if they were found not to be equitable. Livy, lib. 1. cap. 24. ascribes their institution to Ancus Martius, in the year of Rome 747.

Varro assures us, that in his time most of these functions of the sociales were set aside; though Plutarch observes, that they had still some authority in his time.

The sociales were crowned with corpones, "ver- vains," when they went to declare war. Their head was covered with a veil, over which the crown was applied. In this equipage they proceeded to the frontiers of the new enemy’s country, and threw a bloody dart or javelin into the ground within the same. In Livy and other ancient authors we have the formula used in such declarations.

FECUNDITY, the same with FERTILITY.

FEE, in Law, signifies a complete feudal property. Hence, where the bare interest of any feudal subject is meant to be conveyed to A, and the absolute property to B, that meaning is expressed thus: "a to A in different, and to B in fee." See LAW, No. 1. 

Fees are commonly divided into absolute, otherwise called fees-simple; and limited, one species of which we usually call fee-tail.

1. Tenant in fee-simple (or as he is frequently styled, tenant in fee), is he that hath lands, tenements, or hereditaments, to hold to him and his heirs for ever; generally, absolutely and simply; without mentioning what heirs, but referring that to his own pleasure, or to the disposal of the law. The true meaning of the word fee (feudum) is the same with that of feud or fief, and in its original sense it is taken in contradistinction to allotodium; which latter the writers on this subject define to be every man’s own land, which he possesses merely in his own right, without owing any rent or service to any superior. This property is in its highest degree; and the owner thereof hath absolutum et directum dominium, and therefore is said to be seized thereof absolutely in dominico suo, in his own demesne. But feudum or fee, is that which is held of some superior, on condition of rendering him service; in which superior the ultimate property of the land resides. And therefore Sir Henry Spelman defines a feud or fee to be, the right which the vassal or tenant hath in lands to use the same and take the profits thereof to him and his heirs, rendering to the lord his due services; the mere allotodial property of the soil always remaining in the lord. This allotodial property no subject in Britain has; it being a received and now undeniable principle in the law, that all the lands are held mediately or immediately of the king. The king therefore only hath absolutum et directum dominium; but all subjects lands are in the nature of feudum or fee, whether derived to them by descent from their ancestors, or purchased for a valuable consideration; for they cannot come to any man by either of those ways, unless accompanied with those feudal clogs which were laid upon! the first feuatory when it was originally granted. A subject therefore hath only the usufruct, and not the absolute property of the soil; or, as Sir Edward Coke expresses it, he hath dominium utile, but not dominium directum. And hence it is, that, in the most solemn acts of law, we express the strongest and highest estate that any subject can have, by these words, "he is seized thereof in his demesne, as of fee." It is a man’s demesne, dominium, or property, since it belongs to him and his heirs for ever: yet this dominium, property, or demesne, is strictly not absolute, but qualified or feudal: it is of his demesne, as of fee; that is, it is not purely and simply his own, since it is held of a superior lord, in whom the ultimate property resides.

This is the primary sense and acceptation of the word fee. But (as Sir Martin Wright very justly observes) the doctrine, "that all lands are holder’s," having been for so many ages a fixed and undeniable axiom, the English lawyers do very rarely (of late years especially) use the word fee in this its primary original sense, in contradistinction to allotodium or absolute property, with which they have no concern; but generally use it to express the continuance or quantity of estate. A fee therefore, in general, signifies an estate of inheritance; being the highest and most extensive interest that a man can have in a feud: and when the term is used simply, without any other adjunct, or has the adjunct of simple annexed to it (as, a fee, or a fee simple), it is used in contradistinction to a feud, in the common law, or as a fee-tail by the statutes, importing an absolute inheritance, clear of any condition, limitation, or restrictions to particular heirs, but descendable to the heirs-general, whether male or female, lineal, or collateral. And in no other sense than this is the king said to be seized in fee, he being the feuatory of no man.

Taking therefore fee in this its secondary sense, as a state of inheritance, it is applicable to, and may be had in, any kind of hereditaments either corporeal or incorporeal. But there is this distinction between the two species of hereditaments; that of a corporeal inheritance a man shall be said to be seized in his demesne, as of fee; of an incorporeal one he shall only be said to be seized as of fee, and not in his demesne. For as incorporeal hereditaments are in their nature collateral to, and issue out of, lands and houses, their owner hath no property, dominium, or demesne, in the thing itself, but hath only something derived out of it; resembling the servitudes, or services, of the civil law. The dominium, or property, is frequently in one man, while the appendage or service is in another. Thus Caius may be seized as of fee, of a way going over the land, of which Titius is seized in his demesne as of fee.

The fee-simple or inheritance of lands and tenements is generally vested and resides in some person or other; though divers inferior estates may be carried out of it. As if one grants a lease for 21 years, or for one or two lives, the fee-simple remains vested in him and his heirs; and after the determination of those years or lives, the land reverts to the grantor or his heirs, who shall hold it again in fee-simple. Yet sometimes the fee may be in abeyance, that is (as the word signifies) in expectation, remembrance, and contemplation in law; there being no person in esse, in whom it can vest and abide.

Though
though the law considers it as always potentially existing, and ready to vest whenever a proper owner appears. Thus, in a grant to John for life, and afterwards to the heirs of Richard, the inheritance is plainly neither granted to John nor Richard, nor can it vest in the heirs of Richard till his death, nam nemo est heres viventis: it remains therefore in waiting, or abeyance, during the life of Richard. This is likewise always the case of a parson of a church, who hath only an estate therein for the term of his life, and the inheritance remains in abeyance. And not only the fee, but the freehold also, may be in abeyance; as, when a parson dies, the freehold of his glebe is in abeyance until a successor be named, and then it vests in the successor.

The word heirs is necessary in the grant or donation, in order to make a fee or inheritance. For if land be given to a man for ever, or to him and his assigns for ever, this vests in him but an estate for life. This very great nicety about the insertion of the word heirs in all feoffments and grants, in order to vest a fee, is plainly, a relic of the feudal strictness: by which it was required, that the form of the donation should be punctually pursued: or that, as Craig expresses it in the words of Baldus, donationes sint stricti juris, ne quis plus dosissimus quam in donationem expressisset. And therefore, as the personal abilities of the donee were originally supposed to be the only inducements to the gift, the donee's estate in the land extended only to his own person, and subsisted no longer than his life; unless the donor, by an express provision in the grant, gave it a longer continuance, and extended it also to his heirs. But this rule is now softened by many exceptions.

For, 1. It does not extend to devises by will; in which, as they were introduced at the time when the feudal rigour was space wearing out, a more liberal construction is allowed: and therefore by a devise to a man for ever, or to one and his assigns for ever, or to one in fee-simple, the devisee hath an estate of inheritance; for the intention of the deviseor is sufficiently plain from the words of perpetuity annexed, though he hath omitted the legal words of inheritance. But if the devise be to a man and his assigns, without annexing words of perpetuity, there the devisee shall take only an estate for life; for it does not appear that the devisor intended any more. 2. Neither does this rule extend to fines or recoveries, considered as a species of conveyance; for thereby an estate in fee passes by act and operation of law without the word heirs; as it does also for particular reasons, by certain other methods of conveyance, which have relation to a former grant or estate, wherein the word heirs was expressed.

3. In creations of nobility by writ, the peer so created hath an inheritance in his title, without expressing the word heirs; for they are implied in the creation, unless it be otherwise specially provided: but in creations by patent, which are stricti juris, the word heirs must be inserted, otherwise there is no inheritance. 4. In grants of lands to sole corporations and their successors, the word successors supplies the place of heirs; for as heirs take from the ancestor, so doth the successor from the predecessor. Nay, in a grant to a bishop, or other sole spiritual corporation, in frankismoignon, the word frankismoignon supplies the place of successors (as the word successors supplies the place of heirs) evi termini; and in all these cases a fee-simple vests in such sole corporation. But, in a grant of lands to a corporation aggregate, the word successors is not necessary, though usually inserted: for, albeit such simple grant be strictly only an estate for life, yet as that corporation never dies, such estate for life is perpetual, or equivalent to a fee-simple, and therefore the law allows it to be one. Lastly, in the case of the king, a fee-simple will vest in him, without the words heirs or successors in the grant; partly from regal original, and partly from a reason similar to the last, because the king, in judgment of law, never dies. But the general rule is, that the word heirs is necessary to create an estate of inheritance.

II. We are next to consider limited fees, or such estates of inheritance as are clogged and confined with conditions or qualifications of any sort. And these we may divide into two sorts: 1. Qualified or base fees; and, 2. Fees conditional, so called at the common law; and afterwards fees-tail, in consequence of the statute de donis.

1. A base or qualified fee, is such a one as has a qualification subjoined thereto, and which must be determined whenever the qualification annexed to it is at an end. As, in the case of a grant to A and his heirs, tenants in the manor of Dale; in this instance, whenever the heirs of A cease to be tenants of that manor, the grant is entirely defeated. So, when Henry VI. granted to John Talbot, lord of the manor of Kingswood Lisle in Berks, that he and his heirs, lords of the said manor, should be peers of the realm, by the title of Barons of Lisle; here John Talbot had a base or qualified fee in that dignity; and the instant he or his heirs quitted the seigniory of this manor, the dignity was at an end. This estate is a fee, because by possibility it may endure for ever in a man and his heirs; yet as that duration depends upon the concurrence of collateral circumstances, which qualify and debase the purity of the donation, it is therefore a qualified or base fee.

2. As to fees-conditional, or fee-tail, see the article Tail.

Fees also signifies a certain allowance to physicians, barristers, attorneys, and other officers, as a reward for their pains and labour.

If a person refuse to pay an officer his due fees, the court will grant an attachment against him, to be committed till the fees are paid; and an attorney may bring an action of the case for his fees against the client that retained him in his cause.

Fees also denotes a settled perquisite of public officers, payable by those who employ them.

The fees due to the officers of the custom-house are expressly mentioned in a schedule, or table, which is hung up in public view in the said office, and in all other places where the said fees are to be paid or received. And if any officer shall offend, by acting contrary to the regulations therein contained, he shall forfeit his office and place, and be for ever after incapable of any office in the custom-house.

The other public offices have likewise their settled fees, for the several branches of business transacted in them.

Fees-Farm, a kind of tenure without homage, fealty, or other service, except that mentioned in the foist-
ment; which is usually the full rent, or at least a fourth part of it.

The nature of this tenure is, that if the rent be behind, and unpaid for two years, then the sequestrer and his heirs may have an action for the recovery of the lands.

FEELERS, in Natural History, a name used by some for the borns of insects.

FEELING, one of the five external senses, by which we obtain the ideas of solid, hard, soft, rough, hot, cold, wet, dry, and other tangible qualities. See Anatomy Index.

FEET. See Foot.

Fist-Bearer, the name of an officer in the courts of the ancient Anglo-Saxon and Welsh kings. He was a young gentleman whose duty it was to sit on the floor, with his back towards the fire, and hold the king's feet in his bosom all the time he sat at table, to keep them warm and comfortable; a piece of state and luxury unknown in modern times.

FEINT, in fencing, a show of making a thrust at one part, in order to deceive the enemy, that you may really strike him in another.

A simple feint is a mere motion of the wrist, without stirring the foot.

FELON, in Law, a person guilty of felony. See Felony.

FELONY, in the general acceptance of the law, comprises every species of crime, which occasions at common law the forfeiture of lands or goods; and this most frequently happens in those crimes for which a capital punishment either is or may be inflicted: for those felonies that are called clergymen, the benefit of clergy extends, were anciently punished with death in all lay or unlearned offenders; though now, by the statute law, that punishment is for the first offence universally remitted. Treason itself, says Sir Edward Coke, was anciently comprised under the name of felony; and in confirmation of this we may observe, that the statute of treasons, 25 Edw. III. c. 2. speaking of some dubious crimes, directs a reference to parliament; that it may be there adjudged, "whether they be treason or other felony." All treasons, therefore, strictly speaking, are felonies; though all felonies are not treason. And to this also we may add, that all offences, new, capital, are in some degree or other felony; but this is likewise the case with some other offences, which are not punished with death; as suicide, where the party is already dead; homicide by chance-medley, or in self-defence; and petit-larceny, or pilfering; all which are (strictly speaking) felonies, as they subject the committees of them to forfeiture. So that, upon the whole, the only adequate definition of felony seems to be that which is before laid down; viz. an offence which occasions a total forfeiture of either lands or goods, or both, at the common law; and to which capital or other punishment may be superadded, according to the degree of guilt.

To explain this matter a little farther: The word felony, or felonia, is of undoubted feudal origin, being frequently to be met with in the books of feuds, &c. but the derivation of it has much puzzled the juridical lexicographers, Fratenus, Calvinus, and the rest: some deriving it from the Greek, φέλον, "an impostor or deceiver;" others from the Latin, falsus, falsif, to countenance.
Felony, which they would have it called *fellonia*. See Edward Coke, as his manner is, has given us a still stranger etymology; that it is *crimen animo felleo perpetratum*, "with a bitter or gullish inclination." But all of them agree in the description, that it is such a crime as works a forfeiture of all the offender's lands or goods. And this gives great probability to Sir Henry Spelman's Teutonic or German derivation of it: in which language, indeed, as the word is clearly of feudal origin, we ought rather to look for its signification, than among the Greeks and Romans. *Fel-ony* then, according to him, is derived from two northern words: *FEE*, which signifies (we well know) the sief, feud, or beneficiary estate; and *LON*, which signifies price or value. Felony is therefore the same as *pretium feudi*, the consideration for which a man gives up his sief; as we say in common speech, such an act is as much as your life or estate is worth. In this sense it will clearly signify the feudal forfeiture, or act by which an estate is forfeited, or escheats to the lord.

To confirm this, we may observe, that it is in this sense of forfeiture to the lord, that the feudal writers constantly use it. For all those acts, whether of a criminal nature or not, which at this day are generally forfeitures of copyhold estates, are styled *fellonia* in the feudal law: "*Si dominus deessevoluere usurarii*:—*si annum et cladem cessauerit in petendo inveniretur*:—*si dominus ejus usurarii*: i.e. *negaret ad dominum feudum habere*:—*si dominus in usu vacante, ter citatus non compromitteri*":—all these, and many, many others, are still causes of forfeiture in our copyhold estates, and were denominated *fellonies* by the feudal constitutions. So likewise injuries of a more substantial or criminal nature were denominated *fellonies*, that is, forfeitures: as assaulping or beating the lord;initiating his wife or daughter, "*si dominus curcubitaverit, i.e. cum sore ejus concubuerit*: all these are esteemed felonies, and the latter is expressly so denominated, "*si fecerit feloniam, dominum forte curcubitaverit*. And as these contempt or smaller offences, were felonies or acts of forfeiture, of course greater crimes, as murder and robbery, fell under the same denomination. On the other hand, the lord might be guilty of felony, or forfeit his seignory to the vassal, by the same act as the vassal would have forfeited, his feoff to the lord. "*Si dominus commissit feloniam, per quam usurarii amitteret feudum si eam commiserit in dominum, feudum proprietatem ejus dominus perdere debeat*. One instance given of this sort of felony in the lord being the servant of his vassal, so that he loses his servitude, which seems merely in the nature of a civil injury, so far as it respects the vassal. And all these felonies were to be determined, "*per laudamentum sive judicium parium suorum*," in the lord's court; as with us forfeitures of copyhold lands are presentable by the homage in the court-baron.

Felony, and the act of forfeiture to the lord, being thus synonymous terms in the feudal law, we may easily trace the reason why, upon the introduction of that law into England, these crimes which induced such forfeiture or escheat of lands (and, by a small deflection from the original sense, such as induced the forfeiture of goods also) were denominated *fellonies*. Thus it was that suicide, robbery, and rape, were felonies; that is, the consequence of such crimes was forfeiture; till by long use we began to signify by the term of *felony*, the actual crime committed, and not the penal consequence. And upon this system only can we account for the cause, why treason in ancient times was held to be a species of felony; viz. because it induced a forfeiture.

Hence it follows, that equal punishment does by no means enter into the true idea and definition of felony. Felony may be without inflicting capital punishment, as in the cases instance of self-murder, execrable homicide, and petit-larceny: and it is possible that capital punishments may be inflicted, and yet the offence be no felony; as in case of heresy by the common law, which, though capital, never worked any forfeiture of lands or goods, an inseparable incident to felony. And of the same nature was the punishment of standing mute, without pleading to an indictment; which at the common law was capital, but without any forfeiture, therefore such standing mute was no felony. In short, the true criterion of felony is forfeiture: for, as Sir Edward Coke justly observes, in all felonies which are punishable with death, the offender loses all his lands in fee simple, and also his goods and chattels; in such as are not punishable, his goods and chattels only.

"The idea of felony is indeed so generally connected with that of capital punishment, that we find it hard to separate them; and to this usage the interpretations of the law do now conform. And therefore, if a statute makes any new offence felony, the law implies that it shall be punished with death, viz. by hanging, as well as with forfeiture: unless the offender prays the benefit of clergy; which all felons are entitled once to have, unless the same is expressly taken away by statute.

Felonies by statute are very numerous; and as this work will not admit of a proper enumeration, we must refer to the table of the quarto edition of the Statutes, where they are set forth in alphabetical order.

FELT, in *Commerce*, a sort of stuff deriving all its consistence merely from being fulled, or wrought with lees and size, without either spinning or weaving. Felt is made either of wool alone or of wool and hair.

FELTING, the method of working up hair or wool into a species of cloth, independent of either spinning or weaving. Felting in Britain is not much practised, excepting in the manufacturing of hats; and as the generality even of those who are employed in making them, are unacquainted with the principles on which they act, a few observations on the method of felting, may, to such, be both useful and agreeable.

If wool, the hair of a rabbit, hare, beaver, or human hair, be examined with a microscope of the greatest magnifying power, the surface of each hair appears perfectly smooth, or if any inequalities are observed, they do not appear so much to arise from an irregular surface, as from some peculiar difference in the colour and transparency of the substances examined; for if their image be viewed by a solar microscope, it terminates in even lines, without the smallest vestige of any roughness. Yet nothing is more evident than that the surfaces of hairs are not perfectly smooth, but either composed of lamellae covering each other from the root to the point, resembling the scales of fishes; or, what some have deemed more
Felting, or Felting, is a process commonly associated with the treatment of wool. The process involves applying pressure to the wool fibers to make them adhere to each other, forming a dense fabric. This can be done naturally, by the action of the weather, or artificially, by using a Felting paddle or similar device.

For the manufacturing of felts, the wool is first washed and prepared, usually by boiling. The fibers are then spread out on a felt board, and pressure is applied to them using a Felting paddle or a similar tool. The pressure helps the fibers to stick together, creating a dense, sturdy fabric.

Felting is used in a variety of applications, from making clothing and accessories, to creating decorative items. It is also used in the production of some types of rugs and carpets.

The Felting paddle is a tool used in the process. It consists of a handle and a paddle, which is typically made of wood or plastic. The paddle is used to apply pressure to the wool fibers, helping them to stick together.

Felting is also used in the production of some types of fabrics. These fabrics are often called "felts," and they are made by combining wool fibers with other materials, such as cotton or synthetic fabrics. The felts are then treated with chemicals to make them more durable and resistant to moisture.

The Felting paddle is an important tool in the Felting process, and it is used to apply the necessary pressure to the wool fibers. The Felting paddle is designed to be easy to use, and it is typically made of a durable material that can withstand the high pressure required in the Felting process.

Felting is a skilled trade, and it requires a good understanding of the Felting process and the materials being used. It is a popular craft among both professionals and hobbyists, and it can be a rewarding and satisfying way to create unique and beautiful fabrics and products.
It is remarkable, that, though all is open, the cattle used to one particular spot of ground seldom leave it, but the owner may always find them in or near the same place. The fens have many large and deep drains. In these the pike and eel grow to a vast size: and they are full of geese which feed on the grass; but these eat rank and muddy, and may even be smelt as soon as a person comes into the room where they are roasting. But the people have another very great advantage from these birds besides the eating of them, namely, their feathers and quills; and the produce of these is so great, that the custhouse books in the town of Boston show, that there are frequently sent away in one year 300 bags of feathers, each containing a hundred and a half weight. Each pound of feathers brings in the owner twopence; and it may be thought strange by people unacquainted with these things, but it is a certain truth, that the owners pull them five or six times a year for the feathers, and three times for the quills. Each pulling comes to about a pound, and many people have 1000 geese at a time, or more. They are kept at no charge, except in deep snowy weather, when they are obliged to feed them with corn.

Oats also grow very well in many of the fen countries, and in good seasons bring great increase and advantage to the owners. There is also another vegetable of great profit to them. This is the *rapum silvestre*; the seed of which they call *cole-seed*; and they make an oil from it of great use in trade. They grind the seed between two large stones, the one standing perpendicularly on the other. The stones are made of a sort of black marble, and are brought from Germany. They sometimes turn them by sails, and sometimes by the drains which carry off the water from the fen lands.

The fens lying low, and being of a vast extent, are very subject to be overflowed by waters from the neighbourhood high countries; and though great care and expense is used to keep them dry, they are often like a sea; and the sheep are obliged to be carried off in boats, and the people to live in their upper rooms, and to be supplied with provisions also with boats.

**FENCE**, in *Gardening and Husbandry*, a hedge, wall, ditch, bank, or other enclosure, made round gardens, fields, woods, &c.

In hot climates, where they have not occasion for walls to ripen their fruit, their gardens lie open, where they can have a water fence, and prospects; or else they bound their gardens with groves, in which are fountains, walks, &c. which are much more pleasing to the sight than a dead wall: but, in colder countries, we are obliged to have walls to shelter and ripen our fruit, although they take away much from the pleasant prospect of the garden. Brick walls are accounted the best and warmest for fruit: and these walls, being built panellwise, with pillars at equal distances, will save a great deal of charge, in that the walls may be built thinner than if they were made plane without these pannels, for then it would be necessary to build them thicker everywhere; and, besides, these pannels make the walls look the handsomer. Stone walls, however, on account of their durability, are to be preferred to those of brick, especially those of square bawn stones. Those that are made of rough stones, though
though they are very dry and warm, yet, by reason of their unevenness, are inconvenient to nail up trees to, except pieces of timber be laid in them here and there for that purpose.

But, in large gardens, it is better to have the prospect open to the pleasure garden; which should be surrounded with a fosse, that from the garden the adjacent country may be viewed. But this must depend on the situation of the place: for, if the prospect from the garden is not good, it had better be shut out from the sight than be open. As also, when a garden lies near a populous town, and the adjoining grounds are open to the inhabitants; if the garden is open, there will be no walking there in good weather, without being exposed to the view of all passengers, which is very disagreeable.

Where the fosses are made round a garden which is situated in a park, they are extremely proper; because hereby the prospect of the park will be obtained in the garden, which renders those gardens much more agreeable than those that are confined.—In the making these fosses there have been many inventions; but, upon the whole, none seem preferable to those which have an upright wall next the garden, which, (where the soil will admit of a deep trench,) should be five or six feet high; and, from the foot of this wall, the ground on the outside should rise with a gradual easy slope, to the distance of 18 or 20 feet; and where it can be allowed, if it slopes much farther it will be easier, and less perceptible as a ditch, to the eye, when viewed at a distance; but, if the ground is naturally wet, so as not to admit a deep fosse, then, in order to make a fence against cattle, if the wall be four feet high, and slight posts of three feet high are placed just behind the wall, with a small chain carried on from post to post, no cattle or deer will ever attempt to jump against it; therefore it will be a secure fence against them; and if these are painted green, they will not be discerned at a distance, and at the same time the chain will secure persons walking in the garden from tumbling over.

In places where there are no good prospects to be obtained from a garden, it is common to make the enclosure of park paling; which, if well performed, will last many years. For appearance, it may be a wall; and this pale may be hid from the sight within, by plantations of shrubs and evergreens; or there may be a quick hedge planted within the pale, which may be trained up, so as to be an excellent fence by the time the pales begin to decay.

Fences round parks are generally of paling; which, if well made of winter-fallen oak, will last many years. But a principal thing to be observed, in making these pales, is, not to make them too heavy: for, when they are so, their own weight will cause them to decay; therefore the pales should be cleat thin; and the rails should be cut triangular, to prevent the wet lodging upon them; and the posts should be good, and not placed too far asunder. If these things are observed, one of these pales will last, with a little care, upwards of 40 years very well. The common way of making these fences is, to have every other pale nine or ten inches above the intermediate ones; so that the fence may be six feet and a half high, which is enough for fallow deer; but when there are red deer, the fence should be one foot higher, otherwise they will leap over.

Some enclose their parks with brick walls; and in countries, where stone is cheap, the walls are built with this material; some with, and others without, mortar.

A kitchen garden, if rightly contrived, will contain walling enough to afford a supply of such fruits as require the assistance of walls, for any family; and this garden, being situated on one side, and quite out of sight of the house, may be surrounded with walls which will screen the kitchen garden from the sight of persons in the pleasure garden; and, being locked up, the fruit will be much better preserved than it can be in the public garden; and the having too great a quantity of walling is often the occasion that so many ill managed trees are frequently to be seen in large gardens.

The height of garden walls should be 12 feet, which is a moderate proportion; and, if the soil be good, it may in time be well furnished with bearing wood in every part, especially that part planted with pears, notwithstanding the branches being trained horizontally from the bottom of the walls.

With regard to the different kinds of fences, see Agriculture Index.

Fence-Month, the month wherein deer begin to fawn, during which it is unlawful to hunt in the forest.

It commences 15 days before Midsummer, and ends 15 days after it. This month, by ancient foresters, is called defence-month.

FENCING, the art of making a proper use of the sword, as well for attacking an enemy as for defending one’s self.

This art is acquired by practising with foils, called in Latin rudes; whence fencing is also denominated gladiatura rudioria.—It is one of the exercises learnt in the academies (see Exercise and Academy); and is an accomplishment both agreeable and useful:—Agreeable, as it affords gentlemen a noble and distinguished amusement:—Useful, as it forms their body; and furnishes them with the faculty of defence, whether it be of their honour or their life, when the one or the other is attacked by those turbulent and dangerous persons whose correction is of service to society in general.

Pyrrah assures us, that the art of fencing is so highly esteemed in the East Indies, that none but princes and noblemen are allowed to teach it. They wear a badge or cognizance on their right arms, called in their language curt; which is put on with great ceremony, like the badges of our orders of knighthood, by the kings themselves.

Fencing is divided into two parts, simple and compound.

Simple is that performed directly and nimbly, on the same line; and is either offensive or defensive.—The principal object of the first, is whatever may be attempted, in pushing or making passes from this or that point, to the most uncovered part of the enemy. The second consists in parrying and repelling the thrusts aimed by the enemy.

The compound includes all the possible arts and inventions to deceive the enemy, and make him leave that part we have a design on bare and unguarded, upon
FENELON, Francis de Salignac de la Motte, was of an ancient and illustrious family, and born at the castle of Fenelon in Perigord in 1651. In 1689, he was appointed tutor to the dukes of Burgundy and Anjou; and in 1655 was consecrated archbishop of Cambrai. After this preferment, a storm arose against him, that obliged him to leave the court for ever, occasioned by his performance entitled, An Explanation of the Maxims of the Saints concerning the Interior Life; in which he was suspected to favour the extravagant notions of Madame Guyon, and the principles of Quietism. A controversy on this occasion was for some time carried on between him and M. Bossuet, bishop of Meaux: which terminated in an appeal to the pope; when his holiness condemned the archbishop's book, by a brief dated March 12, 1699. Some friends indeed pretend, that there was more of court policy than religious zeal in this affair: but be this as it may, the archbishop submitted patiently to this determination; and, retiring to his diocese of Cambrai, acquitted himself punctually in all the duties of his station, and had a most exemplary life. The work that gained him the greatest reputation, and which will render his memory immortal, is his Adventures of Telemaque; the style of which is natural, the fictions well contrived, the moral sublime, and the political maxims tending all to the happiness of mankind. Hence it is thought, as the printing of this work was stopped at Paris, that the prelate's heresy was in politics instead of religion; and though his disgrace was prior to this work, he had, while he was tutor to the young princes, taught them the same principles asserted and exemplified in Telemaque. Fenelon died in 1715; and a collection of all his religious works was afterwards printed at Rotterdam, under the care of the marquis de Feneuron his grand-nephew, when ambassador to the States-General.

FENNEL. See ANETHUM, BOTANY INDEX.

FENTON, Sir Geoffrey, privy councillor and secretary in Ireland during the reign of Queen Elizabeth and King James I. is well known for his translation of Guicciardini's History of the Wars of Italy, dedicated to Queen Elizabeth in 1579. He died at Dublin in 1608; after having married his daughter to Mr Boyle, afterward the great earl of Orkney.

FENTON, Elizah, descended from an ancient family, was born at Shelton near Newcastle, but in what year is uncertain. He was the youngest of 13 children, and was intended for the ministry; but embracing principles contrary to the government, while at Cambridge, he became dissatisfied for entering into holy orders. After he quitted the university, he was secretary to the Earl of Ormonde; but seems to have spent the most of his life amongst his friends and relations, and used to pay an annual visit to his elder brother who enjoyed an estate of 1000l. a-year. He was a man of great tenderness and humanity, enjoyed the fairest reputation, and was much esteemed by Mr Pope; who, when he died in 1730, paid him the tribute of a very elegant epitaph. He published a volume of poems in the year 1717; and in 1723 acted his tragedy of Mairianne, built upon his story collected from Josephus in the third volume of the Spectator.

FENUZIQUE. See TRAGOMELIA, BOTANY INDEX.

FEOD, or FEUD, is defined to be a right which a vassal hath in lands or some immovable thing of his lord's, to use the same, and make the profits thereof hereditarily, rendering unto the lord such feudal duties and services as belong to military tenure, &c., and the property of the soil always remaining to the lord.

FEODAL, of or belonging to a FEUD or FEUD.

FEODAL SYSTEM, the constitution of FEUDS or FEUDS. About 12 centuries ago, this system was so universally received in Europe, that Sir Henry Spelman calls it the law of nations in our western world. Hence it deserves our attention in a particular manner: a knowledge of the different funds being indispensably requisite for a proper understanding either of the civil government of our own country, or of the laws by which its landed property is regulated.

The military policy of the Celtic or northern nations, known by the names of Goths, Vandals, Franks, Huns, and Lombards, furnished the original constitution or system of feuds. These people pouring out in vast multitudes from the same effectus gentium or "storehouse of nations," overran all the European countries on the declension of the Roman empire: They brought the feudal system along with them from the countries out of which they emigrated; and, supposing it to be the most proper method of securing their new conquests, they introduced it into their more southern colonies.

According to this system, the victorious general allotted considerable tracts of land to his principal officers; while they, in like manner, divided their possessions among the inferior officers, and even those common soldiers who were thought to be the most deserving. Allotments of this kind were named freuda, fiefa, feet, or feuds, from a combination of words, in the language of these barbarians, signifying a reward or stipend bestowed on certain conditions (A). The condition upon which these rewards were given was, that the possessors should faithfully serve the person from whom they were received, both at home and abroad, in the military way. To this they engaged themselves by a juramentum fidelitatis, or oath of fidelity: in the event of a breach of which, either by not performing the service, or

(A) We were informed by Pontopiddan, that ODH in these northern languages is the same with proprietas, and ALL with tosim in the Latin. Hence among the northern nations, he tells us, that ODHAL signifieth right; and hence we may conjecture that the Udal Right in Finland is derived. By transposing these two northern syllables,
service agreed upon, by deserting their lord in time of battle, &c. the lands were to return to their original possessor.

Thus the possessors of feodal allotments became interested in the defence of them; and not only the receivers but those who gave them, were equally and mutually bound to defend their possessions, none of them being able to pretend any right but that of conquest. For this purpose government and subordination were absolutely necessary; it being impossible to conduct any system of defence where every thing was tumultuous and irregular. Every person, therefore, who was a feudatory, i.e. who had received lands, was bound to do every thing in his power to defend the lord of his fee; while, on the other hand, the latter was no less subordinate to his immediate superior; and so on to the prince himself. In like manner a reciprocal bond of defence existed down from the prince to the lowest feudists.

Such were the foundations on which the feodal system was properly established: and the natural consequence was, a military subjection throughout the whole community. The prince could always collect an army of feudatories ready to defend not only the kingdom in general, but the particular possessions of each person, and the propriety of this constitution was soon apparent in the strength which these newly erected kingdoms acquired, and the value with which their conquests were defended.

Besides these feodal grants, however, which were held only on the terms of military service above mentioned, there were others called alodial, which were given upon more enlarged principles. To these every free man had a title; and could not only claim his territory as well as the rest, but dispose of it at his pleasure (a); and this freedom was denominated alodiality. These alodialia, however, were not exempt from military service. A part of their freedom consisted in liberty to go to the wars; for this, in the barbarous times we speak of, was the only way to acquire any degree of renown. Only the slaves were destined to follow the arts of peace; while every free person was not only at liberty to defend his own country, but under an obligation to do it in case of any urgent necessity.

Thus there was a feodal and a national militia. The Feodal and free people only were allowed to possess property; the feodal system constituted the army, properly so called; while the national militia was composed of the alodial proprietors. This alodiality, however, was not confined to landed property, but included likewise movable estates or money; so that proprietors of the latter kind were obliged also in times of danger to bear arms and appear in the field. Between the feodal and different situations of landholders, however, there was this further of the fees; difference, that the latter had no concern with any feudal and of private quarrels which might take place among the feudal lords themselves; so that they were never obliged to proprietor appear in the field unless when called forth by the sovereign against the enemies of the nation at large.

This circumstance we might suppose to be an advantage, but it ultimately operated otherwise; becoming the means of changing the alodial right into a feodal tenure. For some time the holders of fees had an eminent advantage over the alodial proprietors. This was owing to the imperfection of government in these days; so that the nobles had it in their power to revenge their own quarrels, while the weak were equally exposed to the insults of both parties. The lords and his vassals therefore were always formidable; but the alodial

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(a) The author of "A View of Society in Europe," has traced the remote sources of the feodals laws in an elegant and spirited manner (book i. chap. ii. sect. i.). Tacitus informs us, that the individuals of each of the German nations cultivated by turns a tract of land proportionable to their number, for the use of the whole; after which each individual received such an allotment of the cultivated tract as his dignity seemed to require. These nations had not altered their political principles at the time they overran the Roman empire; and hence the provinces of it were then divided after the same manner. The most considerable allotment was bestowed on the king, as being the most dignified person in the community, and this allotment was styled his domain; while the shores of citizens and warriors, which were likewise in proportion to the merit or dignity of each, constituted what was called alodiality. But as it often happened that all the land was not exhausted by these partitions, what remained was considered as the property of the community, and in the barbaric codes was called the lands of the free. In such German nations as had thus obtained a settlement, it was necessary that there should be a more close connexion between the sovereign and the chiefs, as well as between the chiefs and the people, than in others. This was effected by means of the lands of the free; for of these the sovereign took possession, dealing them out to the chiefs under the burden of appearing in arms whenever he should please to call; while the chiefs in like manner dealt out lands to those called their retainers, who were also obliged to supply them with military assistance in cases of necessity. Hence a political system was founded, which had a prodigious effect on society in all those countries where it prevailed. The intention and tendency of this system was to render the nation independent both at home and abroad; for, while the people were all armed in their common defence, individuals were also properly guarded against the attacks of depopulation. The power of the chiefs, who formed a regular nobility, was a counterpoise to that of the sovereign; while the number of the retainers and vassals, constituting the greatness and power of the nobility, was a proper barrier against aristocratical oppression; for a chief who oppressed his vassals evidently acted against his own interest.
allodial proprietors had scarce any means of defending themselves. The reason of this was, in the first place, that the law did not allow them to commit any hostilities; and in the next, they were too distant and unconnected to form any proper league for mutual defence; and hence proceeded the necessity already hinted at, of converting allodial property into feudal tenure. This was indeed owing in a great measure to the absurdity and violence of the times, by which gifts of property, burdened with service, and which might return to the person who granted them, were rendered superior in value to the absolute and unconditional possession of a subject. Other considerations, however, besides that just mentioned, contributed to produce the same effect. As in those dark ages no right existed but what had its origin in conquest, it thence followed, that the greatest conqueror or warrior was the most honourable person. The king, in whom the whole exploits of the community centered, as being their head, was the most honourable person; all others derived from him that portion of honour which they enjoyed, and which was most nicely adjusted in proportion as they approached him. Allodial proprietors, therefore, having no pretensions of this kind, were treated with contempt as a kind of potters. From this disagreeable situation they wished to free themselves, by converting their allodial property into feudal tenures; while the princes, supposing it their interest to extend those tenures as much as possible, discouraged the allodial possessions. As the feudalists supported the importance of the nation and dignity of the monarch, it was not thought proper to allow the allodial proprietors any greater compensations than what were given to vassals in similar cases. Thus they were exposed to continual mortifications in the courts of justice; they were neglected by the king; denied sufficient protection from the laws; exposed not only to continual insults; but to have their property on all occasions destroyed by the great: so that they were without resource except from the feudal tenures, and were obliged even to solicit the privileges which were bestowed in other cases on vassals. In these unhappy circumstances, they were glad to yield up their lands to any superior whom they thought most agreeable, and to receive them back from him as a feudal gift. Thus the landed property was everywhere changed into feudal tenures, and fees became universal (c).

For some time the feudal system was not only useful in itself, but honourable in its principles; but this continued no longer than while the importers of it into Europe adhered to their original simple and noble maxims. During that period, the lord exercised his beauty

(c) It has been an object of inquiry to the learned, in what nation of barbarians fees had their origin? But it is probable, that they took place in all these nations nearly about the same time, on the same principles; and were continued by reason of a similarity of manners, conquests, &c. so that we cannot ascribe the prevalence of them to imitation.

In France, we find mention made of fees as early as the age of Childeric. They were introduced into Italy by the Lombards; amongst whom the customs and laws relating to fees seem very early to have made rapid advances*. They were introduced into Spain before the invasion of the Moors and Saracens in the year 710. Lands were granted for service and attachment among the Goths; among whom also the person who received the gift was the retainer of him who granted it. If he refused his service, the grant was forfeited, and he was said to receive it in patrocinio; he also swore fealty to his lord; and on this footing the national militia was regulated†. There can be very little doubt that the feudal law was known in England in the	

* See also Whitaker's Hist. of Manches.
† L. Wid.
§ See also Whitaker's Hist. of Manches.
\(\frac{4}{4}\) See also Stuarts Obserw. on the Law and Constit. of Scotland.
Feudal System.

7. The feudal incidents.

The expectants of sefs were educated in the hall of the superior, while the tenures were precarious or only for life: and even when they became hereditary, the lord took care of the son and estate of his deceased vassal; not only protecting his person, but taking charge of his education, and directing the management of his affairs. He took pleasure in observing his approach to maturity; and when he came of age, never failed to deliver to him the lands, with the care of which he had been entrusted, and which he had been careful to improve. This was called the incident of wardship.

The incident of relief was founded upon the gratitude of the vassal; who, upon entering on his sef, brought a present to his lord, as an acknowledgement of his care of him during the early part of his life, and in order to conciliate his future regard.

The incident of marriage proceeded also upon the principle of gratitude on the part of the vassal. The latter, conscious of the favours he had received, did not choose to ally himself with a family inimical to his chief; while the superior himself, ambitious to aggrandize and augment the importance of his family, sought how to find the most advantageous match for his vassal.

Sometimes the superior himself was reduced in his circumstances by war or other accident: but from whatever cause his distress proceeded, even though it had arisen from his own extravagance or profligacy, or when only destitute of means to support his ambition or grandeur, his vassals were bound to support and relieve him according to their circumstances; and this was called the incident of aid.

The incident of escheat took place on the part of the vassal, when, through cowardice, treachery, or any remarkable misbehaviour, he rendered himself unworthy of his sef. In that case, the taking it from him, and giving it to one more worthy, was called an escheat.

While the lords and vassals thus vied with one another in mutual acts of friendship and benevolence, universal happiness, liberty, and activity, were diffused through the society. The vassals behaved courteously towards the retainers, who were immediately below them; while they again were courted by the lords as constituting their importance and strength; the lords, lastly, giving a like importance and dignity to the sovereignty himself. Thus a regular, powerful, and compact system of government took place; an oneness and attention pervaded the various departments of state; so that, while the subjects were free, the nation at large was formidable.

During this happy state of affairs, the members of the national assembly in every country in Europe appeared in arms, whether they came personally or by their representatives. Such particularly was the case under the Anglo-Saxon government; and the happiness they at that time enjoyed made the oppression and tyranny of the Normans appear the more intolerable. In process of time, however, the state of society began to suffer a remarkable alteration. The high and disinterested notions, from which the happiness above mentioned took its origin, declined: the romantic ideas of chivalry ceased; and much more interested notions of fief property came in their stead. The separation of the vassal and interests of the lords from their vassals was the first step towards the destruction of the feudal system. Thus the incidents, which, as has just now been mentioned, version of promoted their happiness, did the very reverse. Pro-fief property being now looked upon as a distinction superior to personal merit, naturally introduced the most mercenary views. In consequence of these the infant ward, the care of whom was wont to be considered as a sacred and honorary trust, was now only looked upon as a means of procuring emolument to the superior. The latter now regarded the profits of his vassals as so many diminutions of his own wealth. Instead of taking care to improve the estate of his ward as formerly, he impoverished it; not only neglecting the education of the heir, but offering insults to himself; insomuch that the relations of the unfortunate vassal were frequently obliged to ransom from the avaricious superior both his person and effects. By merchandise of this kind the coffers of princes were filled, and wardships let out to strangers, who might exercise their rapacity with greater freedom. When the vassal at last attained the years of maturity, he came to the possession of his land without any of that joy and festivity which usually took place on the occasion. He received an inheritance wasted and destroyed, while new grievances daily presented themselves to augment the horrors of his situation. All the incidents, which in former times were so many expressions of gratitude on the part of the situation of vassal, were now changed into taxes which might be the vassals exacted at the pleasure of the lord. Before the vassal was invested in his land, the superior exacted from him a certain sum or other gift, to be measured only by his own rapacity; and in case of delay or inability to pay this demand, the superior continued in possession of the estate. Such scandalous oppression could not but produce the greatest discontent and clamour. Applications were made to the law without success; nor were even the laws regarded which were fabricated on purpose for their relief. The incident of marriage now proved a source of the most dreadful oppression. The lord assumed a right of marrying his vassal to whom he pleased; and he not only exercised this right himself, but would sell it to a stranger, or allow the vassal to buy it himself; while the penalty annexed to a marriage without easily pointed out. At first they were precarious, or at the pleasure of the lord; afterwards they were granted for life; then for a course of years longer than the natural life of a man; and, lastly, they became hereditary, which was their most perfect stage. This progress has been observed in every country where feudal tenures exist; and the same must have been known in Scotland, though, in considering it, we are necessarily carried back to periods of remote antiquity; for as sefs were hereditary as early as the time of Malcolm II, they must have been in their precarious state several centuries before.
out the consent of the superior involved no less punishment than the loss of the estate itself, or some grievous infliction as for a crime of the first magnitude. The case was still worse with the female ward; whose beauty and accomplishments became a source of gain to the superior, or were sacrificed to please his whim or caprice; so that her relations were frequently obliged to buy from him the privilege of marrying her to the person she or they thought most proper. In like manner the estate, which was formerly a voluntary gift from the vassal in cases of distress happening to his lord, now became an unavoidable tax. An aid formerly was demanded when the eldest daughter of the superior was married, when his eldest son was knighted, or when the superior himself was taken prisoner in battle. These were the only legal causes of making a demand of this kind; but in the subsequent times of degeneracy, the most frivolous pretences were every day made use of by the prince to oppress the lords, and by the lords to oppress their vassals; demanding subsidies at pleasure, which their inferiors were always obliged to comply with. Lastly, The escheat, which in former times took place only in cases of cowardice, treachery, or some other heinous crime, was now inflicted on the most trivial occasions. If the vassal happened to be too long in attending the court of his superior to take the oath of fidelity; if he committed any action which could in the least be construed an infringement of the oath; if he neglected to give his lord warning of any misfortune which he might suppose was about to befall him; revealed anything concerning him; made love to his sister or daughter, &c.; or even if he should grant a tenure of land to another person in form different from that in which he held his own; all these, now others still more ridiculous, were judged sufficient reasons for the superior to seize on the estate of the vassal, and involve him and his family in ruin.

Notwithstanding these oppressions, however, the vassal was still obliged to submit to his lord; to own him as his superior; and even, in appearance, to pay him the same respect as formerly when the greatest unanimity and cordial affection subsisted between them. Still he was obliged to perform the same military service; because a failure in that respect would have subjected him to a forfeiture of lands according to the original agreement. A vast difference, however, now took place in the valour and activity which inspired the army. The vassals, forced into the field with despair, were indifferent as to the success of the cause in which they were engaged, and frequently obstructed instead of forwarding the operations of the field. Hence the sovereign found himself embarrassed; and, though nominally at the head of a martial and powerful people, was frequently unable to effect anything, by reason of the mutual hatred and dissension which everywhere prevailed.

Thus the feudal states of Europe became unnaturally weak: a remedy was necessary; and it is remarkable that the same remedy was applied all over the continent. This was, in short, the making heirs hereditary, which till now had only been granted for a long term of years; and, in return, burdening the lands with a certain number of soldiers, which were not to be refused under any pretence whatever. Hence was derived the tenure of knight-service. A certain portion of land, invested with the service of one soldier or knight, was called a knight's fee; and thus the estate, furnishing any certain number of soldiers, was said to contain as many knight's fees; so that now the manors, baronies, &c. became powerful according to the number of soldiers they were bound to furnish. In the grants from the crown, the nobility were obliged to furnish a certain number of soldiers for the service of the sovereign; and in those from the nobility to their vassals, the like service was required. Even the commons who had grants from the crown furnished a certain proportion of knights. The force of the nation was called into action by grants in capite, or from the sovereign and nobility. A numerous and powerful army was instantly assembled, and at once ready for action. Of this army the king was the general, the nobility the officers, and the vassals soldiers; the whole being exactly arranged, and capable of entering upon any expedition without the least delay.

Thus a remedy was found in some measure for the weakness of the feudal sovereigns: but though the knights tenure could accomplish this, it could not bring back the former affection and cordiality which subsisted between the various ranks of people. On the contrary, by uniting them more firmly to one another by legal ties, it rendered matters rather worse. The oppression originating from the operation of the feudal incidents, still continued with unremitting violence. The grants of knights tenure were attended with the same oaths of homage and fealty; the same incidents of relief, wardship, marriage, aid, and escheat, with the feudal tenures. The princes promised to abate somewhat of their rigour in demanding the feudal perquisites, but did not keep their word. Laws were occasionally promulgated, and for some time had an effect; but palliatives soon became ineffectual, and a new state of weakness began to commence.

The two remarkable eras in the feudal history are, Two on the time before the invention of knight-service (D), and in the bi- that during which it continued. Feuds were in a state of fluctuation from the destruction of the Roman empire till the ninth century; but they were rendered perpetual in France about the year 877, and were gen- erally become so in every country of Europe about the begining of the tenth. Du Cange, voces Militiae, gives us an example of a knight fee in the year 880. By the year 987, when Hugh Capet was raised to the throne Duke of France, knight service was became general all over Europe, and was introduced into England after having made its appearance in other countries (E). In Eng- land, however, there have been several doubts and in- quiries respecting it.
quias among the learned concerning the introduction of the feudal laws. Many are of opinion, that they were first introduced by William the Conqueror; and, consequently, that they were entirely unknown to the Anglo-Saxons: but others think, that they existed among the latter in the same form under which they were continued by the Normans. Dr Stuart is of opinion that the Saxons who settled in England could not be strangers to seises. He supposes the conformity of manners, which undoubtedly prevailed between the Saxons and other barbarians, a sufficient proof that the hereditary grant of land, as well as the fluctuating state of feudal tenures which preceded it, were known to the former. Collateral proofs are derived from the spirit and tenure of the Anglo-Saxon laws, but especially from the grants of hereditary estates on condition of military service (f). The condition of seises under the Anglo-Saxons was very different from what it was afterwards. In their times we find no mention made of these oppressive grants; and when such notice has been taken, and this may be easily accounted for from the alteration of the feudal spirit in different ages. During the time that a warm and generous affection subsisted between the feudal superiors and vassals, the incidents were marks of generosity on the one part, and gratitude on the other; but as soon as a variance had taken place, by reason of the interested disposition which the introduction of luxury produced, the same incidents became sources of the most flagrant oppression. This was remarkably the case in the time of William the Conqueror; and during the reign of King John, matters were come to such a crisis, that the people everywhere complained loudly, and demanded the restoration of the laws of Edward the Confessor (c). "What these laws of Edward the Confessor were (says Mr Home), which the English every reign during a century and a half desired so passionately, to have restored, is much disputed by antiquaries; and our ignorance of them seems one of the greatest defects of the ancient English history." Dr Stuart has offered an explanation; but this is in fact no more than a conjecture, that "by the laws or customs of the Confessor, they by that condition of felicity was expressed which had been enjoyed during the fortunate state of the feudal association. The cordiality, equality, and independence, which then prevailed among all ranks in society, continued to be remembered in less prosperous times, and occasioned an ardent desire for the revival of those laws and usages which were the sources of so much happiness."

Besides the great distinction (of which an account has already been given) between the state of seises under the Anglo-Saxons and under the Normans, they were no less distinguished by the introduction of knighthood and the service. Hitherto the refinement of the English had Anglo-Saxon nobility, and not the aristocratic party of the Danes, and the Norman insular situation of the kingdom; but after the Norman conquest the seises were made perpetual. Still, however, the knight-fee and knight-service were altogether unknown. William, the sixth prince who enjoyed the duchy of Normandy, was well acquainted with every thing relating to seises; for that duchy had experienced all the variety incidental to them from the time of its being granted to Rollo by Charles the Simple in the year 912, to the year 1066, when William was put in possession of England by the battle of Hastings.

On his accession to the throne, a number of forfeitures took place among those who had followed the fortune of Harold. Their estates were to be disposed of at the pleasure of the conqueror; and it was natural to suppose that he would follow the method practised in

was known in Scotland, and that it was not a novelty at that time. The same author thinks it even probable that it was known in the time of David I. (f) The custom of entail was known to the Anglo-Saxons; and this practice, as well as the succession to alodial estates, must have contributed very much to establish hereditary seises. This opinion seems also to be confirmed by the accounts we have of the great power of many of the nobility among the Anglo-Saxons, and the natural tendency that seises must have, in the course of things, to become perpetual, though analogical arguments cannot entirely be depended on in this case. There is indeed positive evidence that the territory which ancellately constituted the kingdom of Mercia belonged to Ethelred as an hereditary seise and earldom. The grant was given him by Alfred when he married his daughter Ethelfleda: and it is likewise attested by Camden, that in the time of Ethelred the earldom of Leicester was an inheritance, and the regular succession of its earls is still known. We are informed also by creditable historians, that Beresia and Deirieland were seised and inheritable earldoms among the Saxons. The same was true of the county of Cumberland when possessed by the Scottish monarchs. This last appears from the Saxon Chronicle: in which the grant was conveyed by Edmund king of England to Malcolm of Scotland in the following terms: "Edmundus rex totam Cumberland predidit, et contrivit, et commendavit eam Malcolm regis Scotiae; hoc pacto, quod in auxilium sibi foret terram et mari." From the use of the word commendavit, indeed, Spelman takes occasion to say, that a seised homage was not intended: but the contrary may be proved by the original Saxon from which the foregoing is a Latin translation; and the word, according to several learned critics, signifies seised homage with the most strict propriety. Thus Du Cange informs us, that commendavit se abutus was the general expression for faire Hemmage a us suerfrans.

(c) The laws which are now extant under the name of Edward, are generally allowed to be of doubtful authenticity; nor are they, even supposing them to be genuine, of any use in answering the present question. They determine indeed the existence of seises among the Anglo-Saxons: and Dr Stuart is of opinion, that the compilation which goes under the name of this prince, though posterior to the date it bears, nevertheless merits greater attention than has usually been bestowed upon it. M. Honard, a foreign lawyer, is the latest writer who has made it his study; but he is better acquainted with the Norman than the Anglo-Saxon customs.
in his own country. Hence the origin of knight service in England. A grant of land to a tenant, whatever was estimated at a certain number of knight fees; and each of these required the service of a knight. The grants of lands were even renewed to the old tenants under this tenure; so that by degrees the whole military people in the kingdom acquiesced in it. To accomplish this, Domesday Book is supposed to have been compiled, which contained an exact account of all the landed property of the kingdom.—Hence it is to be concluded, not that William introduced septs into England, as some have imagined, but that he brought them to their ultimate state of perfection by the introduction of knight-service. This is evident from the laws enacted during his reign. In these it is not only mentioned that knight-service was enacted, but that it was done expressly with the consent of the common council of the nation; which at that time was equivalent to an act of parliament (H).

The invention of knight-service proved generally agreeable: for, as only a few of the Anglo-Saxon septs were hereditary, the advancement of the new dignity, under the tenure of knight-service, must have accounted for an acquisition of some importance; as not only augmenting the grandeur and dignity of the sovereign, but securing the independence of the subject, and improving his property. In the happy state of the feudal association, there was indeed no necessity for the knight's fee; but when the discordance and oppression so often mentioned began to take place, it became then necessary to point out particularly every duty of the vassal, as well as of the lord; and this was fully done by the invention of knight-service. The nobles possessed dukedoms, baronies, and earldoms; which extensive possessions were divided into as many fees, each of them to furnish a knight for the service of the king, or of the superior; so that every feudal state could command a numerous army and militia to support and defend it in case of any emergency. The knights were also bound to assemble in complete arms whenever the superior should require it, to go to the field, and to hold themselves in readiness for action whenever the king or superior found it convenient to take the field: so that thus the militia might be march ed at the shortest notice to defend or support the honour of the nation.

The knights were usually armed with a helmet, sword, lance, and shield; and each was besides obliged to keep a horse. This last requisite was owing to the contempt into which the infantry had fallen through the prevalence of tournaments and luxuries of various kinds, though it was by means of the infantry that the barbarians had originally distinguished themselves in their wars with the Romans, and became able to cope with these celebrated warriors. All proprietors of the said tenantry, by knight-service, fought on foot; the cavalry were distinguished by the name of battle; and the success of every encounter was supposed to depend on them alone. They only were completely armed; the infantry, being furnished by the villages under the jurisdiction of the barons, had at first only bows and stings; though afterwards they were found worthy of much greater attention.

While the feudal association remained in perfection, its service the superior could at any time command the military service of his vassals; but in the subsequent degeneracy this service could neither be depended upon when wanted, nor was it of the same advantage when obtained as formerly. The invention of knight-service tended in a great degree to remedy this inconvenience. Those who were possessed of knight's fees were now obliged to remain 40 days in the field at their own expense; and this without exception, from the great crown vassals to the smallest feudatories; but if longer service was required, the prince was obliged to pay his troops. In those times, however, when the fate of nations was frequently decided by a single battle, a continuance in the field for 40 days was sufficient for ordinary occasions.

Thus matters seemed once more to be restored nearly to their former state. It was now, as much as ever, the interest of the nation to act with unanimity in its defence, not only against foreign enemies, but against the tyranny of the prince over his subjects, or of one part of the subjects over the other. New inconveniences, however, soon began to take place, owing to the gradual improvements in life and the refinement of manners. From the first institution of military service, a fine had been accepted instead of actual appearance in the field. In the times of barbarity, however, when men accounted rape and bloodshed to their only glory, there were but few who made an offer of this compensation; but as wealth and luxury increased, and the manners of people became softer, a general unwillingness of following the army into the field became also prevalent. A new tenure, called escape, was therefore introduced, by which the vassal was only obliged to pay his superior a sum of money annually, instead of attending him into the field*. Hence originated taxes and their misapplication; for as the king possessed thus the whole kingdom, it thence happened that the whole escape money collected throughout the nation centre in him. The princes then, instead of recruiting their armies, frequently filled them with the money, or dissipated it otherwise, hiring mercenaries to defend their territories when threatened with any danger. These being composed of the dregs of the people, and disbanded at the army.

(H) The following law of William the Conqueror not only makes express mention of the knight's fee and service, but alludes to a former law of William and his parliament, by which this tenure was actually established.

FER [601]

end of every campaign, filled all Europe with a disorderly banditti, who frequently proved very dangerous to society. To avoid such inconveniences, standing armies were introduced, and taxes began to be raised in every European kingdom. New inconveniences arose. The sovereigns in most of these kingdoms, having acquired the right of taxation, as well as the command of the military power, became completely despotic; but in England the sovereign was deprived of this right by Magna Charta, which was extended to them, as related under the article ENGLAND, No. 1533; so that, though allowed to command his armies, he could only pay them by the voluntary contributions of the people, or their submitting to such taxes as were voluntarily imposed by themselves.

FEOFFMENT, in Law, (from the verb feoffare or infeudare, "to give one a feud") the gift or grant of any corporeal hereditament to another. He that so gives, or enfeoffs, is called the feoffor, and the person enfeoffed is denominated the feoffee.

This is plainly derived from, or is indeed itself the very mode of the ancient feudal donation; for though it may be performed by the word "enfeoff," or "grant," yet the aptest word of feoffment is do or deet. And it is still directed and governed by the same feudal rules; it is in its principle relative to the extent and effect of the feudal grant, tenor est qui legem dat feudeo, is in other words become the maxim of our law with relation to feoffments modus legem dat donation.

And therefore, as in pure feudal donations, the lord, from whom the feud moved, must expressly limit and declare the continuance or quantity of estate which he meant to confer, ne quis plus donasse praesumatur, quam in donatione expressisset; so if one grants by feoffment lands or tenements to another, and limits or expresses no estate, the grantee (due ceremonies of law being performed) hath barely an estate for life. For, as the personal abilities of the feoffee were originally presumed to be the immediate or principal inducements to the feoffment, the feoffee's estate ought to be confined to his person, and subsist only for his life; unless the feoffee, by express provision in the creation and constitution of the estate, hath given it a longer continuance. These express provisos are indeed generally made; for this was for ages the only conveyance, whereby our ancestors were wont to create an estate in fee-simple, by giving the land to the feoffee, to hold to him and his heirs for ever; though it serves equally well to convey any other estate of freehold.

But by the mere words of the deed the feoffment is by no means perfected: there remains a very material ceremony to be performed, called divinity of seisin, without which the feoffee has but a mere estate at will. See SEISIN.

FERÆ, an order of quadrupeds, belonging to the class Mammalia. See MAMMALIA INDEX.

FERALIA, in antiquity, a festival observed among the Romans on February 21st, or, according to Ovid, on the 17th of that month, in honour of the manes of their deceased friends and relations. Varro derives it from inferi, or from feri; on account of a reap carried to the sepulchres of such as the last offices were that day rendered to. Festus derives it from ferio, on account of the victims sacrificed.

Vol. VIII. Part II.

Vossius observes, that the Romans called death feră, "cruel," and that the word feralia might arise thence. —Macrobius, Saturni lib. 1. cap. 13. refers the origin of the ceremony to Numia Pompilius. Ovid, in his Fasti, goes back as far as Æneas for its institution. He adds, that on the same day a sacrifice was performed to the goddess Mutta, or Dume; and that the persons who officiated were an old woman attended with a number of young girls.

During the continuance of this festival, which lasted eleven days, presents were made at the graves of the deceased, marriages were forbidden, and the temples of the gods shut up. While the ceremonies continued, they imagined that the ghosts suffered no punishments in hell, but that their tormentors allowed them to wander round their tombs, and feast upon the meats which their surviving friends had prepared for them.—For a more particular account of the offerings and sacrifices and feasts for the dead, see INFERI and SILENIO.

Sometimes at the feralia public feasts were given to the gods, at the tombs of the rich and great, by their heirs or particular friends.

FER DE FOURCHETTE in Heraldry, a cross having at each end a forked iron, like that formerly used by soldiers to rest their muskets on. It differs from the cross-fourche, the ends of which turn forked; whereas this has that sort of fork fixed upon the square end. See HERALDRY.

FER de Moulins, Milinde, Inks de Moulins, in Heraldry, is a bearing supposed to represent the iron ink, or ink of a mill, which sustains the moving millstone.

FERDINAND V. king of Spain, called the Catholic, which title was continued to his successors. He married Isabella of Castile, by which that kingdom was united to the Spanish crown. This illustrious couple laid the foundation of the future glory and power of Spain. The conquest of Granada, and the discoveries of Christopher Columbus, made this reign a celebrated era in the history of Spain. He died in 1516, aged 63. See (History of) SPAIN.

FERENTARI, in Roman antiquity, were auxiliary troops, lightly armed; their weapons being a sword, bow, arrows, and a sling.

FERENTINUM, in Ancient Geography, a town of the Hernici in Latium, which the Romans, after subduing that nation, allowed to be governed by its own laws. Now Feretino, an episcopal city in the Campagna di Roma. E. Long. 14. 5. N. Lat. 41. 45.

FERENTUM or FORENTUM, in Ancient Geography, a town of Apulia in Italy. Now Forenza, in the Basilicata of Naples.

FERETRIUS, a surname of Jupiter, Æ ferendo, because he had assisted the Romans: or Æ ferendo, because he had conquered their enemies under Romulus. He had a temple at Rome built by Romulus. It was there that the spoils called opima were always carried.

FERETRUM, among the Romans, the bier used in carrying out the bodies of the dead, which duty was performed by the nearest male relations of the deceased: thus, sons carried out their parents, brothers their sisters, &c.

FERG, or FERQUE. Francis Paul, a charming landscape-painter, was born at Vienna in 1680, and there learned the first principles of his art. He successively
essively practised under Hans Graf, Orient, and Thiele. This last, who was painter to the court of Saxony, invited him to Dresden to insert small figures in his landscapes. Ferf thence went into Lower Saxony, and painted for the duke of Brunswick and for the gallery of Salzbad. From Germany he went to London, where he might have lived in the highest esteem and affluence, if, by an indirect marriage, he had not been so effectually depressed, that he was ever after involved in difficulties. The necessities which arose from his domestic troubles compelled him to diminish the prices of his paintings in order to procure an immediate support; and as those necessities increased, his pictures were still more sunk in their price, though not in their intrinsic value. By a series of misfortunes he was overrun with debts, and to avoid the pursuit of his creditors, he was constrained to secrete himself in different parts of London. He died suddenly in the street one night as he was returning from some friends, about the year 1738, before he had attained his 50th year; and left four children. This pleasing artist, Mr Walpole observes, had formed a manner of his own from various Flemish painters, though resembling Polemarch, most in the enamelled softness and mellowness of his colouring; but his figures are greatly superior; every part of them is sufficiently finished, every action expressive. He painted small landscapes, fairs, and rural meetings, with the most agreeable truth; his horses and cattle are not inferior to Wouvermans; and his buildings and distances seem to owe their respective softness to the intervening air, not to the pencil. More faithful to nature than Denner, he knew how to omit exactness, when the result of the whole demands a less precision in parts. The greatest part of his works are in London and Germany; and the price they now bear is the best proof of their real merit. He also etched well with aquafortis; and his prints of that kind are generally esteemed by the curious.

FERGUSON, the name of three kings of Scotland. See (History of Scotland).

FERGUSON, JAMES, an eminent experimental philosopher and mechanic, was born in Scotland, of very poor parents. At an early age his extraordinary genius began to be felt within him. He first learned to read by overhearing his father teach his elder brother; and he had made this acquisition before any one suspected it. He soon discovered a peculiar taste for mechanics, which first arose on seeing his father use a lever. He pursued this study a considerable length, even while very young; and made a watch in woodwork, from having once seen one. As he had no instructor, nor any help from books, everything he learned had all the merit of an original discovery; and such, with infinite joy, he believed it to be. As soon as his age would permit he went to service; in which he met with hardships which rendered his constitution feeble through life. Whilst he was servant to a farmer (whose goodness he acknowledges in the modest and humble account of himself which he prefixed to his last publication), he frequently contemplated the stars; and began the study of astronomy, by laying down, from his own observations only, a celestial globe. His kind master, observing these marks of his ingenuity, procured him the countenance and assistance of his superiors. By their help and instructions, he went on gaining farther knowledge, and was sent to Edinburgh. There he began to take portraits; an employment by which he supported himself and family for several years, both in Scotland and England, whilst he was pursuing more serious studies. In London he first published some curious astronomical tables and calculations; and afterwards gave public lectures in experimental philosophy, which he repeated (by subscription) in most of the principal towns in England, with the highest marks of general approbation. He was elected a fellow of the Royal Society, without paying for admission (an honour scarcely ever conferred on a native); and had a pension of 50l. per annum, given him, unsolicited, by our gracious king, at his accession, who had heard lectures from him, and frequently sent for and conversed with him on curious topics. He also received several presents from his majesty, the patron of real merit. To what a degree of consideration Mr Ferguson mounted by the strength of his natural genius, almost every one knows. He was universally considered as the head of astronomy and mechanics in this nation of philosophers. And he might justly be stiled self-taught, or rather heaven-taught; for in his whole life he had not above half a year's instruction at school. He was a man of the clearest judgment and the most unwearied application to study; benevolent, meek, and innocent in his manners as a child; humble, courteous, and communicative; instead of pedantry, philosophy seemed to produce in him only diffidence and urbanity,—a love for mankind and for his Maker. His whole life was an example of resignation and Christian piety. He might be said to be an enthusiast in his love of God, if religion, founded on such substantial and enlightened grounds as his was, could be styled enthusiasm. He died in 1776.

FERGUSON, Robert, a Scottish poet, who acquired a considerable share of celebrity at a very early period of life, was born at Edinburgh on the 5th of September 1750, of which we are assured from unquestionable authority, although some have placed it in 1751. His father's name was William, who, as well as the son, likewise paid court to the muse: but he wisely relinquished the study of poetry for the more certain emolu- ments of trade and commerce. He was employed in different mercantile houses both in Edinburgh and Aberdeen. He was an accountant in the Linen Hall when he died, but never acquired any thing like an independent fortune.

The subject of the present sketch was of a weak and delicate constitution during infancy,—indeed to such a degree, that small hopes were entertained of his ever reaching the years of manhood. Yet such were the care and attention of his parents, that he was able to attend an English school by the time he was six years of age, when his progress was considered as very extraordinary. It was no less rapid at the high school of Edinburgh, which he attended four years, acquiring a competent knowledge of the Latin tongue with very little labour or exertion. From that he went to the grammar school of Dundee, and in two years after to the university of St Andrews, which place his father preferred to Edinburgh, because a gentleman of the name of Ferguson had left two bursaries for the education of two boys of the same name.
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So great were his necessities at this period, that he copied papers in the commissary clerk's office for so much per sheet, which employment he soon left in disgust. So boundless was his wit, which was only equalled by his good nature, modesty, and goodness of heart; that all who knew him received him with affection: but his powers of song and talents for mimicry often led him into the company of the dissipated, whose example could not fail of doing him essential injury, but who had neither the power nor inclination to provide for him through life. The irregularities into which he was thus frequently led, often awakened upon him the dictates of conscience; and the conversation of a minister who understood his manner of life, made a deep impression on his mind. In short, his remorse soon after assumed the appearance of absolute despair. His sprightliness entirely forsook him: but he gradually recovered from his despondency, and his health was fully restored. Soon after he cut his head so dreadfully in consequence of a fall, that from the loss of blood he became delirious, in which condition he remained for some months, till the want of sleep and perpetual talking put a period to his existence on the 18th of October 1774. He was buried in the Canongate churchyard. Over his grave his admirer Robert Burns has since erected a monument. Had he joined prudence to his bright genius and good heart, he would have no doubt risen to distinguished eminence in the literary world. His poems in the Scottish dialect have been universally admired by his countrymen; and when we reflect that they were composed in a round of dissipation, they must be considered as unequivocal evidences of his genius and taste.

FERGUSON, Adam, LL.D. a late Scottish philosopher and historian. See Supplement.

FERIAE, in Roman antiquity, holidays, or days upon which they abstained from work. Proclamation was generally made by the herald, by command of the Rex Sacrorum or Flamines, that all should abstain from business; and whoever transgressed the order was severely fined.—The feriae were of two kinds, public and private.

1. Statiae, which were kept as public feasts by the whole city upon certain immovable days appointed by their calendar; such were the Compitalia, Carmentalia, Lupercalia, &c.
2. Feriae Conceptionis, which were movable feasts, the days for the celebration of which were fixed by the magistrates or priests; of this sort were the Feriae Latinae, Paganalia, Compitalia, &c. which happened every year, but the days for keeping them were left to the discretion of the magistrates or priests.
3. Feriae Imperatives, which were fixed and instituted by the mere command of consuls, praetors, dictators, upon the gaining of some victory or other fortunate event.
4. Nundinae. See the articles NUNDINAE, AGONALIA, CARMENTALIA, &c.

The private feriae were holidays observed by particular persons or families on several accounts, as birthdays, funerals, &c. The feriae belonged to, and were one division of the dies festi. See FERI.

FERIAE Latinae, a festival at which a white bull was sacrificed, and the Latin and Roman towns provided each a set quantity of meat, wine, and fruits; and during the celebration, the Romans and Latins swore 4 G 2 eternal
The festival was instituted by Tarquinius Superbus when he overcame the Tuscans and made a league with the Latins, proposing to build a common temple to Jupiter Latialis, at which both nations might meet and offer sacrifices for their common safety. At first the solemnity lasted but one day, but it was at different times extended to ten. It was held on the Alban mount, and celebrated with chariot races at the Capitol, where the victor was treated with a large draught of wormwood drink.

FERIA, in the Roman breviary, is applied to the several days of the week; thus Monday is the feria seunda, Tuesday the feria tertia; though these days are not working days, but holidays. The occasion of this was, that the first Christians were used to keep the Easter week holy, calling Sunday the prima feria, &c. whence the term feria was given to the days of every week. But besides these, they have extraordinary feriae, viz. the three last days of Passion week, the two following Easter day, and the second feria of Rogation.

FERIANA, the ancient city of Thala in Africa, taken and destroyed by Metellus in the war with Jugurtha. It was visited by Mr. Bruce in his late travels through Africa, who expected to have found many magnificent ruins in the place, but was disappointed. The only remarkable objects he met with were the baths, which are excessively warm. These are without the town, and flow from a fountain named El Tarmid. Notwithstanding the excessive heat of its waters, the fountain is not destitute of fishes. They are of the shape of a gudgeon, about four inches in length; and he supposed that there might have been about five or six dozen of them in the pool. On trying the water with a thermometer, he found the heat so great, that he was surprised the fish were not boiled in it. That fish should exist in this degree of heat, is very surprising; but it seems no less wonderful that Mr. Bruce, while standing naked in such water, should leisurely make observations on its heat, without suspecting that he himself would be boiled by continuing there. We have to regret that the accidental wetting of the leaf on which he wrote down his remarks has deprived the public of the knowledge of the precise degree to which the thermometer was raised by this water. The fish are said to go down the stream to some distance during the day, and to return to the spring or warmest part at night.

FERMANAGH, a county of Ireland, in the province of Ulster, bounded by Cavan on the south, Tyrone on the north and north-east, Leitrim on the south-west, and Monaghan on the west. It is 38 miles long, and 24 broad. A great part of it is taken up with bogs; and the great lake called Lough-Earne, which is near 20 miles in length and in some places 14 in breadth, diversified with upwards of 300 islands, most of them well wooded, inhabited, and covered with cattle. It abounds also with greater variety of fish, such as huge pike, large breams, roach, eels, trout, and salmon. The water of the lake in some places is said to have a particular softness and limonose, that bleaches linen much sooner than could be done by other water. In one part of the country are marble rocks 50 or 60 feet high. This county sends three members to parliament, viz. two for the shire, and one for Inniskillen the capital. See FERMANAGH, SUPPLEMENT.

FERMAT, Peter de', an eminent French mathematician. See SUPPLEMENT.

FERMENT, any body which being applied to another, produces fermentation.

Ferments are either matters already in the act of fermentation, or that soon run into this act. Of the first kind are the flowers of wine, yeast, fermenting beer, or fermenting wine, &c. and of the second are the new expressed vegetable juices of summer fruit.

Among distillers, ferments are all those bodies which, when added to the liquor, only correct some fault, therein, and, by removing some obstacle to fermentation, forward it by secondary means: as also such as, being added in time of fermentation, make the liquor yield a larger proportion of spirit, and give it a finer flavour.

Fermentation, may be defined a sensible internal motion of the constituent particles of a moist, fluid, mixed or compound body; by the continuance of which motion, these particles are gradually removed from their former situation or combination, and again, after some visible separation is made, joined together in a different order and arrangement, so that a new compound is formed, having qualities very sensibly different from those of the original fluid.

Fermentation, properly so called, is confined to the vegetable and animal kingdoms; for the effervescences between acids and alkalies, however much they may resemble the fermentation of visous liquors, are nevertheless exceedingly different. It is divided into three kinds; or rather, there are three different stages of it, viz. the vinous, the acetic, and the putrefactive. To these has been added a fourth, the pomary, or the fermentation of bread. Of the first, vegetables alone are susceptible; the flesh of young animals is in some slight degree susceptible of the second (A); but animal substances are particularly susceptible of the third, which vegetables do not so easily fall into without previously undergoing the first and second. The produce of the first stage is wine, or some other visous liquor; of the second, vinegar; and of the third, ammonia or volatile alkali.

(A) Under the article CHINA, No. 115, a fact is mentioned which seems to show that animal substances are likewise capable of the visous fermentation; viz. that the Chinese make use of a certain liquor called lamb wine, and likewise that they use a kind of spirit distilled from sheep's flesh. This is related on the credit of M. Grosier: but as he does not mention the particulars of the process, we are at liberty to suppose that the flesh of these animals has been mixed with rice, or some other ingredients naturally capable of producing a visous liquor; so that instead of contributing any thing to the fermentation in question, they may in reality be detrimental, and furnish only that strong and disagreeable smell complained of in the liquid.
For the explanation of this process, according to the principles of modern chemistry, see Chemistry Index; and for the more general details of the process, see Brewing, Malting, and Vinegar-making.

FERN, FLEX. See FELIX, BOTANY INDEX.

Ferns are very common in dry and barren places. It is one of the worst weeds for lands, and very hard to destroy where it has any thing of a deep soil to root in. In some grounds, the roots of it are found to the depth of eight feet. One of the most effectual ways to destroy it is mowing the grass; and if the field is ploughed up, plentifully dunging thereof is very good: but the most certain remedy for it is urine. However, fern, cut while the sap is in it, and left to rot upon the ground, is a very great improver of land.

In some places of the north, the inhabitants mow it green; and, burning it to ashes, make those ashes into balls, with a little water. They then dry them in the sun, and make use of them to clean their linen with; looking upon it to be as good as soap for that purpose.

Male Fern. See Polypodium, Botany Index.
Female Fern. See Pteris, Botany Index.

FERNANDO, or FERNANDES, an island in the Pacific ocean. See JUAN FERNANDES.

FERNELIUS, John, physician to Henry II. king of France, was born in Picardy, in the latter end of the 16th or the beginning of the 17th century. Being sent to Paris to study rhetoric and philosophy, he applied himself in a most intense manner. All other pleasure was insipid to him. He cared neither for play nor for walking, nor for entertainments, nor even for conversation. He read Cicero, Plato, and Aristotle. The reading of Cicero procured him this advantage, that the lectures he read on philosophical subjects were as eloquent as those of the other masters were barbarous at that time. He also applied himself very earnestly to the mathematics. This continual study drew upon him a long fit of sickness, which obliged him to leave Paris. On his recovery, he returned thither with a design to study physic; but before he applied himself entirely to it, he taught philosophy in the college of St. Barbara. After this, he spent four years in the study of physic; and taking a doctor’s degree, confined himself to his closet, in order to read the best authors, and to improve himself in the mathematics; that is, as far as the business of his profession would suffer him. Never was a man more diligent than Fernel. He used to rise at four o’clock in the morning, and studied till it was time either to read lectures or to visit patients. He then examined the urine that was brought him; for this was the method of those times, with regard to the poor people, who did not send for the physician. Coming home to dine, he shut himself up among his books till they called him down to table. Rising from table, he returned to his study, which he did not leave without necessary occasions. Coming home at night, he did just as at noon: he staid among his books till they called him to supper; returned to them the moment he had supper; and did not leave them till 11 o’clock, when he went to bed. In the course of these studies he contrived mathematical instruments, and was at great charges in making them. But his wife murmuring at the expense, he dismissed his instrument-makers, and applied himself in good earnest to practise physic. But as visiting patients did not employ his whole time, he read public lectures upon Hippocrates and Galen. This soon gained him a great reputation through France and in foreign countries. His business increasing, he left off reading lectures; but as nothing could make him cease to study in private, he spent all the hours he could spare in composing a work of physic, entitled Physiologia, which was soon after published. He was prevailed with to read lectures upon this new work, which he did for three years; and undertaking another work which he published, De venae sectione, he laid himself under the necessity of reading lectures some years longer, in order to explain this new book to the youth. While he was thus employed, he was sent for to court, in order to try whether he could cure a lady, whose recovery was despaired of. He was so happy as to cure her; which was the first cause of that esteem which Henry II. was then but gaining, and was in love with that lady, conceived for him. This prince offered him, even then, the place of first physician to him; but Fernel, who infinitely preferred his studies to the hurry of a court, would not accept the employment. When Henry came to the throne, he renewed his entreaties: but Fernel represented that the honour which was offered him was due, for several reasons, and as an hereditary right, to the late king’s physician; and that, as for himself, he wanted some time to make experiments concerning several discoveries he had made relating to physic. The king admitted this: but as soon as Francis I’s. physician died, Fernel was obliged to go and fill his place at Henry II.’s court. And here just the contrary of what he dreaded came to pass; for he enjoyed more rest and more leisure at court than he had done at Paris; and he might have considered the court as an agreeable retirement, had it not been for the journey which the new civil war obliged the king to take. He died in 1548, leaving behind him a great many works, besides what have been mentioned; as, De abditis rerum causis, seven books on Pathology, a book on Remedies, &c. They have been printed several times, with his life prefixed, written by William Plantius his disciple.

Feronia, the Pagan goddess of woods and orchards. This deity took her name from the town Ferons, situated at the foot of Mount Soracte in Italy, where was a wood and temple consecrated to her. That town and wood are mentioned by Virgil, in the catalogue of Turnus’s forces. Strabo relates, that those who sacrificed to this goddess, walked barefoot upon burning coals, without being hurt. She was the guardian deity of freed men, who receive their capitulation at her temple.

Ferrara, a city of Italy, in the territory of the pope, capital of a duchy of the same name. It is seated in an agreeable and fertile plain; watered by the river Po, which is a defence on one side; and on the other is encompassed by a strong wall and deep broad ditch, full of water, as well as by a good citadel, finished by Pope Paul. In the middle of the city is a magnificent castle, which was formerly the palace of the dukes, and is now the least ornament of Ferrara. It is quite surrounded with water; and the arsenal, which is near it, deserves the observation of travellers. Over against the palace is the duke’s garden; with a park, called...
BELVIDERE on account of its beauty. Behind the garden there is a palace, built with white marble, called the palace of diamonds, because all the stones are cut in diamond fashion. Ferrara had formerly a considerable trade; but it is now much deserted. It is said to contain 24,000 inhabitants. The fortifications are now neglected, and the ancient university is dwindled into a wretched college of the Jesuits. However, in 1755, it was advanced to an archbishopric by Pope Clement XII. The country about it is so marshy, that a shower or two of rain renders the roads almost impassable. It is 24 miles north-east of Bologna, 38 north-west of Ravenna, 70 north-west of Florence, and 190 north of Rome. Murat’s army was defeated here in 1815 by the Austrians. E. Long. 12. 14. N. Lat. 44. 36.

FERRARA, the duchy of; a province in the pope’s territory, bounded on the north by the Austrian territories, on the west by the duky of Mantua and Mirandola, on the south by the Bolognese and by Romagna, of which it was formerly a part, and on the east by the gulf of Venice. It is 50 miles in length, and 48 in breadth along the coast; but grows narrow and narrower towards the Mantuan. This country is almost surrounded by the branches of the Po, which often overflow the country, and form the great morass of Comacchio, which has a bad effect on the air. It is thin of people, and indifferently cultivated, though fit for corn, pulse, and hemp. The Po and the lake of Comacchio yield a large quantity of fish. Ferrara is the capital town; besides which there are Arano, Comacchio, Magnavacca, Belriguardo, Cento, Buendeno, and Ficherola. This duchy was formerly possessed by the house of Este. But the pope took possession of it in 1598. The part of it beyond the Po was annexed to Lombardy in 1815.

FERRARIA, a genus of plants, belonging to the gynandria class; and in the natural method ranking under the sixth order, Euteria. See BOTANY INDEX.

FERRARS, George, a lawyer, poet, historian, and accomplished gentleman, was descended from an ancient family in Hertfordshire, and born about the year 1610, in a village near St Albans. He was educated at Oxford, and thence removed to Lincoln’s Inn; where applying with uncommon diligence to the study of the law, he was soon distinguished for his eloquence at the bar. Cromwell, earl of Essex, the great minister of Henry VIII. introduced him to the king, who employed him as his personal servant, and in 1535, gave him a grant of the manor of Flamstead, in his native county. This is supposed to have been a profitable estate; nevertheless, Mr Ferrars being a gay courtier, and probably an expensive man, about seven years after was taken to execution by a sheriff’s officer for a debt of 200 marks, and lodged in the compter. Being at this time member for Plymouth, the house of commons immediately interfered, and he soon obtained his liberty. He continued in favour with the king to the end of his reign, and in that of Edward VI. he attended the lord protector Somerset as a commissioner of the army in his expedition to Scotland in 1548. In the same reign, the young king being then at Greenwich, Mr Ferrars was proclaimed lord of mirrudes, that is, prince of sports and pastimes; which office he discharged during 12 days, in Christmas holidays, to the entire satisfaction of the court. This is all we know of Mr Ferrars; except that he died in 1579, at Flamstead in Hertfordshire, and was buried in the parish church. He is not less celebrated for his valor in the field, than for his other accomplishments as a gentleman and a scholar. He wrote, 1. History of the Reign of Queen Mary; published in Grafton’s chronicle, 1569, fol. 2. Six tragedies, or dramatic poëms; published in a book called the Mirror for Magistrates, first printed in 1559, afterwards in 1587, and again in 1610.

FERRET. See Mustela, Mammalia Index.

FERRETS, among glassmakers, the iron with which the workmen try the melted metal, to see if it be fit to work. It is also used for those irons which make the rings at the mouth of the bottles.

FERRETTO, in glass-making, a substance which serves to colour glass.

This is made by a simple calcination of copper, but it serves for several colours: there are two ways of making it. The first is this: Take the plates of copper, and lay them on a layer of powdered boracic ash, in the bottom of a crucible; over these lay more borax, and over that another layer of the plates, and so on alternately till the pot is full. Cover the pot, let it well, place it in a wind furnace, and make a strong fire about it for two hours. When it is taken out and cooled, the copper will be found so calcined, that it may be crumbled to pieces between the fingers like a friable earth. It will be of a reddish, and, in some parts, of a blackish colour. This must be powdered and sifted fine for use.

Another way of making ferretto is as follows. Make a number of stratifications of plates of copper and white vitriol alternately in a crucible; which place on the floor of the glass furnace near the eye; and let it stand there three days; then take it out, and make a new stratification with more fresh vitriol; calcine again as before. Repeat this operation six times, and a most valuable ferretto will be obtained.

FERRO, (W. Long. 19. N. Lat. 28.) the most westerly of the Canary islands, near the African coast, where the first meridian was lately fixed in most maps; but now, the geographers of almost every kingdom make their respective capitals the first meridian, as we do London. It is a dry and barren spot, affording no water except what is supplied in a very surprising manner by a tree which grows in these islands, called the FOUNTAIN-TREE.

FERRO, Faro, or Feroe Islands; a cluster of little islands lying in the Northern ocean, between 61° 15' and 62° 21' N. Lat. and between 5° and 8° W. Long. They belong to Denmark. There are 17 which are habitable; each of which is a lofty mountain arising out of the waves, divided from the others by deep and rapid currents. Some of them are deeply indented with secure harbours; Providence seeming to have favoured mankind with the safest retreats in the most boisterous seas. All are very steep, and most of them faced with most tremendous precipices. The surface of the mountains consists of a shallow soil of remarkable fertility; for barley, the only corn sown here, yields above 20 for one; and the grass affords abundant pasturage for sheep. The exports are, salted mutton and tallow, goose quills, feathers, and eider down; and, by
by the industry of the inhabitants, knitted woolen waistcoats, caps, and stockings. No trees beyond the size of juniper or stunted willows will grow here, nor are any wild quadrupeds to be met with except rats and mice, originally escaped from the shipping. Vast quantities of sea fowl frequent the rocks; and the taking of them furnishes a very profitable amusement to the natives, as described under the article Bird-Catching.

The sea which surrounds these islands is extremely turbulent. The tides vary greatly on the western and eastern sides. On the first, where is received the uninterupted flood of the ocean from the remote Greenland, the tide rises seven fathoms; on the eastern side it rises only three. Dreadful whirlwinds, called by the Danes øee, agitate the sea to a strange degree; catch up a vast quantity of water, so as to leave a great temporary chasm in the spot on which it falls, and carries away with it, to an amazing distance, any fishes which may happen to be within the reach of its fury. Thus great shoals of herrings have been found on the highest mountains of Feroe. It is equally resistless on land; tearing up trees, stones, and animals, and carrying them to very distant places.

Among the numerous whirlpools of these seas, that of Suderoe, near the island of the same name, is the most noted. It is occasioned by a crater 67 fathoms in depth in the centre, and from 50 to 55 on the sides. The water forms four fierce circumferences. The point they begin at is on the side of a large basin, where commences a range of rocks running spirally and terminating at the verge of the crater. This range is extremely rugged, and covered with water from the depth of 12 to 8 fathoms only. It forms four equidistant wreaths with a channel from 35 to 40 fathoms in depth between each. On the outside beyond that depth, the sea suddenly sinks to 80 and 90. On the south border of the basin is a lofty rock, called Sumbaa Munk, noted for the multitude of birds which frequent it. On one side, the water is only 3 or 4 fathoms deep; on the other 15. The danger at most times, especially in storms, is very great. Ships are irresistibly drawn in; the rudder loses its power; and the waves beat as high as the masts; so that an escape is almost miraculous; yet at the reflux, and in very still weather, the inhabitants will venture in boats for the sake of the fish.

Innumerable flocks of aquatic birds are continually to be seen perched on the extremities of the rocks, which make their nests in the crefts above the precipices; and vast numbers of them may be killed by the discharge of a single musket, and the rest will not stir, so little are they accustomed to be disturbed. One of the islands contains but a single habitation, which can be visited by the curate only in summer. In the southern parts of these islands coal-mines were discovered about the beginning of the eighteenth century, and trials of the coals were only made in 1777, when it was judged that working them would be of sufficient interest and consequence. The quarry was determined by a comissary to be about 12,000 feet long, 6000 broad on a medium, and five feet deep; but so great did the difficulty of working it appear, that the idea was abandoned. The coals were analyzed by the celebrated professor Krætzenstein of Copenhagen, who found that they were superior to those of England, as burning longer, and giving a more intense heat, but not so easily kindled. A trial of them has been made in Scotland, and they are allowed to be of a superior quality. It is a favourable circumstance to the exportation of the produce of those islands, that their harbours are never frozen, and navigation of consequence could meet with no interruption during the winter.

The measles and smallpox never attack the inhabitants but when they are brought there by strangers, when the ravages they make are almost as terrible as those of the pestilence; but for 50 years back they have not been subjected to this dreadful visitation. The air is temperate, and neither too hot in summer, nor extremely cold in winter. There are frequent mists on these islands, but they do not seem to be injurious to the health of the inhabitants. The wind often blows with such violence, that the people on horseback are obliged to dismount at its approach, which is announced by a whistling across the rocks; and persons on foot must throw themselves flat on their face, to avoid the dreadful consequences of the irresistible hurricane. So sudden is its approach at some times, that a burning candle might be carried in the open air but a few seconds before it. There is seldom any thunder on these islands; but when the phenomenon does happen, its awful and incessant roar among the rocks is truly appalling. Potatoes, the cultivation of which is rapidly advancing, thrive well, and the same is the case with radishes and turnips. Corn is not much cultivated, which would require excessive labour in a country so mountainous, and the spring fishery requires all the hands that can be spared. Trees cannot be made to grow upon them, and of consequence there is no wood.

The number of inhabitants amounted to 5,209 in 1812, and they are in general well made, with fair complexions, and their whiteness is very seldom impaired by the influence of the sun. They are not deficient in understanding; and although phlegmatic, yet they are benevolent and hospitable, and are seldom known to quarrel. They are fond of brandy, and yet it is said that they are very rarely seen in a state of intoxication. They are frugal and upright, yet extremely credulous, and much addicted to superstitious practices. There are no schools among them, as parents educate their own children, and their knowledge of consequence is very circumscribed. They abound in skilful players at chess, but are wholly unacquainted with instruments of music, and dance to the sound of the voice. See Feroe, Supplement.

FEROLO, a sea port town in Spain, in the province of Galicia, seated on a bay of the Atlantic ocean. It has a good harbour, and is frequented by the Spanish fleet in time of war. W. Long. 8° 46'. N. Lat. 43° 26'.

FERRUGINOUS, any thing partaking of iron, or which contains particles of that metal.

FERRUCO, Rust, or oxide of iron. See Iron, Oxide of, Chemistry Index.

FERRUM, Iron. See Iron, Chemistry Index.

FERRY, a liberty by prescription, or by the king's grant, to have a boat for passage, on a frith or river, for carrying passengers, horses, &c. over the same for a reasonable toll.

FERTILITY, that quality which denominates a thing fruitful or prolific.

Nothing can produce fertility in either sex, but what promotes
promotes perhaps health; nothing but good blood, spirits, and perfect animal functions, that is, high health, can beget perfect fecundity; and therefore, all means and medicines, all nostrums and specifics, to procure fertility, different from those which procure good blood and spirits, are arrant quackery. Dr. Cheyne says, that water-drinking males are very rarely infertile; and that, if any thing in nature can prevent infertility, and bring fine children, it is a milk and seed diet persevered in by both parents.

To increase the fertility of vegetables, says Lord Bacon, we must not only increase the vigour of the earth and of the plant, but also preserve what otherwise would be lost, whence he infers that there is much saved by setting, in comparison of sowing. It is reported, continues he, that if nitre be mixed with water to the thickness of honey, and after a vine is cut, the bud be anointed therewith, it will sprout within eight days. If the experiment be true, the cause may be in the opening of the bud, and contiguous parts, by the spirit of the nitre; for nitre is the life of vegetables.

How far this may be true, is not perhaps sufficiently shown, notwithstanding the experiments of Sir Kenelm Digby and M. Homberg. Consult Mr. Evelyn's Sylva, the Philosophical Transactions, the French Memoirs, and Dr. Stahl's Philosophical Principles of Chemistry; but a proper set of accurate experiments seems still wanting in this view.

FERULA, a little wooden paddle or slice, reputed the schoolmaster's sceptre, wherewith he chastises the boys by striking them on the palms of the hand. The word is Latin, and has also been used to denote the prelate's crozier and staff. It is supposed to be formed of the Latin ferre, "to strike." Under the eastern empire, the ferula was the emperor's sceptre, as is seen on divers medals: it consists of a long stem or shank, and a flat square head. The use of the ferula is very ancient among the Greeks, who used to call their princes μαχαρευομενοι, q. d. "ferula-bearers."

In the ancient eastern church, ferula or μαρθανη signified a place separated from the church; wherein the penitents or the excommunicates of the second order, called ausculantes, αυσκυλαντες, were kept, as not being allowed to enter the church; whence the name of the place, the persons therein being under penance or discipline: such ferula ortent ecclesiae.

FERULA, Fennel Giant, a genus of plants belonging to the pentandria class, and in the natural method ranking under the 45th order, Umbellatae. See BOTANY INDEX. The drug asafoetida is obtained from a species of ferula.

FESCENNIA, or FESCENNIUM, in Ancient Geography, a town of Eturia, above Falerii; where the Fescennine verses were first invented. Now Galass, in the Ecclesiastical State, near the Tiber.

FESCENNIUM VERSES, in antiquity, were a kind of satirical verses, full of wanton and obscene expressions, sung or rehearsed by the company, with many indecent gestures and dances, at the solemnization of a marriage among the Romans; (Hor. lib. v. ep. i. 145.) The word is borrowed, according to Macrobius, from faucium, "a charm;" the people taking such songs to be proper to drive away witches, or prevent their effect; but its more probable origin is from Fescennium, a city of Campania, where such verses were first Fescennine used.

FESSE, in Heraldry, one of the nine honourable ordinaries. See HERALDRY. Fesse Point, is the exact centre of the escutcheon.

Fesse Ways, or in Fesse, denotes any thing borne after the manner of a fesse; that is, in a rank across the middle of the shield.

Festi dies, in Roman antiquity, certain days in the year devoted to the honour of the gods. Numa, when he distributed the year into 12 months, divided the same into the dies festi, dies profesti, and dies intercessi.

The festi were again divided into days of sacrifices, banquets, games, and feasts. See FERIA.

The profesti were those days allowed to men for the administration of their affairs, whether of a public or private nature: these are divided into fasti, comitiales, &c. See FASTI, COMITIALES, &c.

The intercessi were days common both to gods and men, some parts of which were allotted to the service of the one, and some to that of the other. FESTINO, in Latin, the third month of the second figure of the syllabium, the first proposition whereof is an universal negative, the second a particular affirmative, and the third a particular negative; as in the following example:

FEST No bad man can be happy.
TI Some rich men are bad men.
NO Ergo, Some rich men are not happy.
FESTIVAL, a time of feasting. See FEST.

The term is particularly applied to anniversary days of civil or religious joy.

FESTOON, in Architecture and Sculpture, &c. an ornament in form of a garland of flowers, fruits, and leaves, intermixed or twisted together.

It is in the form of a string or collar, somewhat bigger in the middle, where it falls down in an arch; being extended by the two ends, the extremities of which hang down perpendicularly.

Festoons are now chiefly used in friezes, and other vacant places which want to be filled up and adorned; being done in imitation of the long clusters of flowers, which the ancients placed on the doors of their temples and houses on festival occasions.

FESTUCA, FESCUE GRASS, a genus of plants belonging to the triandria class, and in the natural method ranking under the 34th order, Gramina. See BOTANY and AGRICULTURE INDEX.

FESTUS POMPÆIUS, a celebrated grammarian of antiquity, who abridged a work of Verrius Flaccus, De Significatione Verborum; but took such liberties in extraction and criticising, as, Gerard Vossius observes, are not favourable to the reputation of his author. A complete edition of his Fragments was published by M. Dacier in 1681, for the use of the Dauphin. Scaliger says, that Festus is an author of great use to those who would attain the Latin tongue with accuracy.

FETLOCK, in the manege, a tuft of hair growing behind the external joint of many horses; for those of a low size have scarce any such tuft.

FETT,
FETTI, DOMENICO, an eminent painter in the style of Giulio Romano, was born at Rome in 1520, and educated under Ludovico Cigoli of Florence. He painted but little for churches, but excelled in history: his pictures are much sought after, and are scarce. He abandoned himself to disorderly courses; and put an end to his life by excesses, in the 33rd year of his age.

FEETUS. See FOETUS.

FEUD, in our ancient customs is used for a capital quarrel or enmity, not to be satisfied but with the death of the enemy; it is usually called simply feud. Feud, called also feoda, and feudum, in the original German, signifies guerra, i. e. bellesm, war. Lambert writes it feoth, and saith it signifies caputis inimicitia, or implacable hatred.

In Scotland, and the north of England, feud is particularly used for a combination of kinds, to revenge the death of any of their blood, against the killer and all his race, or any other great enemy.

FEUD (Foeda), the same with Fief, or Feud. See Feudal System.

FEUDAL, or FEODAL, of or belonging to a feud or fief. See Feodal.

FEUDATORY, or FEODATORY, a tenant who formerly held his estate by feodal service. See Feodal Tenure.

FEUD-DUTY, in Scots Law, is the annual rent or duty which a vassal, by the tenor of his right, becomes bound to pay his superior.

FEUD-HOLDING, in Scots Law, is that particular tenure by which a tenant is bound to pay an annual rent or fee-duty to his superior. See Feodary.

FEVER. See Medicine Index.

The ancients deified the diseases, as well as the passions and effections of men. Virgil places them in the entrance into hell, Aen. vi. 273. Among these Fevers, a temple on Mount Palatine, and two other parts of ancient Rome; and there is still extant an inscription to this goddess. FEBRI. DIV. E. FEBR. SANCTÆ. FEBR. MAGNÆ. CA. MILLA. AMATA. PRO. FILIO. MALE. AFF. CTO.

FEVER, in Farriery. See Farriery Index. FEVERFEW. See Matricaria, Botany Index.

FEVERSHAM, a town of the county of Kent in England, situated on a branch of the river Thames, which is navigable for boats. It was a royal demesne A.D. 811, and called in Domesday the King's little Town, though it is now a large one. It was inhabited by the Britons long before the invasion of Caesar. In 903, King Athelstan held a great council here. King Stephen erected a stately abbey, 1147, whose abbots sat in parliament; and he was buried in it, together with his queen, and Eustace his son; but of this building, two mean gate-houses are all that now remain. The town was first incorporated by the name of the barons of Faversham; afterwards by Henry VIII. with the title of the mayor and commonalty; and lastly, by that of the mayor and jurats and commonalty. It contained 3655 inhabitants in 1811, and consists chiefly of two long broad streets, with a market-house in the centre, built 1574. Its ancient church was rebuilt in 1754, at the expense of £3000.

FEVRE, TANEGUI LE, of Caen in Normandy, born in 1615, was an excellent scholar in Greek and Roman learning. Cardinal de Richelieu gave him a pension of 2000 livres to inspect all the works published at the Louvre, and designed to have made him principal of a college he was about to erect at Richelieu. But the cardinal's death cut off his hopes; and Cardinal Magazine having no great reliish for learning, his pension was ill paid. Some time after the marquis de Francler, governor of Langres, took him along with him to his government, and there he embraced the Protestant religion; after which he was invited to Saumur, where he was chosen Greek professor. He there taught with extraordinary reputation. Young men were sent to him from all the provinces in the kingdom, and even from foreign nations, while divines and professors themselves gloried in attending his lectures. He was preparing to go to Heidelberg, whether he was invited by the prince Palatine, when he died, aged 57. He wrote, 1. Notes on Anacreon, Lucan, the Roman poets, &c. 2. A short account of the lives of the Greek poets. 3. Two volumes of letters: and many other works.

FEVE, CLAUD LE, an eminent French painter, was born at Fountainbleau in 1633, and studied in the palace there, and then at Paris under Le Sueur and Le Brun; the latter of whom advised him to adhere to portraits, for which he had a particular talent, and in his style equalled the best masters of that country. He died in England in 1675, aged 42.

FEZ, the capital of a kingdom of the same name in Barbary, in Africa. It is described as a very large place, surrounded with high walls, within which there are hills and vallies, only the middle being level and flat. The river which runs through the city, is divided into two streams, from which canals are cut into every part of the town: so that the mosques, colleges, palaces, and the houses of great men, are amply supplied with water. They have generally square marble basins in the middle of the court of their houses, which are supplied with water by marble pipes that pass through the walls. They constantly run over, and the stream returns back into the street, and so into the river. The houses are built with brick or stone; and are adorned on the outside with fine mosaic work, or tiles like those of Holland. The woodwork and ceilings are carved, painted and gilt. The roofs are flat; for they sleep on the tops of the houses in summer. Most of the houses
houses are two stories high, and some three. There are piazzas and galleries running all round the court on the inside, so that you may go under cover, from one apartment to another. The pillars are of brick, covered with glazed tiles, or of marble, with arches between. The timber work is carved and painted with gay colours, and most of the rooms have marble cisterns of water. Some of the great men build towers over their houses several stories high, and spare no expense to render them beautiful; from hence they have a fine prospect all over the city.

There are in this city 700 mosques, great and small, 50 of which are magnificent, and supported with marble pillars and other ornaments. The floors are covered with mats, as well as the walls to the height of a man. Every mosque has a tower or minaret, like those in Turkey, with a gallery on the top, from whence they call the people to prayers. The principal mosque is near a mile and a half in circumference. The middle building is 150 yards in length, and 80 in breadth, with a tower proportionably high. Round this to the east, west, and north, there are great colonnades 30 or 40 yards long. There are 900 lamps lighted every night; and in the middle of the mosque are large branches, which are capable of holding 500 lamps each. Along the walls are seven pulpits, from which the doctors of the law teach the people. The business of the priest is only to read prayers, and distribute alms to the people; to support which, there are large revenues.

Besides the mosques, there are two colleges built in the Moorish manner, and adorned with marble and paintings. In one of them there are 100 rooms, besides a magnificent hall. In this there is a great marble vase full of water, adorned with marble pillars of various colours, and finely polished. The capitals are gilt, and the shafts with gold, azure, and purple. The walls are adorned with Arabic verses in gold characters. The other colleges are not near so beautiful, or rather are all gone to ruin since the neglect of learning.

There are hospitals in the city, where formerly all strangers were maintained three days gratis. But the estates belonging to them have been confiscated for the emperor's use. There are above 100 public baths, many of which are stately buildings. People of the same trade or business live in streets by themselves.

Though the country about Fez is pleasant and fertile, and in many places abounding with corn and cattle, yet a great part of it lies waste and uncultivated, not so much for want of inhabitants as from the oppression of the governors; which makes the people choose to live at some distance from the high roads, where they cultivate just as much land as is necessary for their own subsistence.

Round the city there are fine marble tombs, mausoleums, and gardens full of all manner of fruit trees. Such are the common accounts of this city. The following are given by M. Chenier, in his *Recherches Historiques sur les Maures*.

Fez was built in the end of the eighth century by Edris, a descendant of Mahomet and of Ali; whose father, in order to avoid the proscriptions of the caliph Abdalla, retired to the extremity of Africa, and was proclaimed sovereign by the Moors. Sidy Edris, having succeeded to the throne of his father, built the city of Fez in the year 792. He caused a mosque to be erected, in which his body was interred, and the city ever afterwards became an asylum for the Moors, and a place of devotion. In the first moments of its prosperity, which a new worship inspires, another mosque was built, called carabine, which is perhaps one of the largest and most beautiful edifices in Africa. Several others were successively built, besides colleges and hospitals; and the city was held in such veneration, that when the pilgrimage to Mecca was interrupted in the fourth century of the Hegira, the western Mahometans substituted that of Fez in its stead, while the eastern people went to Jerusalem.

When the Arabs had overspread Asia, Africa, and Europe, they journeyed to Fez the little knowledge they had acquired in the sciences and arts; and that capital conjoined, with the schools of religion, academies where philosophy was taught, together with medicine and astronomy. This last gradually degenerated; ignorance brought astrology into repute, and this quickly engendered the arts of magic and divination.

Fez soon became the common resort of all Africa. The Mahometans went thither for the purposes of devotion; the assembly of strangers introduced a taste for pleasure; libertinism quickly followed; and as its progress is most rapid in warm countries, Fez, which had been the nurse of sciences and arts, became a harbour for every kind of vice. The public baths, which health, cleanliness, and custom, had rendered necessary, and which were everywhere respected as sacred places, became scenes of debauchery; where men introduced themselves in the habits of women: youths in the same disguise, with a distaff in their hands, walked the streets at sunset in order to entice strangers to their inns, which were less a place of resort than a convenience for prostitution.

The usurpers who disputed the kingdom of Fez after the 16th century overlooked these abuses, and contented themselves with subjecting the masters of the inns to furnish a certain number of cooks for the army. It is to this laxity of discipline that Fez owed its first splendour. As the inhabitants are beautiful, the Africans flocked thither in crowds; the laws were overturned, morals despised, and vice itself turned into an engine of political resource. The same spirit, the same inclinations, the same depravity, still exist in the hearts of all the Moors. But libertinism is not now encouraged; it wears there, as in other places, the mask of hypocrisy; and dares not venture to show itself in the face of day.

The Mahometans of Andalusia, those of Granada and Cordova, migrated to Fez during the different revolutions that agitated Spain; they carried with them new customs and new arts, and perhaps some slight degree of civilization. The Spanish Moors carried from Cordova to Fez the art of staining goats and sheep skins with a red colour, which were then called Cordova leather, and now Masmoud leather, from that city where the art is less perfect. They manufacture gauzes at Fez, silk stuffs, and girdles, elegantly embroidered with gold and silk, which show how far their ingenuity might be carried if industry were more encouraged.

There is still some taste for study preserved at Fez, and the Arabic language is spoken there in greater purity.
purity than in any other part of the empire. The rich Moors send their children to the schools at Fezz, where they are better instructed than they could be elsewhere.

Leo Africanus, in the 16th century, gave a magnificent description of this city, from which most of those that have been afterwards made are copied; but its situation, its schools, and the industry and great urbanity of its inhabitants, are the only circumstances that give it any preference to the other cities of the empire. There are some pretty convenient inns here, consisting of two or three stories. The houses have no elegance; generally the streets are ill-paved, and no street that two persons riding abreast can hardly pass. The shops are like stalls; and have no more room in them than is sufficient to serve for the owner, who is always seated with his wares around him, which is shown to the passengers. But though the Moors of Fezz are more civilized than the rest, they are vain, pretentious, and intolerant; and an order must be obtained from the emperor before a Christian or a Jew can be allowed to enter the city.

The situation of Fezz is exceeding singular. It lies in the bottom of a valley surrounded by little hills in the shape of a funnel; the declivities are divided into gardens planted with tall trees, orange shrubs, and all sorts of fruit trees; a river meanders along the declivity, and turns a number of mills, which disperse the water abundantly to all the gardens, and almost to every house. The descent to the city, which stands in the centre, is long; and the road lies through these gardens, which it traverses in a serpentine direction. The houses, seen from the city, form a most delightful amphitheatre. Formerly each house had a hause in which the inhabitants spent the summer. These houses were destroyed in the times of the civil wars, and in the revolutions to which Fezz has been subject, and few individuals have restored them. Mr. Bay estimates the population of Fezz at 100,000; and Mr. Jackson at 380,000. But the latter estimate, though founded on public documents, is most probably an exaggeration.

On the height above Fezz, in a plain susceptible of rich cultivation, stands New Fezz, finely situated, and enjoying excellent air, containing some old palaces, in which the children of the emperor live, and where he sometimes resides himself. New Fezz is inhabited by some Moorish families, but by a greater number of Jews.

Fezz is seated on the river Cebu. W. Long. 4° 25'. N. Lat. 33° 48'.

FEZZAN, a kingdom of Africa, about 300 miles long from north to south, and 200 broad from east to west. It is bounded on the east by the Harattich and line of the deserts; by the country of the Tilboes on the south and south-west; by that of the Nomad Tuaregs on the south-west; and the country which forms the western boundary is inhabited by Arabs. It contains 101 towns and villages, of which Mourzouk is the metropolis. The climate of this kingdom is neither temperate nor agreeable at any season whatever; for the heat of summer is almost intolerable, even to the inhabitants, especially when the wind blows from the south; and the prevalence of the north wind during winter makes the cold so intense, as not only to chill the natives, but those also who visit it from northern regions.

Rain falls but seldom in this country, and in very small quantities. Thunder is also a rare phenomenon: Mr. Horneman assures us that there was not a single storm from November 1798 to June 1799; and that on the last day of January 1799 there were some faint flashes of lightning, unaccompanied by any claps of thunder. Winds, however, blow very frequently, both from the north and south, whirling up the dust and sand in such a manner as to give the atmosphere a yellowish appearance. There is neither river nor rivulet of any consequence in the whole country, according to Mr. Horneman, who informs us that the soil is a clay band, beneath which is found calcareous rock or earth, and sometimes a stratum of an argillaceous substance.

Date trees may be considered as the natural production of Fezzan, in the western parts of which some senan grows, of a superior quality to that which is imported from the country of the Tilboes. Culinary plants, and almost every vegetable peculiar to the garden, are met with in abundance. Wheat and barley seem well adapted to the nature of the soil, as well as to the climate; yet corn is not raised in sufficient quantity for home consumption, which is brought from those parts of Africa bordering on the northern parts of the kingdom. This is most probably owing to the native indolence of the people, the despotism of their government, and the difficulties inseparable from their peculiar mode of tillage.

They bestow little attention on the rearing of cattle, which are only found in the most fertile parts of the country, and even in these they are not numerous. They are made use of to draw water from the wells, and are never killed but in cases of absolute necessity. The common domestic animal is the goat; and although sheep are reared in the southern parts of the country, the most abundant supply is furnished by the Arabs on the borders. They make coarse cloths of the wool, which constitute the apparel of the inhabitants in general. Their horses are not numerous, as they make most use of asses, either for carriage, draught, or burden. Camels bear a most extravagant price, being only made use of by the higher ranks, or by opulent merchants; and the common food of all these animals is the fruit of the date tree.

Although the trade of Fezzan consists entirely of foreign articles, it is nevertheless considerable. Mourzouk is the great market and place of general resort for different caravans from Cairo, Bengasi, Tripoli, and other places, between the months of October and February. The caravans which come to Mourzouk from the east or south, deal in goods from Fezzan, gold dust, and also in slaves of both sexes as articles of commerce. Tobacco and snuff, with other articles manufactured in Turkey, are brought to the capital by the merchants from Bengasi; and paper, fire-arms, sabres, knives, and woollen cloth, are conveyed to it from Tripoli.

Fezzan is governed by a sultan, a descendant of the family of the Shereefs; and according to the tradition of the country, his ancestors came from the western parts of Africa, and made a conquest of it about 500 years ago. He reigns over his dominions with ab-
FEZ

It is difficult to ascertain any thing like an accurate statement of the population of Fez: but Mr. Horm
man conjectures that they may amount to about 75,000, all of them professing the religion of Mahomet.
The complexion of the people varies considerably; those in the northern parts bearing in this respect a striking resemblance to the Arabians, while those in the southern districts are very much like the Tihobes and Touaregs. Those who are strictly indigenous are of ordinary stature, and their limbs far from being muscular; of a deep brown colour, short black hair, with their faces formed like the people of Europe, and their nose not so flat as that of the negro. Their walk, mien, and gesture, indicate a total want of energy, either of body or mind.

The women of this country are in general fond of dancing, and the wanton manners and public freedoms in which they are permitted to indulge, are frequently astonishing, even to Mahometans from other countries; and the men are very much addicted to the vice of drunkenness, using the juice of the date-tree, or a drink that is called fous, which is of an intoxicating nature.

Different species of the venereal disease prevail in this country, but that which is brought from Sevastopol is reckoned the most inveterate. The common loes venerea is called fronzi, the cure of which they make use of salt and colostrum as powerful cathartics, healing the sores with natron water or dissolved soda. They are sometimes afflicted with hemorrhoids, the cure of which is no doubt rendered more difficult by the too liberal use of red pepper; and a fever and ague which are very pernicious to foreigners. They are entirely unacquainted with phlebotomy, yet they sometimes draw blood by means of cupping; and some are as much acquainted with surgery as to be able to cure a simple fracture.

Their houses are miserable structures, composed of stones or bricks mixed with clay, and dried in the sun, and the hands of the labourers are all the tools which are employed in building. When the walls are finished, they are covered over with mortar made of calcareous earth, which is also done with the hand. Their houses are extremely low, and there is no other entrance for the light but by the door. They have uncommonly abstemious in respect of diet. Indeed they can never abstain from butcher meat when it is placed before them; but this is not an article of food with the generality, and their expression for a rich man is, "that he eats bread and meat every day."

FEWEL. See FUEL.

FIASCONO, a town of Italy, in the territories of the pope, remarkable for its good wine. E. Long. 13. 12. N. Lat. 42. 20.

FIAT, in Law, a short order or warrant signed by a judge, for making out and allowing certain processes.

FIBRABLE, an old term applied to minerals of a fibrous structure.

FIBRE, in Anatomy, a perfectly simple body, or at least as simple as any thing in the human structure; being fine and slender like a thread, and serving to form other parts. Hence some fibres are hard, as the bony ones; and others soft, as those destined for the formation of all the other parts.

The fibres are divided also, according to their position and
and direction, into such as are straight, oblique, transverse, annular, and spiral; as they are arranged in these directions in different parts of the body.

Fibre is also used to denote the slender filaments which compose other bodies, whether animal, vegetable, or mineral; but more especially the capillary roots of plants.

Fibrose or fibrous, something consisting of fibres, as the roots of plants. See Root.

Fibula, in Anatomy, the outer and smaller of the two bones of the leg. See Anatomy Index.

Fibula. in Surgery, a small instrument in use among the ancients for the closing of gaping wounds. —Celsius speaks of the fibula as to be used when the wound was so patent as not easily to admit of being sewed. (Op. lib. viii. cap. 25. admodum.)

Fibula, in Antiquity, was a sort of button, buckle, or clasp, made use of by the Greeks and Romans for keeping close or tying up some part of their clothes. They are of various forms, and often adorned with precious stones. Men and women wore them in their hair and at their shoes. Players and musicians, by way of preserving the voices of children put under their care to learn their arts, used to keep close the prepuce with a fibula, lest they should have commerce with women.

Fichte, John Theophilus, a late eminent German metaphysicist. See Supplement.

Ficinus, Marsilius, celebrated Italian, was born at Florence in 1433, and educated at the expense of Lawrence de Medici. He attained a perfect knowledge of Greek and Latin tongues, and became a great philosopher, a great physician, and a great divine. He was in the highest favour with Lawrence and Cosmo de Medici, who made him a canon of the cathedral church of Florence. He applied himself intensely to the study of philosophy; and while others were striving who should be the deepest read in Aristotle, who was then the philosopher in fashion, he devoted himself wholly to Plato. He was indeed the first who restored the Platonic philosophy in the west; for the better effecting of which, he translated into Latin the whole works of Plato. There goes a story, that his friend Marcus Masarius disliking the translation, he did it all over again. He next translated Plotinus; and afterwards the works, or part of them at least, of Proclus, Jam- bicus, Porphyrius, and other celebrated Platonists.—In his younger years, Ficinus lived like a philosopher; and too much so, as is said, to the neglect of piety. However, Savonarola coming to Florence, Ficinus went with every body else to hear his sermons; and while he attained them for the sake of the preacher’s eloquence, he imbibed a strong sense of religion, and devoted himself henceforward more especially to the duties of it. He died at Correggio in 1499; and as Boronius assures us upon the testimony of what he calls credible authors, appeared immediately after his death to his friend Michael Mercatus: to whom, it seems, he had promised to appear, in order to confirm what he had taught concerning the immortality of the soul. His writings, sacred and profane, which are very numerous, were collected and printed at Venice, in 1516; at Basle in 1551 and 1576, and at Paris 1651, in two volumes. Twelve books of his Epistles, among which are many treatises, were printed separately in folio at Venice 1493, and at Nuremberg, 1497, in 4to.

Ficoides, the specific name given to several plants as the mesembryanthemum, musa, and opuntia. See Mesembryanthemum, &c. Botany Index.

Fiction. See Fabre and Poetry.

Ficus, the fig-tree; a genus of plants, belonging to the polygammia class; and in the natural method ranking under the 55th order, Scanduris. See Botany Index.

The ficus religiosa, or Basian tree, is a native of several parts of the East Indies. It has a woody stem, branching to a great height and vast extent, with heart-shaped entire leaves ending in acute points. Of this tree the following lines of Milton contain a description equally beautiful and just:

There soon they chose
The Fig-tree: not that tree for fruit renowned;
But such as, at this day to Indians known
In Malabar or Deccan, spreads her arms,
Branching so broad and long, that in the ground
The bended twigs take root, and daughters grow
About the mother tree, a pillar'd shade.
High overarch'd, and echoing walks between;
There oft the Indian bard, man, shunning heat,
Shelters in cool, and tends his pasturing herds
At loop-holes cut through thickest shade.

Par. Lost, Book. ix. 1, 1180.

The Basian tree, or Indian fig, is perhaps the most beautiful of Nature’s productions in their genial climate, where she sports with the greatest profusion and variety. Some of these trees are of amazing size and vast extent, as they are continually increasing, and contrary to most other things in animal and vegetable life, they seem to be exempted from decay. Every branch from the main body throws out its own roots; at first, in small tender fibres, several yards from the ground: these continually grow thicker until they reach the surface; and then striking in, they increase to large trunks, and become parent trees, shooting out new branches from the top: these in time suspend their roots, which, swelling into trunks, produce other branches; thus continuing in a state of progression as long as the earth, the first parent of them all, contributes her sustenance. The Hindus are particularly fond of the Basian tree; they look upon it as an emblem of the Deity, from its long duration, its outstretching arms, and overshadowing beneficence; they almost pay it divine honours, and

Find a vase in every sacred grove.

Near these trees the most esteemed pagodas are generally erected; under their shade the Brahmins spend their lives in religious solitude; and the natives of all castes and tribes are fond of recreating in the cool recesses, beautiful walks, and lovely views from this unbraggadocious canopy, impervious to the hottest beams of a tropical sun.

A remarkable large tree of this kind grows on an island in the river Nerudda, ten miles from the city of Baroohe in the province of Gruzat; a flourishing settlement lately in possession of the East India Company, but ceded by the government of Bengal, at the treaty of peace concluded with the Maharattas in 1782, to
towards Mahadhee Scindia a Mahattta chief. It is distinguish'd by the name of Cobbee or Burre, which was given to him in honour of a famous saint. It was once much larger than at present; but high floods have carried away the banks of the island when it grows, and with them such parts of the tree as had thus far extended their roots: yet what remains is about 2000 feet in circumference, measured round the principal stems; the overhanging branches, not yet struck down, cover a much larger space. The chief trunks of this single tree (which in size greatly exceed our English elms and oaks), amount to 350; the smaller stems, forming into stronger supporters, are more than 3000; and every one of these is casting out new branches, and hanging roots, in time to form trunks, and become the parents of a future progeny. Cobbee Burre is famed throughout Hindostan for its great extent and surpassing beauty. The Hindoos generally encamp around it; and, at stated seasons, solemn jatarras, or Hindoo festivals, are held there, to which thousands of votaries repair from various parts of the Mogul empire. It is said that 7000 persons find ample room to repose under its shade. The English gentlemen, on their hunting and shooting parties, used to form extensive encampments, and spend weeks together under this delightful pavilion, which is generally filled with green wood pigeons, doves, peacocks, and a variety of feathered songsters; crowded with families of monkeys performing their antics tricks; and shaded by bats of a large size, many of them measuring upwards of six feet from the extremity of one wing to the other. This tree not only affords shelter, but sustenance, to all its inhabitants, being covered amid its bright foliage with small figs of a rich scarlet, on which they regale with as much delight, as the lords of creation on their more costly fare in their parties.

FIDD, an iron pin used at sea to splice or fasten ropes together; it is made tapering and sharp at one end. There are also fids of wood, which are much larger than the iron ones.

The pin also in the beef of the toppin, which bears it upon the chess-tree, is called a fiddle. Fiddle-hammer, is used for a hammer, the handle of which is a fiddle, or made tapering into that form.

FIDDES, Richard, a learned divine and police writer, was born in 1671, and educated at Oxford. He was presented to the living of Halsham in Yorkshire, where he was so admired for the sweetness of his voice and the gracefulness of his delivery, that the people for several miles round flocked to his sermons. Coming to London in 1711, he was by the favour of Dean Swift, introduced to the earl of Oxford, who made him one of his chaplains, and the queen soon after appointed him chaplain to the garrison at Hull; but losing his patrons upon the change of the ministry, he lost his chaplainship; and being obliged to apply himself to writing, composed 1. A Body of Divinity; 2. The Life of Cardinal Wolsey; 3. A Treatise of Morality, &c. He died in 1725.

FIDDLE. See Violin.

FIDDLE-WOOD. See Citharexylon, Botany Index.

FIDE-JUSORES Astiti. See Assiduous.

FIDS, in the Civil Law, is a survey, or one that obliges himself in the same contract with a principal, for the greater security of the creditor or stipulator.
Fielding before the year 1737, and many of them are still voted with applause. While he was thus employed, he married a young lady with 1500L. fortune, and inherited an estate of 200L. a-year from his mother; all which, though on the plan of retiring into the country, he contrived to dissipate in three years; and then applied himself to the study of the law for a maintenance. In losing his fortune, he acquired the ghost; which, rendering it impossible for him to attend the bar, he with a chattering conversation had recourse to many extemporary applications of his pen for immediate supplies; until, soon after the rebellion in 1745, he accepted the office of acting justice for Middlesex, an employment much more profitable than honourable in the public esteem. Reduced at length by the fatigues of this office, and by a complication of disorders, he, by the advice of his physicians, went to Lisbon, where he died in 1754. He wrote a great number of fugitive pamphlets and periodical essays; but is chiefly distinguished by his Adventures of Joseph Andrews, and History of Tom Jones. His works have been collected and published, with his life prefixed, by Mr. Murphy.

FIENUS, THOMAS, an ingenious and learned physician, born at Antwerp in 1566. He went into Italy to study physic under Mercorialis and Aldrovandus; and on his return distinguished himself so much in the university of Louvain, that he was there chosen professor of physic, and was afterwards made physician to the duke of Bavaria. He wrote several works, among which were, De viribus imaginatis; and De formatione factus. He died at Louvain in 1631.

FIERI FACIAS, in Law, a writ that lies where a person has recovered judgment for debt or damages in the king's court against one, by which the sheriff is commanded to levy the debt and damages on the defendant's goods and chattels.

FIFE, in Music, is a sort of wind instrument, being a small pipe. See PIPE.

FIFESHIRE, a county of Scotland, lying between the friths of Tay and Forth; bounded on the north and north-east by the Frith of Tay, which divides it from Perth and Angus; on the south by the Frith of Forth, which separates it from the Lothians; the German ocean bounds it on the east; and on the west it borders with the counties of Perth and Kinross, and a small corner of Clackmannan. It extends about 60 miles in length from Coirross to Fifeness, and is about 18 in breadth; comprehending a superfluous of nearly 324 square miles. The face of the country is agreeably diversified; towards the west it is mountainous, and a ridge of hills extends eastward almost its whole length, occupying the central district; towards the north and south the surface gradually descends to the friths, exhibiting the most beautiful and enlivening prospect of fertile and well cultivated fields. It is watered by several streams, none of which deserve the name of rivers, except the Eden and Leven; the former empties itself into the ocean at St Andrews, and the latter at the village of Leven; both these rivers abound with trout and salmon; and on no coast of Scotland is the white fishing more productive than on the Fife coast. From its situation, it appears to have been very early inhabited; the fisheries, coal-mines, harbours, and other advantages for navigation, attracted settlers, and the coast was first peopled and best cultivated: this appears to have been the case, when King James VII compared the county to a gray mantle with a gold fringe. The whole coast is covered with small burghs, which that monarch regarded with particular attention, and very early in his reign endeavoured to render them subservient to his wishes, of raising Scotland high in the world as a commercial nation; he granted them many privileges and immunities, and encouraged the inhabitants, by every means in his power, to prosecute the advantages which, by their local situation, they possessed; indeed the municipal privileges which they received from that monarch, though rendered unimportant by the union with England, will long remain a monument of his political sagacity and discernment. The county can boast of possessing several ancient seats of royalty: at Dunfermline, at Falkland, at Kinross, and at St Andrews, vestiges of royal splendour are still to be seen. It contains 13 royal boroughs, which possess parliamentary representation, and several which have lost that privilege from their being unable to defray the expense which attended the sending a commissioner to the Scottish parliament. To the county also belong the small island of May, on which there is a lighthouse, and Inchgavie. Fife is divided into 60 parishes, and contains, by the enumeration in 1811, 101,372 inhabitants, being nearly 208 to the square mile; a much greater proportion than is to be found in any other county in Scotland. It was anciently an estate in the Macduff family, created by Malcolm III. for the services performed by the house of Fife, in restoring him to the throne of Scotland, when assurred by Macbeth. That title having expired, it was lately revived in the Duffs of Braco, lateral descendants of the ancient family: the ruins of the residences of that powerful nobleman are still evident in many parts of the county. The whole of the south side lies upon coal, and many pits are wrought on every part of the coast: in many places is excellent limestone; and some marl is found in the county. Ironstone, of excellent quality, is found in the western and middle quarters, and much is forged in the county, or exported to the Carron works. Lead ore is found in the Eastern Lothians, one of the two conical hills which rise nearly in the middle of the county, and are seen at a great distance: in Kincardine parish also, lead ore has been wrought. The county of Fife sends one member to parliament. Cupar is the county town.

The following account of the population of Fifeshire at two different periods, is taken from the Statist. Hist. of Scotland.

<table>
<thead>
<tr>
<th>Parishes</th>
<th>Population 1755</th>
<th>Population 1790-92</th>
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<td>Broughty</td>
<td>1390</td>
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Camerra.
**Fife**

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<tr>
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<td>Pittenweem</td>
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<td>St Andrew's and St Leonard's</td>
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<td>St Monance</td>
<td>780</td>
<td>832</td>
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<td>Saline</td>
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<td>Scoonie</td>
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<td>Strathmiglo</td>
<td>1695</td>
<td>980</td>
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<td>Torryburn</td>
<td>1634</td>
<td>1600</td>
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<tr>
<td>Wemyss</td>
<td>3041</td>
<td>3025</td>
</tr>
</tbody>
</table>

| Total           | 82,170             | 97,280                 |

Population in 1801, 93,743; in 1811, 101,272.

See Fifeshire, Supplement.

**Fife-Raile**, in a ship, are those that are placed on banisters; on each side of the top of the poop, and so along with haunches or falls. They reach down to the quarter deck, and to the stair of the gangway.

**Fifth**, in Music. See INTERVAL.

**FIG** or **Fig-tree**. See Ficus, Botany Index.

**FIGWORT**. See Scrophularia, Botany Index.

**FIGURAL, FIGURE, or FIGURATIVE, a term applied to whatever is expressed by obscure resemblance. The word is chiefly applied to the types and mysteries of the Mosaic law; as also to any expression which is not taken in its primary and literal sense.**

**FIGURATE NUMBERS.** See NUMBERS, Figure.

**FIGURE**, in Physics, expresses the surface or terminating extremities of any body.

**FIGURES**, in Arithmetic, are certain characters whereby we denote any number which may be expressed by any combination of the nine digits, &c. See ARITHMETIC.

**Figure**, among divines, is used for the mysteries represented under certain types.

**Figure**, in Dancing, denotes the several steps which the dancer makes in order and cadence, considered as they mark certain figures on the floor. See DANCING.

**Figure**, in Painting and Designing, denotes the lines and colours which form the representation of any animal, but more particularly of a human personage. See Painting.

**Figure**, in the manufactures, is applied to the various designs represented or wrought on velvets, damasks, taffeties, satins, and other stuffs and cloths.

The most usual figures for such designs are flowers imitated from the life; or grotesques, and compartments of pure fancy. Representations of men, beasts, birds, and landscapes, have only been introduced since the taste for the Chinese stuffs, particularly those called **fureses**, began to prevail among us. It is the woof of the stuff that forms the figures; the warp only serves for the ground. In working figured stuffs there is required a person to show the workman how far he must raise the threads of the warp, to represent the figure of the design with the woof, which is to be passed across between the threads thus raised. This some call **reading the design**.

For the figures on tapestry, brocade, &c. see TAPESTRY, &c.

For those given by the calendars, printers, &c. see CALENDAR, &c.

**Figure**, in Logic, denotes a certain order and disposition of the middle term in any syllogism.

Figures are fourfold. 1. When the middle term is the subject of the major proposition, and the predicate of the minor, we have what is called the first figure.

2. When the middle term is the predicate of both the premises, the syllogism is said to be in the second figure.

3. If the middle term is the subject of the two premises, the syllogism is in the third figure; and lastly, by making it the predicate of the major, and subject of the minor, we obtain syllogisms in the fourth figure.

Each of these figures has a determinate number of moods, including all the possible ways in which propositions differing in quantity or quality can be combined, according to any disposition of the middle term, in order to arrive at a just conclusion. See Logic.

**Figure**, in composition. See ORATORY; also ALEGORY, APOSTROPHE, HYPERBOLE, METAPHOR, PERSONIFICATION, &c.

**A Figure, the means or instrument conceived to be the agent.** When we survey a number of connected objects, that which makes the greatest figure employs chiefly our attention; and the emotion it raises, if lively, prompts us even to exceed nature in the conceptions we form of it. Take the following examples.
man who listens, to the passion with which he is moved. In the expression bold deed, or audax facinus, we extend the effect which properly belongs to the cause. But not to waste time by making a commentary on every expression of this kind, the best way to give a complete view of the subject, is to exhibit a table of the different relations that may give occasion to this figure. And in viewing the table it will be observed, that the figure can never have any force, but where the relations are of the most intimate kind.

1. An attribute of the cause expressed as an attribute of the effect.
   Audax facinus.
   Of yonder fleet a bold discovery make.
   An impious mortal gave the daring wound.
   To my adventrous song,
   That with no middle flight intends to soar.

2. An attribute of the effect expressed as an attribute of the cause.
   Quae perisse ambo misericors semen in mari.
   No wonder, fallen such a pernicious height.

3. An effect expressed as an attribute of the cause.
   Jovial wine, Giddy brink, Drowsy night, Musing midnight, Panting height, Astonish'd thought, Mourful gloom.
   And the merry bells ring round,
   And the jocund rebecks sound. Milton, Allegro

4. An attribute of a subject bestowed upon one of its parts or members,
   Longing arms.
   It was the nightingale, and not the lark,
   That pier'd the fearful hollow of thine ear.
   Romeo and Juliet, act. iii. sp. 7.

Oh, lay by
Those most ungentle looks and angry weapons:
Unless you mean my griefs and killing fears
Should stretch me out at your relentless feet.

And ready now
To stoop with wearied wing and willing feet,
On the bare outside of this world.

5. A quality of the agent given to the instrument with which it operates.
   Why peep your coward swords half out their shells?

6. An attribute of the agent given to the subject upon which it operates.
   High-climbing hill. Milton.

7. A quality of one subject given to another.
   Icici, beatis nunc Arabum invides
   When sapless age, and weak unable limbs,
   Shall bring thy father to his drooping chair.

Shakespeare.
By art, the pilot through the boiling deeps
And howling tempest, steers the fearless ship.
_Iliad_, book xxiii. l. 385.

Then, nothing loth, the amorous fair he led,
And sunk transported on the conscious bed.
_Odyssey_, book viii. l. 337.

A stupid moment motionless she stood.
_Summer_, l. 1336.

8. A circumstance connected with a subject, expressed as a quality of the subject.

_Breezy_ summit.

'Tis ours the chance of fighting fields to try.
_Iliad_, book v. l. 301.

Oh! had I dy'd before that well-fought wall.

From this table it appears, that the adorning a cause with an attribute of the effect, is not so agreeable as the opposite expression. The progress from cause to effect is natural and easy: the opposite progress resembles retrograde motion, and therefore panting height, astonished thought, are strain'd and uncouth expressions, which a writer of taste will avoid.

It is not less strained to apply to a subject in its present state, an epithet that may belong to it in some future state:

Submersaque orbis puppes. _Eneid_, book i. l. 73.

And mighty ruins fall. _Iliad_, book v. l. 435.

Impious sons their mangled fathers wound.

Another rule regards this figure, That the property of one subject ought not to be bestowed upon another with which the property is incongruous.

K. Rich.—How dare thy joints forget
To pay their awful duty to our presence?
_Richard II_. act iii. sc. 6.

The connexion between an awful superior and his submissive dependent is to intimate, that an attribute may readily be transferred from the one to the other: but awfulness cannot be so transferred, because it is inconsistent with submission.

**Figure of Speech, as peculiarly distinguished from the above and from those first referred to.** Under the article _Metaphor_ and _Allegory_, a figure of speech is defined, "The using a word in a sense different from what is proper to it;" and the new or uncommon sense of the word is termed the _figurative sense_. The figurative sense must have a relation to that which is proper; and the more intimate the relation is, the _figure_ is the more happy. How ornamental this _figure_ is to language, will not be readily imagined by any one who hath not given peculiar attention; and therefore we shall endeavour to unfold its capital beauties and advantages. In the first place, a word used figuratively, or in a new sense, suggests at the same time the sense it commonly bears: and thus it has the effect to present two objects; one signified by the figurative sense, which may be termed the _principal object_; and one signified by the proper sense, which may be termed _accessory_; the principal makes a part of the thought; the accessory is merely ornamental. In this respect, a _figure of speech_ is precisely similar to concordant sounds in music, which, without contributing to the melody, make it harmonious.

To explain the matter by examples. _Youth_, by a _figure of speech_, is termed the _morning of life_; This expression signifies _youth_, the principal object which enters into the thought; it suggests, at the same time, the proper sense of _morning_; and this accessory object, being in itself beautiful, and connected by resemblance to the principal object, is not a little ornamental. _Imperious ocean_, is an example of a different kind, where an attribute is expressed figuratively: Together with _stormy_, the figurative meaning of the epithet _imperious_, there is suggested its proper meaning, viz. the stern authority of a despotic _prince_; and these two are strongly connected by resemblance. Upon this figurative power of words, Vida descants with elegance, _Poet. lib._ iii. l. 44.

In the next place, this _figure_ possesses a signal power of aggrandizing an object, by the following means.—Wards, which have no original beauty but what arises from their sound, acquire an adventitious beauty from their meaning: a word signifying any thing that is agreeable, becomes by that means agreeable; for the agreeableness of the object is communicated to its name. This acquired beauty, by the force of custom, adheres to the word, even when used figuratively; and the beauty received from the thing it properly signifies, is communicated to the thing which it is made to signify figuratively. Consider the foregoing expression _Imperious ocean_, how much more elevated it is than _Stormy ocean_.

Thirdly, This _figure_ hath a happy effect by preventing the familiarity of proper names. The familiarity of a proper name is communicated to the thing it signifies by means of their intimate connexion; and the thing is thereby brought down in our feeling. This bad effect is prevented by using a figurative word instead of one that is proper: as, for example, when we express the sky by terming it _the blue vault of heaven_; for though no work of art can compare with the sky in grandeur, the expression however is relished, because it prevents the object from being brought down by the familiarity of its proper name. With respect to the degrading the familiarity of proper names, Vida has the following passage:

_Hinc  si dura mibi passus dicendos Ulysses,
Non ilium vere mem branabomin, sed qui
Et mares hominum multorum vidit, et urbes,
Nausfragus aversae post secvra incendias Trojan._

_Poet. lib._ ii. l. 460.

Lastly, By this _figure_, language is enriched, and rendered more copious; in which respect, were there no other, a _figure of speech_ is a happy invention. This property is finely touched by Vida; _Poet. lib._ iii. l. 90.

The beauties we have mentioned belong to every _figure_ of speech. Several other beauties, peculiar to one or other sort, we shall have occasion to remark afterwards.

Not only subjects, but qualities, actions, effects, may be expressed figuratively. Thus, as to subjects, _gates of breath_ for the lips, _the watery kingdom_ for the ocean. As to qualities, _fierce_ for stormy, in the expression _Fierc winter_; _Atus for profundus, Altus puteus, Altum mors_;
youth the beginning of life; the morning is cheerful, so is youth, &c. By another resemblance, a bold warrior is termed the thunderbolt of war; a multitude of troubles, a sea of troubles.

This figure, above all others, affords pleasure to the mind by variety of beauties. Besides the beauties above mentioned, common to all sorts, it possesses in particular the beauty of a metaphor or a simile: a figure of speech built upon resemblance, suggests always a comparison between the principal subject and the accessory; whereby every good effect of a metaphor or simile may, in a short and lively manner, be produced by this figure of speech.

2. A word proper to the effect employed figuratively to express the cause.

Lux for the sun; Shadow for cloud. A helmet is signified by the expression glittering terror; a tree by shadow or umbrage. Hence the expression,

\[ \text{Nec habet Pelion umbras.} \]

Where the dun umbrage hangs. \textit{Spring.} l. 1023.

A wound is made to signify an arrow:

\[ \text{Vulnera non pedibus prosequuntur.} \]

There is a peculiar force and beauty in this figure, the word which signifies figuratively the principal subject, denotes it to be a cause by suggesting the effect.

3. A word proper to the cause employed figuratively to express the effect.

\[ \text{Bourque labores for corn. Sorrow or grief for tears.} \]

Again Ulysses veild his pensive head;
Again ummanad, a shower of sorrow shed.

Streaming grief his faded cheek bedew'd.

Blindness for darkness:

\[ \text{Cecis erramus in unda.} \]

\[ \text{\textit{Aeneid.} iii. 200.} \]

There is a peculiar energy in this figure, similar to that in the former: the figurative name denotes the subject to be an effect by suggesting its cause.

4. Two things being intimately connected, the proper name of the one employed figuratively to signify the other.

\[ \text{Day for light. Night for darkness; and hence, A sudden night. Winter for a storm at sea:} \]

\[ \text{Interas magnis miseriae murmurum portuam,} \]
\[ \text{Emissamque Hyemem sensat Neptumus.} \]
\[ \text{\textit{Aeneid.} i. 128.} \]

This last figure would be too bold for a British writer, as a storm at sea is not inseparably connected with winter in this climate.

5. A word proper to an attribute, employed figuratively to denote the subject.

\[ \text{Youth and beauty for those who are young and beautiful:} \]

Youth and beauty shall be laid in dust.

\[ \text{Majesty for the king:} \]

\[ \text{What art thou, that usurp\'est this time of night,} \]
\[ \text{Together with that fair and warlike form} \]
\[ \text{In which the Majesty of buried Denmark} \]
\[ \text{Did sometimes march?} \]
\[ \text{Hamlet, act i. sc. 1.} \]

\[ 4 \text{I 2} \]
Or have ye chosen this place,
After the toils of battle to repose
Your weary'd virtue? Paradise Lost.
Verdure for a green field. Summer, l. 301.

Speaking of cranes,
The pigmy nations, wounds and death they bring,
And all the sorrow descends upon the wing.
Iliad, book iii. l. 10.

Cool age advances venerably wise.
Iliad, book iii. l. 149.

The peculiar beauty of this figure arises from suggesting an attribute that embellishes the subject, or puts it in a stronger light.

6. A complex term employed figuratively to denote one of the component parts.
Funus for a dead body. Burial for a grave.
7. The name of one of the component parts instead of the complex term.
Tarda for a marriage. The East for a country situated east from us.
Josius vestigia servat, for imitating Jupiter in general.
8. A word signifying time or place, employed figuratively to denote what is connected with it.
Chime for a nation, or for a constitution of government: hence the expression, Merciful chime, Fleecy winter, for snow, Scenulm felix.
9. A part for the whole.
The pole for the earth. The head for the person.
Triginta minas pro capite tuo dedi. Plautus.

Tergum for the man:
Fugiens tergum. Ovid.

Vultus for the man:
Jam fulgor armorum fugaces
Terret equos, equitumque vultus. Horat.
Quis desiderio sit pudor aut modus
Tam charte copitis? Horat.
Dumque virent genus? Horat.
Thy growing virtues justify'd my cares,
And promis'd comfort to my silver hairs.
Iliad, ix. l. 616.

———Forthwith from the pool he rears
His mighty stature. Paradise Lost.

The silent heart which grief assails. Parnel.

The peculiar beauty of this figure consists in marking that part which makes the greatest figure.
10. The name of the container, employed figuratively to signify what is contained.
Grove for the birds in it; Vocal grove. Ships for the season; Agonizing ships. Mountains for the sheep pasturing upon them; Bleating mountains. Zephyrus, Etna, &c. for the inhabitants; En mcctis dominos. Livy.

11. The name of the sustainer, employed figuratively to signify what is sustained.
Alter for the sacrifice. Field for the battle fought upon it; Well-fought field.

12. The name of the materials, employed figuratively to signify the things made of them.
Errum for gladius.
Attemper'd to the lyre, your voice employ,
Such the pleas'd ear will drink with silent joy.

Odyssey, book i. l. 433.

Sprepitunque exterritus hausit.
_Eneid._ book vi. l. 559.

Write, my queen,
And with mine eyes I'll drink the words you send.

_Cymbeline._ act i. sc. 2.

As thus th' effulgence tremulous I drink.

_Summer._ l. 1684.

Neque audit currus habenas.

_Georg._ book i. l. 514.

O prince! (Lyceon's valiant son reply'd),
As thine the steeds, be thine the task to guide.
The horses practis'd to their lord's command,
Shall bear the rein, and answer to thy hand.

_Iliad._ book v. l. 288.

The following figures of speech seem altogether wild
and extravagant, the figurative and proper meaning
having no connexion whatever. _Moving softness,
Freshness breathes, Breezing prospect, Flowing spring,
Dewy light, Lucid connex, and many others
of this false coin, may be found in Thomson's Seasons._

2. The proper sense of the word ought to bear
some proportion to the figurative sense, and not so much above it,
or sink much below it. This rule, as well as the foregoing, is finely illustrated by Vida,
_Poet._ book iii. l. 148.

3. In a figure of speech, every circumstance ought
to be avoided that agrees with the proper sense only,
not with the figurative sense: for it is the latter that
expresses the thought, and the former serves for no other purpose but to make harmony:

_Zacynthus green with ever-shady groves,
And Ithaca, presumptuous boast their loves;
Obruding on my choice a second lord,
They press the Ægialus rite ahord'd._

_Odyssey._ book xix. l. 132.

Zacynthus here standing figuratively for the inhabitants,
the description of the island is quite out of place:
it puzzles the reader, by making him doubt whether
the word ought to be taken in its proper or figurative sense.

Write, my queen,
And with mine eyes I'll drink the words you send,
Though ink be made of gall.

_Cymbeline._ act i. sc. 2.

The disgust one has to drink ink in reality, is not to the
purpose where the subject is drinking ink figuratively.

4. To draw consequences from a figure of speech, as
if the word were to be understood literally, is a gross
abardity; for it is confounding truth with fiction:

Be Moubray's sins so heavy in his bosom,
That they may break his foaming courser's back,
And throw the rider headlong in the lists,
A caitiff recreant to my cousin Hereford.

_Richard II._ act i. sc. 3.

Sin may be imagined heavy in a figurative sense: but
weight in a proper sense belongs to the accessory only;
and therefore to describe the effects of weight, is to

Desert the principal subject, and to convert the accessory
into a principal:

_Cromwell._ How does your Grace?
_Wolsey._ Why well;
Never so truly happy, my good Cromwell.
I know myself now, and I feel within me
A peace above all earthly dignities,
A still and quiet conscience. The king has cur'd me,
I humbly thank his Grace: and, from these shoulders,
These ruin'd pillars, out of pity, taken
A load would sink a navy, too much honour.

_Henry VIII._ act iii. sc. 6.

Ulysses speaking of Hector—

I wond're how yonder city stands,
When we have here the base and pillar by us.

_Troilus and Cressida._ act iv. sc. 9.

_Othello._ No; my heart is turned to stone: I strike
it, and it hurts my hand.

_Othello._ act iv. sc. 5.

Not less, even in this despicable now,
Than when my name fill'd Afric with affright,
And froze your hearts beneath your torrid zone.

_Don Sebastian King of Portugal._ act i.

How long a space, since first I lov'd, it is!
To look into a glass I fear,
And am surpris'd with wonder, when I miss
Gray hairs and wrinkles there.

_Cowley._ vol. i. p. 86.

I chose the flourishing'at tree in all the park,
With freshest boughs and fairest head;
I cut my love into its gentle bark,
And in three days behold 'tis dead;
My very written flames so violent be,
They're burnt and wither'd up the tree.

_Cowley._ vol. i. p. 136.

Ah, mighty Love, that it were inward heat
Which made this precious limbeck sweat!
But what, alas! ab, what does it avail,
That she weeps tears so wondrous cold,
As scarce the ass's hoof can hold.

So cold, that I admire they fall not hail!

_Cowley._ vol. i. p. 132:

Such a play of words is pleasant in a ludicrous poem.

_Almeria._ O Alphonso, Alphonso!

Devouring seas have wash'd thee from my sight,
No time shall raze thee from my memory:
No, I will live to be thy monument:
The cruel ocean is no more thy tomb;
But in my heart thou art inter'd.

_Mourning Bride._ act i. sc. 1.

This would be very right, if there were any inconsistence in being interred in one place really, and in another
place figuratively.

From considering that a word used in a figurative
sense suggests at the same time its proper meaning, we
discover a fifth rule, That we ought not to employ a
word in a figurative sense, the proper sense of which is
inconsistent or incongruous with the subject: for every inconsistence, and even incongruity, though in the expression
only and not real, is unpleasant:

Intermix.
Else shall our fates be numbered with the dead.

Communal death the fate of war confounds.

Speaking of Proteus.

Neptune! when whose arms are bent from shore to shore, and gird the solid world.

A various sweetness swells the gentle breeze.

The distant waterfall swells in the breeze.

In the tenth place, When a subject is introduced by its proper name, it is absurd to attribute to it the properties of a different subject to which the word is sometimes applied in a figurative sense:

As it may gather from reflection and experience, that ornaments and graces suit not any of the dispiriting passions, nor are proper for expressing any thing grave and important. In familiar conversation, they are in some measure ridiculous: Prospero, in the Tempest, speaking to his daughter Miranda, says:

The fringed curtsies of these eyes advance,
And say what these eyes would say.

No exception can be taken to the justness of the figure; and circumstances may be imagined to make it proper; but it is certainly not proper in familiar conversation.

In the last place, Though figures of speech have a charming effect when accurately constructed and properly introduced, they ought, however, to be scattered with a sparing hand; nothing is more luscious, and nothing consequently more satisfying, than redundant ornaments of any kind.

FIG is used, in Theology, for the mysteries represented or delivered obscurely to us under certain types, or actions in the Old Testament. Thus means is held a figure or type of the eucharist; and the death of Abel, a figure of the suffering of Christ.

Many divines and critics contend, that all the actions, histories, ceremonies, &c. of the Old Testament, are only figures, types, and prophecies, of what was to happen under the New. The Jews are supposed to
to have had the figures or shadows, and we the substance.

Figure is also applied in a like sense to profane matters; as the emblems, enigmas, fables, symbols, and hieroglyphics, of the ancients.

FIGURED, in general, something marked with figures.

The term figured is chiefly applied to stuffs, wherein the figures of flowers, and the like, are either wrought or stamped.

FIGURED, in Music, is applied either to simple notes or to harmony: to simple notes, as in these words figured bass, to express a bass whose notes carrying chords are subdivided into many other notes of lesser value: to harmony, when by supposition and in a diatonic procedure, other notes than those which form the chord are employed. See Supposition.

To figure is to pass several notes for one; to form runnings or variations; to add some notes to the air, in whatever manner it be done; in short, it is to give to harmonious sounds a figure of melody, by connecting them with other intermediate sounds.

FILAGO, a genus of plants, belonging to the syngenesia class, and in the natural method ranking under the 49th order. Compositae. See Botany Index.

FILAMENT, in Anatomy, Natural History, &c., a term used in the same sense with fibre, for those fine threads whereof the flesh, nerves, skin, plants, roots, &c. are composed. See Fibre.

Vegetable Filaments form a substance of great use in the arts and manufactures; furnishing thread, cloth, cordage, &c.

For these purposes the filamentous parts of the Cannabis and Linum, or hemp and flax, are employed among us. But different vegetables have been employed in different countries for the same uses. Purification destroys the pulpy or fleshy matter, and leaves the tough filaments entire: By purifying the leaf of a plant in water, we obtain the fine flexible fibres, which constituted the basis of the ribs and minute veins, and which now form as it were a skeleton of the leaf. Alkaline liquors, in some degree, produce similar effects to purification.

The wear of Flascourt, in his history of Madagascar, relates, that different kinds of cloth are prepared in that island from the filaments of the bark of certain trees boiled in strong lye; that some of those cloths are very fine, and approach to the softness of silk, but in durability come short of cotton; that others are coarser and stronger, and last thrice as long as cotton; and that of these the sails and cordage of his vessel were made. See also the article Bark.

The same author informs us, that the stalks of nettles are used for the like purposes in his own country, France. And Sir Hans Sloane relates, in one of his Letters to Mr. Ray, that he has been informed by several, that muslin and calico, and most of the Indian linens, are made of nettles.

In some of the Swedish provinces, a strong kind of cloth is said to be prepared from hop stalks: and in the Transactions of the Swedish Academy for the year 1750, there is an account of an experiment made in consequence of that report. Of the stalks, gathered in autumn, about as many were taken as equalled in bulk a quantity of flax that would have produced a pound after preparation. The stalks were put into filaments, water, and kept covered therewith during the winter. In March they were taken out, dried in a stove, and dressed as flax. The prepared filaments weighed nearly a pound, and proved fine, soft, and white: They were spun and woven into six ells of fine strong cloth. The author, Mr. Shinler, observes, that hop stalks take much longer time to rot than flax; and that, if not fully rotted, the woody part will not separate, and the cloth will neither prove white nor fine.

Hemp, flax, and all other vegetable filaments, and thread or cloth prepared from them, differ remarkably from wool, hair, silk, and other animal productions, not only in the principles into which they are resolvable by fire, but likewise in some of their more interesting properties, particularly in their disposition to imbibe colouring matters; sundry liquors, which give a beautiful and durable dye to those of the animal, giving no stain at all to those of the vegetable kingdom.

A solution of copper in aquafortis, which had been changed blue by an addition of volatile spirit, on being mixed with a little solution of tin, became turbid and greenish. Pieces of white silk and flax were boiled, without any previous preparation, in this mixture, receiving a bright deep yellow dye; whilst pieces of linen, prepared and unprepared, came out as colourless as they were put in.

Fishing nets are usually boiled with oak bark or other like astringents, which render them more lasting. Those made of flax receive from this decoction a brownish colour, which, by the repeated alternations of water and air, is in a little time discharged, whilst the fine glossy brown, communicated by the same means to silken nets, permanently resists both the air and water, and stands as long as the animal filaments themselves. In like manner the stain of ink, or the black dye from solutions of iron, mixed with vegetable astringents, proves durable in silk and woollen; but from linen, the astringent matter is extracted by washing, and only the yellow iron mould remains.

The red decoction of cochineal, which, heightened with a little solution of tin, gives the fiery scarlet dye to wool or silk that have been previously impregnated by a solution of tartar, with additional preparation of linens or cotton prepared in the same manner. M. de Fay informs us, in the Memoirs of the French Academy for the year 1737, that having prepared a mixed cloth whose warp was of wool and the woof of cotton, and thoroughly blendeed the two together by filling, he still found the cotton to resist the action of the scarlet liquor, and the wool to receive the same colour from it as wool by itself, the stuff coming out all over marbled fiery and white.

Many other instances of this kind are known too well to the calico printer; whose grand desideratum is, to find means of making linen receive the same colours that wool does. The physical cause of the difference is wholly unknown; and indeed, of the theory of dyes in general, we know as yet extremely little. (See Dyeing.) Are animal filaments tubular, and the colouring atoms received within them? Are vegetable filaments solid, and the colour deposited on the surface? Or, does not their different susceptibility of colour depend rather on the different intrinsic properties of the two? There are many instances of a like diversity, even
in the metallic kingdom, where a mechanical difference in texture can scarcely be presumed to be the cause: Thus silver receives a deep stain from sulphurous or putrid vapours, which have no effect upon tin.

**FILANDERS**, among botanists. See Botany Index. Consisting of filaments or strings of blood coagulated; and occasioned by a violent rupture of some vein, by which the blood extravasating, hardens into these figures, and accommodates the reins, liver, &c.

FILANDERS, are also worms as small as thread, and about an inch long, that live wrapped up in a thin skin or net, near the reins of a hawk, a part from either gut or gorge. This malady is known by the hawk’s poverty; by ruffling her tail; by her straining the fat or perch, with her pincers; and lastly, by croaking in the night, when the filanders prick her. The disease proceeds from bad food; and must be remedied in time, to prevent its spreading over the whole body, and destroying the bird. These must not be killed as other worms are, for fear of imposthumes from their corruption, being incapable of passing away with the hawk’s meat. They must only be stupefied, to prevent their being offensive; and this is done by giving the hawk a clove of garlic, after which she will feel nothing of the filanders for 40 days. It will be prudent in the falconer, when he observes the hawk poor and low, to give her a clove of garlic once a month by way of prevention.

**FILANGIERI, GAETAN**, an eminent Italian writer on legislation. See Supplement.

**FILBERT**, or **FILBERT** fruit of the Corylus, or Nut. See Corylus, Botany Index.

**FILE**, among mechanics, a tool used in metal, &c., in order to smooth, polish, or cut.

This instrument is of iron or forged steel, cut in little furrows, with chisels and a mallet, this and that way, and after of this or that depth, according to the grain or touch required. After cutting the file, it must be tempered with a composition of chimney soot, very hard and dry, diluted and wrought up with urine, vinegar, and salt, the whole being reduced to the consistence of mustard. Tempering the files consists in rubbing them over with this composition, and covering them in loam; after which they are put in a charcoal fire, and taken out by that time they have acquired a cherry colour, which is known by a small rod of the same steel put in along with them. Being taken out of the fire, they are thrown into cold spring water; and when cold, they are cleaned with charcoal and rag; and being clean and dry, are kept from rust by laying them up in wheat bran. Iron filings require more heating than steel ones. Files are of different forms, sizes, cuts, and degrees of fineness, according to the different uses and occasions for which they are made.

See Filig.

**FILE**, in the art of war, a row of soldiers, standing one behind another, which is the depth of the battalion or squadron. The files of a battalion of foot are generally three deep; as are sometimes those of a squadron of horse. The files must be straight and parallel one to another.

**FILE**, in Law, a thread, string, or wire, upon which writs and other exhibits in courts and offices are fastened or filed, for the more safe keeping, and ready turning to the same. A file is a record of the court; and the filing of a process of a court makes it a record of it. An original writ may be filed after judgment given in the cause, issued forth before; declarations, &c. are to be filed, and affidavits must be filed, some before they are read in court, and some presently when read in court. Before filing a record removed by certiorari, the justices of B. R. may refuse to receive it, if it appears to be for delay, &c.; and remand it back for the expedition of justice: but if the certiorari be once filed, the proceedings below cannot be revived. An indictment, &c. cannot be amended after it is filed.

**FILIAL**, something belonging to the relation of son. See Son.

The divines usually distinguish between a servile and a filial fear. The most abandoned may have a servile fear of God, such as that of a slave to his master; but not a filial fear, i.e. a fear resulting from love and respect. See Fear.

**FILLIÉ, PICTY**, the affectionate attachment of children to their parents; including in it love, reverence, obedience, and relief. These are duties prompted equally by nature and by gratitude, independent of the injunctions of religion. For where shall we find the person who hath received from any one benefits so great or so many, as children from their parents? And it may be truly said, that if persons are unfaithful to their parents, they seldom prove good to any other relations. Profane history furnishes many fine examples of this amiable virtue; a few of which we shall select, according to the plan observed in other similar articles.

1. The Roman dictator T. Manlius having exercised great cruelty over the citizens, was cited at the expiration of his office to answer for his conduct. Among other things that were laid to his charge, he was accused of treating with barbarity one of his own sons. Manlius, according to Livy, had no other cause of complaint against this son than his having an impediment in his speech. For this reason he was banished far from the city, from his home, and the company of those of his own age and fortune, and condemned to servile works. All were highly exasperated against such inhuman conduct, except the son himself, who, under the greatest concern that he should furnish matter of accusation against his father, resolved upon a most extraordinary method to relieve him. One morning, without aspiring any body, he came to the city armed with a dagger, and went directly to the house of the tribune Pomponius, who had accused his father. Pomponius was yet in bed. Young Manlius sent up his name, and was immediately admitted by the tribune, who did not doubt but he was come to discover to him some new instances of his father’s severity. But Manlius, as soon as he was left alone with the tribune, drew out his dagger, and presented it to his breast; declaring he would stab him that moment if he did not swear in the form he should dictate, “Never to hold the assembly of the people for accusing his father.” Pomponius, who saw the dagger glittering at his breast, himself alone, without arms, and attacked by a robust young man, full of a bold confidence in his own strength, took the oath demanded of him; and afterwards confessed with a kind of complacency in the thing, and a sincerity which sufficiently
1. Tertullian, yet there is no account; but he always submitted to her ill
humour with great mildness and patience. Antipater, one of his friends, having one day written a long letter
against her to the king then absent, the latter, after
reading it, replied, "Antipater does not know that one
single tear shed by a mother will obliterate ten thou-
sand such letters as this." A behaviour like this, and
such an answer, show at one and the same time, that
Alexander was both an affectionate son and an able
politician.

5. Epaminondas is universally acknowledged to have
been one of the greatest generals and one of the best
men which Greece ever produced. Before him the
city of Thebes was not distinguished by any memorable
action, and after him it was not famous for its virtu-
es, but its misfortunes, till it sunk into its original
obsccurity; so that it saw its glory take birth and
expire with this great man. The victory he obtained at
Leuctra had drawn the eyes and admiration of all the
neighbouring people upon Epaminondas, who looked
upon him as the support of Thebes, as the triumphant
conqueror of Sparta, as the deliverer of Greece: in
a word, as the greatest man, and the most excellent
captain, that ever was in the world. In the midst of
this universal applause, so capable of making the gen-
eral of an army forget the man for the victor, Epa-
minondas, little sensible to so affecting and so desired a
glory, "My joy (said he) arises from my sense of that
which the news of my victory will give my father and
my mother."

6. Among an incredible number of illustrious per-
sous who were falsely accused and put to death by
Nero, was one Barus Soranus; a man, as Tacitus in-
forms us, of singular vigilance and justice in the dis-
charge of his duty. During his confinement, his
dughter Servilia was apprehended and brought into
the senate, and there arraigned. The crime laid to
her charge was, that she had turned into money all her
ornaments and jewels, and the most valuable part of her
dress, to defray the expense of consulting magicians.
To this the young Servilia, with tears, replied, That
she had indeed consulted magicians, but the whole of
her inquiry was to know whether the emperor and se-
nate would afford protection and safety to her dear
and indulgent parent against his accusers. "With
this view (said she) I presented the diviners, men till
now utterly unknown to me, with my jewels, apparel,
and the other ornaments peculiar to my quality, as I
would have presented my blood and my life, could my
blood and life have procured my father's liberty. But
whatever this my proceeding was, my unfortunate fa-
ther was an utter stranger to it; and if it is a crime,
I alone am the delinquent." She was, however, to-
gether with her father, condemned to die; but in what
manner, history is silent. [Vid. Taciti Annales, lib. vi.
cap. 25.]

7. Valerius Maximus likewise relates a very singu-
lar fact upon this subject. A woman of illustrious
birth had been condemned to be strangled. The Ro-
man prator delivered her up to the trimmvr, who
called her to be carried to prison, in order to her be-
ing put to death. The gaoler, who was ordered to
execute her, was struck with compassion, and could not
resolve to kill her. He chose therefore to let her die
of hunger. Besides which, she suffered her daughter

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to see her in prison; taking care, however, that she
brought nothing to eat. As this continued many
days, he was surprised that the prisoner lived so long
without eating; and suspecting the daughter, upon
watching her, he discovered that she nourished her
mother with her own milk. Amazed at so pious, and
at the same time so ingenious an invention, he told
the fact to the triumvir, and the triumvir to the prector,
who believed the thing merited relating in the assem
dy of the people. The criminal was pardoned, and a
decree was passed that the mother and daughter should
be subsisted for the rest of their lives at the expense of
the public.

The same author gives a similar instance of filial
piety in a young woman named Xantippe to her aged
father Cimonus, who was likewise confined in prison,
and which is universally known by the name of the Ro
man Charity. Both these instances appeared so very
extraordinary and uncommon to that people, that they
could only account for them, by supposing that the
love of children to their parents was the first law of
nature. *Puteati aliquis (any of our author) hoc contra
naturam factum esse, nisi prima naturae lex esset illi
gens, patet.*

In addition to the foregoing examples, we may re
fer to the article *Filata*, where a very noble instance
of filial piety is taken notice of. See also the article *Filat
er*. See Filibeg. See Filibrig. See Filicacia, Vincent, a celebrated Italian poet,
was born at Florence in 1642. He was a member of
the Academy della Crusca and of that of the Arcadi,
and became secretary to the duke of Tuscany. He died
in 1707. His poems are much esteemed for the de
licacy and nobleness of their sentiments. Scipio de Fil
icacia, his son, had them all printed together, under
the title of *Poesie Florentine di Vicenzo da Filicacia*, in
1707, 4to.

*Filices*, (from *filum*, "a thread," *quasi filatim incisa*), *ferns*; one of the seven tribes or families of
the vegetable kingdom, according to Linnæus, by whom
it is thus characterized: "having their fructification
on the back side of the fronds." They constitute the
first order in the class cryptogama; and consist of 16
genera, which are divided into *fructificationes*, epia
cae, frondosae, et radices. This order comprehends the
entire 16th class of Tournefort, in whose system the
*filices* make only a single genus, in the first section of
the above-mentioned class.

*Filices* is also an order of plants in the fragmenta
methodi naturalis of Linnæus. See Botany Index.

*Filigrane*, Filigræus, or Filigræus, Work.
See Fillagree.

Fillying, one of the principal operations in smith
ery, &c. succeeding to forging. See FILE.

The coarser cut files are always to be succeeded by
finer; and in all the kinds the rule is, to lessen heav
on the file in thrusting it forwards, because the teeth of
the file are made to cut forwards. But in drawing the
file back again for a second stroke, it is to be lightly
lifted just above the work, by reason it cuts not coming
back.

The rough or coarse-toothed file (which, when large,
is called a rubber) serves to take off the unevenesses
of the work, left by the hammer in forging.
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F I L L [ 627 ] F I L L

young cocoa nut about the size of a walnut, the top and bottom being cut off. After the leaves have been all placed in order, and stuck on, bit by bit, a solder is prepared of gold filings and borax, moistened with water, which they strewn over the plate; and then putting it in the fire for a short time, the whole becomes united. This kind of work on a gold plate, they call carrang papan: when the work is open, they call it carrang troune. In executing the latter, the foliage is laid out on a card, or soft kind of wood, and stuck on, as before described, with the sago berry; and the work, when finished, being strewn over with their solder, is put into the fire, when the card or soft wood burning away, the gold remains connected. If the piece be large, they solder it at several times. In the manufacture of badjoo buttons, they first make the lower part flat, and having a mould formed of a piece of buffalo's horn, indented to several sizes, each like one half of a bullet mould, they lay their work over one of these holes, and with a horn punch they press it into the form of the button. After this they complete the upper part. When the filagree is finished, they cleanse it, by boiling it in water with common salt and alom, or sometimes lime juice; and in order to give it that fine purple colour which they call repo, they boil it in water with brimstone. The manner of making the little balls with which their works are sometimes ornamented, is as follows: They take a piece of charcoal, and having cut it flat and smooth, they make in it a small hole, which they fill with gold dust, and this melted in the fire becomes a little ball. They are very inexpert at finishing and polishing the plain parts, hinges, screws, and the like, being in this as much excelled by the European artists, as these fall short of them in the fineness and minuteness of the foliage. The Chinese also make filagree mostly of silver, which looks elegant, but wants likewise the extraordinary delicacy of the Malay work. The price of the workmanship depends upon the difficulty or uncommonness of the pattern. In some articles of usual demand, it does not exceed one-third of the value of the gold; but in matters of fancy, it is generally equal to it.

FILLET, or FILET, in Architecture, denotes a little square member or ornament used in divers places, and on divers occasions, but generally as a sort of corona over a greater moulding. The fillet is the same with what the French call retic, bande, and bandelette; the Italians lista or listella.

FILLET, in Heraldry, a kind of orle or bordure, containing only a third or fourth part of the breadth of the common bordure. It is supposed to be withdrawn inwards, and is of a different colour from the field. It runs quite round, near the edge, as a lace over a cloak.

FILLET is also used for an ordinary drawn like the bez from the sinister point of the chief across the shield, in manner of a scarf; though it is sometimes also seen in the situation of a bend, fesse, cross, &c.

According to Guillain, the fillet is a fourth part of the chief, and is placed in the chief point of the escutcheon.

FILLET is also used among painters, gilders, &c. for a little rule or retic of leaf gold, drawn over certain mouldings; or on the edges of frames, panels, &c. especially when painted white, by way of enrichment.

FILLETS, in the Mange, are the loins of a horse, which begin at the place where the hinder part of the saddle rests.

FILLY, a term among horse-dealers, to denote the female colt.

FILM, a thin skin or pellicle. In plants, it is used for that thin, woody skin, which separates the seeds in the pod, and keeps them apart.

FILTER, or Filtre, in Chemistry, &c. a piece of woolen cloth, linen, paper, or other matter, some of which are in the form of hollow inverted cones, used to filtrate or strain liquors through. The filter has the same use and effect with regard to liquids that the sieve or srears has in dry matters.

Filters are of two sorts. The first are simple pieces of paper or cloth, through which the liquor is passed without further trouble. The second are twisted up like a skin or wick, and first wetted, then squeezed, and one end put in the vessel that contains the liquor to be filtrated: the other end is to be out, and hang down below the surface of the liquor; by means hereof the purest part of the liquor distils drop by drop out of the vessel, leaving the coarser part behind. This filter acts as a syphon.

Water is freed from various impurities by means of basins made of porous stones, which vessels must be peculiarly beneficial in long voyages, and even upon land they are of considerable benefit, when none but stagnant waters are to be found, or springs issuing through clay.

A patent was granted in 1790 to a female potter, for inventing a composition to make filtering basins, as a succedaneum for that porous stone which is not every where to be found. She took four out of nine equal parts of tobacco pipe-clay, and five out of nine equal parts of sea, river, or pit sand, which she used for making small basins sufficient to contain one gallon of water. Her next proportions were equal parts of sea, river, or pit sand, and tobacco-pipe clay; her third proportions were three out of nine equal parts of tobacco-pipe clay; one out of nine equal parts of Stourbridge clay, or one out of nine equal parts of Windsor or other loam: and her fourth proportions were four out of eight equal parts of the burnt ground clay of which crucibles are made.

A patent was also granted to Mr. Joshua Collier of Southwark, for a most ingenious method of filtering and sweetening water, oil, and every other liquid. The following is the contrivance, which combines the application of machinery with the antiseptic properties of charcoal.

Fish oil is one of the liquids which he had particularly in view, to free it from every thing disagreeable, either in taste, smell, or colour; to accomplish which he poured a quantity of oil into a convenient vessel, heated to the temperature of 120° of Fahrenheit's thermometer, adding caustic mineral alkali of the specific gravity of 1.25. He then agitated the mixture, afterwards allowing it to stand till the sediment subsided; and then drew it off into another vessel, with a sufficient quantity of burnt charcoal finely powdered, and a small quantity of diluted sulphuric acid, to decompose the saponaceous matter still suspended in the oil, when the oil became
came clear at the surface. He then agitated the contents of this vessel, and left the coaly, saline, and aseptic particles to subsides; afterwards passing it through proper strainers, when it became quite transparent and fit for use.

The principle of the improved filtering machines consists in combining hydrostatic pressure with the mode of filtering per ascension, which procures the peculiar advantage of forcing the fluid and its sediment take opposite directions. The filtering surface remains the same, while the dimensions of the chamber in which the sediment is received may be varied. To adapt the machines to every purpose for which they are intended, chambers must be provided of various capacities, for the precipitated matter. The space required is very great with respect to the oil trade, and as all dimensions will be required occasionally, no particular limits can be fixed. For distilleries and breweries they may be smaller in proportion; and a very small chamber will be sufficient for domestic economy. If water is to be freed from noxious particles, it must be made to pass through an iron box in its way to the filting chamber, and the box must contain charcoal finely powdered. The water is received into this box and delivered by two apertures, which are opened and closed by cocks.

Another part of the invention consists in filtering machines in the form of stills, in which charcoal may be repeatedly burnt after any fluid substances have passed through it, for the purpose of freeing them from noxious particles, or discharging their colouring matter.

To the filtering apparatus of Mr. Collier, instruments are attached for discovering the comparative qualities of oils, which depend in some measure on their specific gravities; spermaceti oil, when compared with fish oils being as 875 to 920. To do this, a glass vessel of any shape most convenient is employed, with a glass bubble, and a thermometer. If the oil is pure, the bubble sinks, when the mercury rises to a particular standard. When spermaceti oil is pure, the bubble floats, though of the temperature required.

To determine the tendency of oils used for burning to congeal in cold weather, a freezing mixture may be put into a glacial of thin glass, into which let a thermometer be immersed, and a single drop of the oil permitted to fall on the outside of the vessel, where it will instantly congeal. As the cold produced by the mixture decreases, let the temperature be observed by the thermometer at which the oil becomes fluid, and runs down the side of the glass.

The following is a short description of the apparatus contrived for this purpose. A (fig. 1. Plate CCXVII.) is the cistern, into which the water or other liquor to be filtered is put. B, is a tube opening into the bottom of the cistern A, and being put along the bottom of the machine, conveying the fluid into C C C, the filtering chamber, which is covered with leather bound down round its circular rim, and through which the water is percolated. D D D, the basin rising above the level of the chamber, and receiving the filtered liquid. E, The spout by which it runs off into a pitcher or other vessel. F, Another spout furnished with a cock to draw off the foul water from the chamber when necessary. G G G G G, The air tube, which begins above the level of the chamber, is covered with a button, which saves the leather from being cut, and has a small lateral aperture for the air to be carried off. This pipe passes along the bottom and up the side, and rising above the level of the water in the cistern, is there closed, except a small lateral aperture through which the air escapes. H, A guard or rim with cross bars put over the leather, to keep it from being forced up by the water. It is fastened down by B B, of two notches on opposite sides of the ground, by which it lacks into two staples rivetted into the bottom of the basin. I, The lid sliding down to cover the water from dust, and suspended at pleasure by means of K K, two springs on each tube for that purpose. L M N O, A cylindrical box containing charcoal, which is connected with the above by means of the tube P, and a continuation of the tube B. L M, The water tube B continued below the charcoal apparatus, so that the fluid may pass through the same into the cylinder, from whence it enters the chambers at P, so as to be filtered through the leather as before described. R R, Collars which may be unscrewed at pleasure, so as to detach the charcoal apparatus whenever the charcoal requires to be purified by heat. S S, Two cocks to direct the fluid through the charcoal cylinder immediately into the filtering chamber.

Fig. 2. A tub or cistern containing the oil to be filtered, and supplying a tube of sufficient height for the hydrostatic pressure to operate. B B, A main tube of wood, tin, leather, or cloth, to which any number of bags, C C C, of the size and shape of corn bags, or any convenient size or shape, may be connected. These are bound to D D D D, straight double iron bars, furnished with a hinge at one end and a screw at the other, by opening which the bags may be emptied. F, A trough underneath, made to receive the filtered oil from the receivers E E E.

Fig. 3. A funnel, cask, or cistern ito which the fluid is put which passes down. B, A tube fitted into the same through which it enters. C, An iron still, or still of any other substance capable of sustaining heat, full of finely powdered and sifted charcoal, through the head of which the fluid passes into any receiver. D, A fire-place of any construction to drive over the fluid remaining interspersed among the charcoal, and also to purify the charcoal by an increase of temperature when required. E, A cock to let water into the flues to cool the apparatus for a subsequent operation.

Fig. 4. The trial glass with its thermometer.

FILTER is also a charm, supposed to have a virtue of inspiring love. The word is derived from φιλεῖν, which signifies the same thing, of φιλος, amio, "I love."

The Greeks, when their love was without success, had several arts to procure the affections of their beloved. The Thessalian women were famous for their skill in this as well as other magical practices. The means whereby it was effected were of divers sorts; it was sometimes done by potions called φιλεῖν, which are frequently mentioned in authors of both languages. Juvenal speaks thus:

Hic magicus aestem cantus, hic Thesala vendit
Philtro, quis volat, sciem tamen venturi mariti.

Their operations were violent and dangerous, and commonly deprived such as drank them of their reason.
or Plutarch and Cornelius Nepos report that Lucullus the Roman general first lost his reason, and afterwards his life, by one of them. Lucrécius reports that the poet ended his life by the same way; and Catius Caligula, as Suetonius reports, was driven into a fit of madness by a litter given him by his wife Ceresia, which story is mentioned by the same poet. Ovid likewise assures us, that this was the usual effect of such potions.

The ingredients they were made of were of various sorts; several of which applied by themselves were thought effectual.

**Filtration**, the act of passing any liquor through a filter, called also colature, percolation, and transmutation. See **Filter**.

**Fimbrié, Fringes.** The extremities or borders of the tube Fallopian were formerly so called; the word signifying a fringed border, which that part resembles.

**Fimbriated, in Heraldry,** an ordinary with a narrow border or hem of another tincture.

**Fin, in Natural History,** a well known part of fishes, consisting of a membrane supported by rays, or little bony or cartilaginous ossicles.

The office of the fin has commonly been supposed to be analogous to that of feathers in fowls; and to assist the fish in its progressive motion, or swimming; but the later naturalists find this a mistake.

The tail is the great instrument of swimming: the fins only serve to keep the fish upright, and prevent vacillation or waverings. See **Ichthyology Index**.

**Final, in general, whatever terminates or concludes a thing; as final judgment, final sentence, &c.**

**Final Cause, is the end for which the thing is done.** The final cause is the first thing in the intention of a person who does a thing; and the last in the execution. See **Cause**.

**Final Letters, among the Hebrew grammarians, five letters so called, because they have a different figure at the end of words from what they have in any other situation.**

**Final, in Geography,** a port town of Italy, subject to Genoa, and situated on the Mediterranean, about 37 miles south-west of that city. It was sold to the Genoese in 1713, by the emperor Charles VI. E Long. 9. 12. N. Lat. 44. 30.

**Finances, in political economy, denote the revenues of a king or state: analogous to the treasury or exchequer of the English, and the fiscus of the Romans. The word is derived from the German **finantis, scraping, usurying.** Though Du Cange choosing rather to deduce it from the barbarous Latin **financia, *presumptio pecuniae.***

**Council of the Finances,** under the former French government, constituted our lords commissioners of the treasuries, or our lord high treasurer, &c.

The French had a peculiar kind of figures, or numerical characters, which they call chiffre de finance.

**Finch-kind,** in Ornithology, a genus of birds down by the name of *Fringilla.* See *Fringilla,* Ornithology Index.

**Finch, Hemage, earl of Nottingham,** the son of Mr. William Finch, sometime recorder of London, and of a younger branch of the Winchelsea family, was born in 1621. By his good parts and diligence, he became a noted proficient in the municipal laws; was made solicitor general by Charles II. on his restoration, and was very active in the prosecution of the recidives. In 1670 he was appointed attorney general; about three years after, lord keeper of the great seal, on the removal of the earl of Shaftesbury; and lord chancellor in 1675. He was created earl of Nottingham in 1681; and died in the year following, being quite worn out by the fatigues of business. He published several speeches on the trials of the judges of King Charles I. with some few other things; and left behind him Chancery Reports in MS.

**Fine, that which is pure and without mixture. The term is particularly used in speaking of gold or silver.**

**Fine, in Law,** hath divers applications. Sometimes it is used for a formal conveyance of lands or tenements, or of any thing inheritable, being in esse temporis finis, in order to cut off all controversies. Others define it to be a final agreement between persons, concerning any lands or rents, &c. of which any suit or writ is depending between them in any court.

**Fine,** sometimes signifies a sum of money paid for entering lands or tenements let by lease; and sometimes a pecuniary mulct for an offence committed against the king and his laws, or against the lord of the manor.

**Fines for Alienation,** in Feudal Law. One of the attendants or consequences of tenure by vassalship, Knight-Service, was that of fines due to the lord for every alienation, whenever the tenant had occasion to make over his land to another. This depended on the nature of the feudal connection; it not being reasonable, nor allowed, that a feudal should transfer his lord's gift to another, and substitute a new tenant to do the service in his own stead, without the consent of the lord: and, as the feudal obligation was considered as reciprocal, the lord also could not alienate his seignory without the consent of his tenant, which consent of his was called an attornment. The restraint upon the lord soon wore away; that upon the tenant continued longer. For when every thing came in process of time to be bought and sold, the lords would not grant a license to their tenants to alienate, without a fine being paid; apprehending that, if it was reasonable for the heir to pay a fine or relief on the renunciation of his paternal estate, it was much more reasonable that a stranger should make the same acknowledgment on his admission to a newly purchased feud. In England, these fines seem only to have been exacted from the king's tenants *in capite,* who were never able to alienate without a license: but as to common persons, they were at liberty by magna charta, and the statute of quis deposuit (if not earlier), to alienate the whole of their estate, to be held of the crown lord as they themselves held it of before. But the king's consent or *in capite,* not being included under the general words of these statutes, could not alienate without a license: for if they did, it was in ancient strictness an absolute forfeiture of the land; though some have imagined otherwise. But this severity was mitigated by the statute Edw. III. c. 12, which ordained, that in such case the lands should not be forfeited, but a reasonable fine be paid to the king. Upon one statute it was settled, that one-third of the yearly value should be paid
the Irish histories died in the year 283, although there is some reason from Ossian's poems for placing his death a few years later. Fingal was denounced in all probability from those Celtic tribes who were the first inhabitants of Britain. Tradition, and the poems of Ossian, give him a long line of royal ancestors, such as Combal, Tremnor, Trathal, &c., who had all reigned over the same territory. Whether this territory was bounded by the Caledonian forest, or extended somewhat farther to the south, towards the Roman province, is uncertain; but there is no doubt of its having extended over all the north and west Highlands, comprehending the Hebrides, whose petty chiefs were all subject to the king of Morven. His principal place of residence was Selima, which was probably in the neighbourhood of Gienlo, supposed to be the Cen of Ossian; though some imagine it to have been Strath-Conan in Moray. The truth seems to be, that as Fingal and his people lived by hunting, they often shifted their habitations. Hence, in all parts of the Highlands we find, in the names of places, such as Bugh, &c., that many of these as yet unexplained claims for the honour of Fingal's residence. Fingal acquired great fame by his prowess in arms. He made many successful incursions into the Roman province, from whence he carried away those spoils which his son so often mentions under the names of the vine of the stranger, and the saw of the stranger. By sea we find him frequently making voyages to Scandinavia, the Orkneys, and Ireland; called by Ossian Loch, Linnistore, and Ulfin. Several of these expeditions were celebrated by his son in epic poems, of which two only remain, Fingal and Temora. In the last of these poems, we find Fingal fighting together with his grandson Oscar. How long he lived afterwards is uncertain. He is said to have died a natural death; and therefore none of his son's poems relate to this event, though it is occasionally mentioned in many of them.

"Did thy beauty last, O Ryno? Stood the strength of car-born Oscar? Fingal himself, passed away; and the halls of his fathers have forgotten his steps. The last of the north is a great king, and I behold thee sitting on mist, dimly gleaming in all thing arms, Thy form now is not the terror of the valiant; but like a watery cloud, when we see the stars behind it, with their weeping eyes. Thy shield is like the aged moon; thy sword, vapour half kindled with fire. Dim and feeble is the chief who travelled in brightness before. But thy steps are on the winds of the desert, and the storms darken in thy hand. Thou takest the sun in thy wrath, and hidest him in thy clouds. The sons of little men are afraid, and a thousand showers descend."—Berrathon.

The character of Fingal (Dr. Blair observer) is perhaps the most perfect that ever was drawn by a poet, for we may boldly defy all the writers of antiquity to show us any hero equal to Fingal. Throughout the whole of Ossian's works, he is presented to us in all that variety of lights which give the full display of a character. In him concurs almost all the qualities that can ensue human nature; that can either make us admire the hero, or love the man. He is not only unconquerable in war, but also in his people happy by his wisdom in the days of peace. He is truly the father of his people. He is known by the epithet of
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Fingal. 'Fingal of the mildest look, and distinguished on every occasion by humanity and generosity. He is merciful to his foes, full of affection to his children, full of concern about his friends, and never mentions Agamemnes, his first love, without the utmost tenderness. He is the universal protector of the distressed; none ever went sad from Fingal. — O Oscar! bend the strong in arms, but spare the feeble hand. Be thou a stream of many tides against the foes of thy people; but like the gale that moves the grass to those who ask thine aid: so Tremor lived; such Traethal was; and such has Fingal been. My arm was the support of the injured; the weak rested behind the lightning of my steel. These were the maxims of true heroism to which he formed his grandson. His fame is represented as everywhere spread; the greatest heroes acknowledge his superiority; his enemies tremble at his name; and the highest encomiums that can be bestowed on one whom the poet would most exalt, is to say, That his soul was like the soul of Fingal. Wherever he appears, we behold the hero. The objects he pursues are always great; to bend the proud, to protect the injured, to defend his friends, to overcome his enemies by generosity more than by force. Some strokes of human imperfection and frailty are what usually give us the most clear view and the most sensible impression of a character, because they present to us a man such as we have seen; they recall known features of human nature. When poets go beyond this range, and attempt to describe a faultless hero, they, for the most part, see before us a sort of vague indistinguishable character, such as the imagination cannot lay hold of, or realize it as the object of affection. But Fingal, though exhibited without any of the common human failings, is nevertheless a real man; a character which touches and interests every reader."

We may observe, that Fingal appears to have been no less a poet than a warrior; at least, in all those passages ascribed to him in the poems of his son, there is a grandeur and loftiness that elevates them above the common style even of Ossian. The following passage from the poem of Carthom may be taken as a specimen of Fingal's poetry. — Raise, ye bard! said the mighty Fingal, 'the praise of the unhappy Moana. Call her ghost, with your song, to our halls; that she may rest with the fair of Morven, the sunbeams of other days, and the delight of the heroes of old. — I have seen the walls of Balclothna, but they were desolate. The fire had resounded in the halls; and the voice of the people is heard no more. The stream of Clutha was removed from its place by the fall of the walls. The thistle shook, there, its lonely head: the moss whistled to the wind. The fox looked out from the window; the rank grass of the wall waved round his head. Desolate is the dwelling of Moana: silence is in the house of her fathers. Raise the song of mourning, O bard; over the land of strangers. They have but fallen before us; for, one day we must fall. — Why dost thou build the hall, son of the winged days? Thou lookest from thy towers to-day; yet a few years, and the blast of the desert comes; it bows in thy empty court, and whirls round thy half-worn shield. — And let the blast of the desert come! We shall be renowned in our day. The mark of my arm shall be in the battle, and my name in the song of bards. Raise the song; send round the shell: and let joy be heard in my hall. When thou, sun of heaven, shalt fail! if thou shalt fail, thou mighty light! if thy brightness is for a season, like Fingal; our fame shall survive thy beams.' — Such was the joy of Fingal in the day of his joy. His thousand bards leaned forward from their seats, to hear the voice of the king. It was like the music of the harp on the gale of the spring. Lovely were thy thoughts, O Fingal! Why had not Ossian the strength of thy soul? But thou standest alone, my father; and who can equal the king of Morven?' — See OSIANN.

FINGERS, in Anatomy, the extreme part of the hand, divided into five members. See ANATOMY, No. 56.

FINING of LIQUORS. See CLARIFICATION.

FINISTERRE, the most westerly cape or promontory of Spain, in 10° 15', W. Long., and 43° N. Lat. This cape is likewise the most westerly part of the continent of Europe.

FINITE, something bounded or limited, in contradistinction to INFINITE.

FINLAND, the duchy of, is bounded on the west by the gulf of Bothnia, on the east by Russia, on the south by the gulf of Finland and Ingria, and on the north by Bothnia and Lapland. It is about 200 miles in length, and almost as much in breadth. It contains many lakes; on which are several islands, which are generally rocks or inaccessible mountains. The inhabitants are small of stature, capable of enduring hardships, and good soldiers. The Russians conquered the Swedish part of Finland in 1808, and now possess the whole. The population of all Finland is about 1,100,100. The Finns speak a language of their own, quite different both from the Russian and the Swedish. As to religion, the Finns are in general Lutherans. The Russians have divided the country into 15 circles; the capital of the whole province is Abo. The climate of Finland is mild, compared with that of Northern Russia. It is an agreeable country, diversified with mountains, forests, lakes, meadows, and pleasant fields. The inhabitants salt the fish they do not consume themselves, and send it into foreign countries.

FINNINGIA, or FENNINIA, in Ancien Geography, the true reading for Eningia in Pliny, which he makes an island, but is more truly a peninsula. Now FINLAND; a province of Sweden. Fenmi, or Femi, the people; whose ferocity was extraordinary, poverty extreme, herbs their food, skins their covering, and the ground their couch: regardless of man and of gods, they attained to a very difficult thing, not to have a single wish to form, (Tacitus).
divided philosophers, have now in a great measure, though not wholly, subsided. The celebrated philosophers of the last century, Bacon, Boyle, and Newton, were of opinion that fire was no distinct substance from other bodies, but that it consisted entirely in the violent motion of the parts of any body. As no motion, however, can be produced without a cause, they were obliged to have recourse to a mechanical force or impulse as the ultimate cause of fire in all cases. Thus Boyle tells us, that "when a piece of iron becomes hot by hammering, there is nothing to make it so, except the forcible motion of the hammer impressing a vehement and variously determined agitation on the small parts of the iron." Bacon defines heat, which he makes synonymous with fire, to be "an expansive undulatory motion in the minute particles of a body, whereby they tend with some rapidity from a centre towards a circumference, and at the same time a little upwards." Sir Isaac Newton said nothing positive upon the subject; but conjectured that gross bodies and light might be convertible into one another; and that great bodies of the size of our earth, when violently heated, might continue and increase their heat by the mutual action and reaction of their parts.

But while the mechanical philosophers thus endeavoured to account for the phenomena of fire upon the same principles which they judged sufficient to explain those of the universe in general, the chemist as strenuously asserted that fire was a fluid of a certain kind, distinct from all others, and universally present throughout the whole globe. Boerhaave particularly maintained this doctrine; and in support of it brought the following argument, that steel and flint would strike fire, and produce the very same degree of heat in Nova Zembla, which they would do under the equator. Other arguments were drawn from the increased weight of metallic calcines, which they supposed to proceed from the fixing of the element of fire in the substance whose weight was thus increased. By these experiments Mr Boyle himself seems to have been staggered; as he published a treatise on the possibility of making fire and flame ponderable; though this was directly contrary to his own principles already quoted. For a long time, however, the matter was most violently disputed; and the mechanical philosophers, though their arguments were equally inconsiderate with those of their adversaries, at last prevailed through the prejudice in favour of Sir Isaac Newton, who indeed had scarce taken any active part in the contest.

That the cause of fire cannot be any mechanical motion which we can impress, is very evident; because on mechanical principles an effect must always be proportionable to the cause. In the case of fire, however, the effect is beyond all calculation greater than the cause, supposing the latter to be only a mechanical percussion, as in the case of hammering iron till it be red hot. By a few strokes of a hammer, the particles of a piece of iron, we shall allow, may be set in a violent motion, and thus produce fire. If, however, we direct the motion of these particles upon another body whose parts are at rest, and in some degree coherent, it is plain that the latter will resist and diminish that motion of the particles already moved, in proportion to their vis inerter, as well as the cohesion of the parts of the second body, if indeed we can suppose the vis inerter of matter to be different from the effect of gravitation, cohesion, or some other power acting upon it. By no argumentation whatever, then, can we show upon mechanical principles, why fire should have such a tendency to increase and multiply itself without end, as we see it has, even abstracting from all consideration of the necessity of air for continuing the action of fire.

The action of the air in augmenting and continuing the power of fire, seems scarce at all to have been considered by those who first undertook an investigation of the subject. It evidently gave rise to the Hutchinsonian hypothesis, that fire, light, and air, were convertible into one another. This, however, is equally untenable with the mechanical hypothesis; for later discoveries have shown, that our atmosphere is composed of two distinct fluids, only one of which is fit for supporting flame; and if we should suppose this to be the only proper air, it is in like manner demonstrated, that this pure fluid is not homogeneous, but composed of a gravitating and non-gravitating substance; the latter of which only has the properties of fire; so that this element is still as invisible as ever; nor can it be shown by any experiment that fire per se has ever been changed into a palpable or gravitating substance.

The experiments which first seemed to bring this dispute to a decision were those of Dr Black, concerning what he called latent heat; on which some other names, such as absolute heat, specific fire, &c. have been bestowed, very little to the advancement of science in general. From these discoveries it appears, that fire may exist in bodies in such a manner as not to discover itself in any other way than by its action upon the minute parts of the body; but that suddenly this action may be changed in such a manner as no longer to be directed upon the particles of the body itself, but upon external objects; in which case we then perceive its action by our sense of feeling, or discover it by the thermometer, and call it sensible heat. This expression, it must be owned, is improper; and the use of the word heat, instead of fire, has produced some confusion, which it is not now easy to avoid in speaking upon these subjects. By the word heat, we ought always to understand the effect of fire, or the fluid acting in a certain manner, rather than the mere element itself, which, it is certain, from the experiments just mentioned, may exist in substances actually cold to the touch.

From this discovery made by Dr Black, along with many others in electricity, and recorded at length in various articles of this work, it is now almost universally allowed, that fire is a distinct fluid, capable of being transferred from one body to another. But when this was discovered, another question no less perplexing occurred, viz. what kind of fluid it was; or whether it bears any analogy to those with which we are better acquainted? Here we find two fluids, viz. the solar light, and the electric matter, both of which occasionally act as fire, and which therefore seem likely to be all the same at bottom. By the vulgar, indeed, the matter has long ago been determined; and the rays of the sun, as well as the electrical fluid, have been promiscuously denominated elementary fire. Philosophers, indeed, have withheld their assent; though
their reasons for so doing are by no means apparent.

The most strange suppositions, however, have been made concerning the nature of both those fluids; and on the most slender grounds imaginable, or rather on no grounds at all, they have been supposed to be phlogiston itself, or to contain a large proportion of it. Mr. Scheele went so far in this way as to form an hypothesis, which he endeavoured to support by some experiments, that fire is composed of dephlogisticated air and phlogiston. But it is now ascertained beyond all possibility of dispute, that the result of such a combination is not fire, but fixed air; and so that we need not take any further notice of this hypothesis than just to observe, that it would have been altogether untenable, even though this discovery had not been made; because the dephlogisticated air itself is not a simple but a compound substance, as has already been observed; and that in all cases of combustion the one part of the air is separated from the other.

It was long ago observed by Sir Isaac Newton, that heat was certainly conveyed by a medium more subtle than the common air; because two thermometers, one included in the vacuum of an air pump, the other placed in the open air, at an equal distance from the fire, would grow equally hot in near the same time. The consequence of this, had he pursued the thought, was, that fire itself was equally present in all places, and as active where there was no terrestrial matter as where there was. New improvements in the air pump have enabled succeeding philosophers to make more perfect vacuums, such as it has been supposed even the electric matter cannot pass through. It is not to be doubted, however, that, even there, the thermometer would be heated by a fire as well as in the open air. Fire, therefore, exists and acts where there is no other matter, and of consequence is a fluid, independent of every terrestrial substance, without being generated or compounded of any thing we are yet acquainted with.

To determine the nature of the fluid, we have only to consider whether any other can be discovered which will pass through the perfect vacuum just mentioned, and act there as fire. Such a fluid we find in the solar light, which is well known to act even in vacuo as the most violent fire. The solar light will likewise act in the very same manner in the most intense cold; for M. de Saussure has found, that on the cold mountain top the sunbeams are equally, nay, more powerful, than on the plain below. It appears, therefore, that the solar light will produce heat independent of any other substance whatever; that is, where no other body is present, at least as far as we can judge, except the light itself and the body to be acted upon. We cannot therefore avoid concluding, that a certain modification of the light of the sun is the cause which produces heat, expansion, vapour, &c. and answers to the rest of the characters given in our definition of fire, and that independent of any other substance whatever.

For a further discussion of this subject, see Chemistry and Electricity Index.

Wild Fire, a kind of artificial or factitious fire, which burns even under water, and that with greater violence than out of it.

It is composed of sulphur, naphtha, pitch, gum, and bitumen; and is only extinguishable by vinegar mixed with sand and urine, or by raw hides.

Vol. VIII. Part II.

Its motion or tendency is said to be contrary to that of natural fire, and always follows the direction in which it is thrown; whether it be downwards, sidewise, or otherwise. The French call it Greek fire, or feu Grecque, because first used by the Greeks, about the year 650: as it is observed by the Jesuit Petavius, on the authority of Nicetas, Theophanes, Cedrenus, &c.

The inventor, according to the same Jesuit, was an engineer of Heliopeia, in Syria, named Callinicus, who first applied it in the sea-fight commanded by Constantine Pogonatus, against the Saracens, near Cyzicus, in the Hellespont; and with such effect, that he burnt the whole fleet therewith wherein were 30,000 men. But others will have it of a much older date, and hold Marcus Gracchus the inventor: which opinion is supported by several passages both in the Greek and Roman writers, which shows it to have been anciently used by both these nations in their wars.

Constantine's successors used it on divers occasions with equal advantage as himself: and what is remarkable enough is, that they were so happy as to keep the secret of the composition to themselves, so that no other nation knew it in the year 960.

Hugh king of Burgundy, demanding ships of the emperor Leo, for the siege of Fresne, desired likewise the Greek fire.

F. Daniel gives a good description of the Greek fire, in his account of the siege of Damietta under St. Louis. Every body, says that author, was astonished with the Greek fire, which the Turks then possessed, and the secret whereof is now lost. They threw it out of a kind of mortar; and sometimes shot it with an odd sort of cross-bow, which was strongly bent by means of a handle or winch, of much greater force than the mere arm. That thrown with the mortar sometimes appeared in the air of the size of a tun, with a long tail, and a noise like that of thunder. The French by degrees got the secret of extinguishing it, in which they succeeded several times.

Machine for preserving from Fire. This machine consists of a pole, a rope, and a basket. The pole is viii. 117.

of fir, or a common scaffold pole, of any convenient length from 36 to 46 feet; the diameter at bottom, or greatest end, about five inches; and at the top, or smallest end, about three inches. At three feet from the top is a mortise through the pole, and a pulley fixed to it of nearly the same diameter with the pole in that part. The rope is about three quarters of an inch diameter, and twice the length of the pole, with a spring hook at one end, to pass through the ring in the handle of the basket when used: it is put through the mortise over the pulley, and then drawn tight on each side to near the bottom of the pole, and made fast there till wanted. The basket should be of strong wicker-work, three feet and a half long, two feet and a half wide, rounded off at the corner, and four feet deep, rounding every way at the bottom. To the top of the basket is fixed a strong iron curve or handle, with an eye or ring in the middle; and at one side of the basket, near the top, is fixed a small cord or guide-ropes of about the length of the pole. When the pole is raised, and set against a house over the window from which any persons are to escape, the manner of using it is so plain and obvious, that it needs not be described. The most convenient distance from the house for the foot.
of the pole to stand, where practicable, is about 12 or
14 feet. If two strong iron straps, about three feet
long, riveted to a bar, crossed and spreading about 14
inches at the foot, were fixed at the bottom of the pole,
this would prevent its turning round or slipping on the
pavement. And if a strong iron hoop, or ferrule, ri-
vetted (or welded) to a semicircular piece of iron
spreading about 12 inches, and pointed at the ends,
were fixed on at the top of the pole, it would prevent
its sliding against the wall.

When these two last mentioned irons are fixed on,
eye give the pole all the steadiness of a ladder; and
because it is not easy, except to persons who have been
used to it, to raise and set upright a pole of 40 feet or
more in length, it will be convenient to have two small
poles or spars of about two inches diameter, fixed to
the sides of the great pole at about two or three feet
above the middle of it, by iron rings rivetted to the two
plates so as to turn every way; the lower end of these
spars to reach within a foot of the bottom of the great
pole, and to have ferrules and short spikes to prevent
sliding on the pavement, when used occasionally to sup-
port the great pole like a tripod. There should be
two strong ash trundles let through the pole, one at
four feet and one at five feet from the bottom, to stand
out about eight inches on each side, and to serve as
handles, or to twist the rope round in lowering a very
heavy weight. If a block and pulley were fixed at about
the middle of the rope, above the other pulley, and the
other part of the rope made to run double, it would di-
nimish any weight in the basket nearly one half, and be
very useful in drawing any person up, to the assistance
of those in the chambers, or for removing any effects
out of a chamber, which it might be dangerous to at-
tempt by the stairs.

It has been proved by repeated trials, that such a
pole as we have been speaking of can be raised from
the ground, and two or three persons taken out of the
upper windows of a house, and set down safely in the
street, in the space of 35 seconds, or a little more than
half a minute. Sick and infirm persons, women, chil-
dren, and many others, who cannot make use of a lad-
er, may be safely and easily brought down from any
of the windows of a house on fire by this machine,
and, by putting a short pole through the handles of the
basket, may be removed to any distance without being
taken out of the basket. The pole most always have
the rope ready fixed to it, and may be conveniently
laid up upon two or three iron hooks under any shade
or gateway, and the basket should be kept at the
watch-house. When the pole is laid up, the two spars
should always be turned towards the head of it. The
basket should be made of peeled rods, and the pole and
spars painted of a light stone colour, to render it more
visible when used in the night.

Machines for extinguishing Fire. In the year 1734,
the state of Sweden offered a premium of 20,000 crowns
for the best method of stopping the progress of acci-
dental fires; when one Mr Fuches, a German physician,
made a preparation for that end, and the experiment
was made on a house built on purpose of dry fir, at
Legard island. In the building were placed several
vats of tar and pitch, and a great quantity of chips,
which were set on fire; flames issuing through the
top of the house, windows, &c. when he threw in one
of the barrels containing the preparation, which imme-
diately quenched the flames; a second barrel entirely
cleared the smoke away; and the whole was executed
to the satisfaction of the spectators, and to the no small
satisfaction of the inventor, who was about to return
home, when unexpectedly the flames broke out again,
supposed to be occasioned by a small quantity of com-
flammable matter being introduced and set on fire secretly
by some malicious person. Upon this the wrong-headed
mob fell upon Mr Fuches, and beat him most un-
mercifully, so that he narrowly escaped with his life.
He soon after left the country, and never could be
prevailed on (though strongly persuaded by some of
the most eminent citizens) to return. It is said, another
experiment of the same kind was tried in the year 1761
in Holland; but rendered abortive through the per-
verseness of the populace.

Attempts of a similar nature have met with a better
reception in England. Of these the most successful
was that of Mr Godfrey, whose contrivance is thus
described by Mr Ambrose Godfrey, grandson to the
inventor. 6 The machine to be employed consists of a
small portion of gunpowder closely confined; which,
when animated by fire, acts by its elastic force upon a
proper medium, and not only divides it into the mi-
nutest atoms, but disperseth it also in every direction,
so as immediately to extinguish any fire within a certain
distance. This medium is a liquor strongly impregnated
with a preparation of antiphlogistic principles, which by
their action upon burning materials extinguish the flames
and reduce them in general to the state of a black coal;
and, by its opposite nature to fire, hinders the remaining
sparks, notwithstanding the admission of the air, from
kindling the flames afresh. By this means, the great
point is obtained, in giving sufficient time for totally
extinguishing any remains of fire.

They who presume that water only will perform
this will find themselves greatly mistaken, as the draught
of air will certainly rekindle the neighbouring ma-
terials, which are very fit to receive a fresh flame, the
fire not being extinguished by the quantity of water, but
rather by the expansion and rarefaction of its particles.
There are several sizes of these machines, from five to
fifty pounds weight, in a portable and rather small com-
pass, and may generally be carried to any place where
a man can go himself.

But though these machines will prevent great fires
by a timely application, they will not extinguish them
after they have reached a frightful height, and several
houses, perhaps near a whole street, are in flames. The
doors must be standing, and access to the building
safe, otherwise no person can be supposed to approach
even enough to apply them in a proper manner. Every
fire has its beginning for the most part in some apart-
ment; and, as soon as discovered, the family, instead of
losing all presence of mind, should immediately apply
one or more of these machines, which will then fully
answer the intention. The proper time of applying
them, supposes that they are ready at hand. It will
be in vain to think of fetching them from any consider-
able distance, as it will then be too late for them to
perform any important service: except indeed being
the probable means of saving some adjacent house, by ex-
distinguishing
FIR

Fire. Stopping the flames as often as they break out, till the building first on fire is totally consumed, and, by falling into ruins, leaves the other in perfect safety.11

On the 19th of May 1761, at noon, Mr Godfrey's experiment for extinguishing fire, was tried in a house erected for that purpose, near Mary-le-bone. Their royal highnesses, the Duke of York, Prince William Henry, Prince Henry Frederick, and a great number of persons of rank and distinction, and many of the learned world, gave their attendance on this singular occasion.

The house, which was of brick, consisted of three rooms one above another, a staircase, chimney, lath and plaster ceilings, and a kind of wainscoting round the rooms, of rough deal. Exactly at 12 o'clock the ground room, and that up one pair of stairs, were set on fire by lighting the faggots and shavings laid in there for that purpose: in about 15 minutes the wainscot of the under room was thought to be sufficiently in flames, and three of the machines were thrown in; which, by almost immediate and sudden explosions, instantaneously extinguished the flames, and the very smoke in that apartment in a few minutes totally disappeared. By this time, the firemen, &c. who had the care of throwing in the machines, gave an alarm that the staircase had taken fire, and that it was necessary directly to go to work upon the next room; which was accordingly done, and with the same effect. The experiment, however, hitherto did not universally satisfy: in the last instance especially it was thought to be too hastily put in execution; and the populace without side the paling, who were supposed to amount to near 20,000, and whose curiosity, from the very nature of their situation, remained much dissatisfied, began to grow rather riotous, and talked of a second battle conjurer. For the sake of the experiment, therefore, and to remove all manner of doubt, Mr Godfrey consented to a third experiment in the upper room, which was entirely of wood. The flames were now suffered to get to a considerable height, and even the window frames destroyed, before the machines were thrown in: which, however, answered exactly as the former had done; and, being quite in sight of the outstanders, met with universal approbation.

These machines of Mr Godfrey's, it is evident, would be of great use in extinguishing fires on shipboard; and might be considered as a no less necessary part of a ship's lading, than her stores or ammunition.

The hint of these machines is said to have been taken by Mr Godfrey from the invention of one Zachary Greyl, who exhibited machines similar to those of Mr Godfrey, before persons of the first rank, but without meeting with any encouragement. His machines were made of wood, and the liquor employed was only water, and consequently inferior to Mr Godfrey's in its power of extinguishing fire. The latter is said to have mixed his water with a certain quantity of oil of vitriol, or with sal ammoniac. These machines, however, as already observed, are found to be only serviceable in the beginning of a fire. When the roof had fallen in, they had no effect.

Composition for extinguishing Fire. For this purpose the following has been invented by M. Von Aken, of which the account is taken from Nicholson's Journal, vol. ii. 4to.

<table>
<thead>
<tr>
<th>Substance</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Burnt alum</td>
<td>30 lbs.</td>
</tr>
<tr>
<td>Green vitriol powdered</td>
<td>40</td>
</tr>
<tr>
<td>Cinabrese or red ochre in powder</td>
<td>20</td>
</tr>
<tr>
<td>Potter's clay, or other clay, also powdered</td>
<td>200</td>
</tr>
<tr>
<td>Water</td>
<td>630</td>
</tr>
</tbody>
</table>

With 40 measures of this mixture an artificial fire was extinguished under the direction of the inventor by three persons, which would have required the labour of 40 men and 1500 measures of common water. Sig. Fabbro was commissioned to examine the value of this invention, and found in his comparative trials with engines of equal power, worked by the same number of men, that the mixture extinguished the materials in combustion in one-sixth part less time, and three-eighths less of fluid, than when common water was used. He observed, as might indeed have been imagined from the nature of the material, that the flame disappeared wherever the mixture fell, and that the saline, metallic, and earthy matters formed an impenetrable lute round the hot combustible matter, which prevented the access of the air, and consequently the renewal of the destructive process.

It is scarcely probable that this practice in the large way, with an engine throwing upwards of 200 gallons (value about 3l. 10s.) each minute, would be thought of or adopted, or that a sufficient store of the materials would be kept in readiness; since at this rate the expenditure for an hour would demand a provision of the amount of 210l. sterling. But in country places the process, or some variation of it, might be applied with sufficient profit in the result; more especially if it be considered that common salt or alum, or such salting matter as can be had and mixed with the water, together with clay, chalk, or lime, ochreous earth or common mud, or even these last without any salt, may answer the purpose of the lute with more or less effect, and extinguish an accidental fire with much greater speed and certainty than clear water would do.

Water-Engine for extinguishing Fire. See Hydraulics.

In using this machine we have the following improvement by Dr Hoffman, which promises to be of great efficacy. As soon as the engine is in readiness to work, stir into the water that immediately is to be discharged, seven or eight pounds of pearl ashes in powder, and continue to add it in this manner as occasion requires; taking care that it be directed against the timber or wainscoat, &c. just beginning to burn, and not wasted against the brick-work; or, where time will admit, dissolve any quantity of pearl ashes in a copper with water, and as fast as it dissolves, which will be in few minutes, mix a paifol with the water in the engine, pretty often; and whatever burning wood it is played upon, will be extinguished as if it was dipped in water, and will not burn afresh in the part extinguished.

Easy method of Extinguishing Fire in Chimneys. It is well known, that the inner parts of chimneys easily take fire; the soot that kindles therein emits a greater flame, according as the tunnel is more elevated, because the inferior air feeds the fire. If this air could therefore be suppressed, the fire would soon be extinguished. In order to this, some discharge a pistol into the chimney, which produces no effect; others lay
under the chimney a copper full of water; but the va-
pours that rise from it, far from extinguishing the fire,
seem to give it new force. Water thrown into the
chimney at top is equally of no effect, because it comes
down through the middle of the tunnel, and not along
the sides. It would be more advisable to stop with
dung the upper orifices of the tunnel for quenching the
fire. But the surest and readiest method is, to take
a little gunpowder, and having bunged it with spittle
for binding it, to form it into small masses, and so throw
it into the heart of the chimney. When it is burnt, and
has produced a considerable vapour, a second, after-
wards a third, are thrown, and so on, as much as is
necessary. In a little time the fire is extinguished, and,
as it were, choked by this vapour; and cakes of in-
flamed soot are seen to fall from the tunnel, till at last
not the least vestige of fire appears.

Securing buildings against Fire. Dr Hales proposes
to check the progress of fires by covering the floors of
the adjoining houses with earth. The proposal is
founded on an experiment which he made with a fir
board half an inch thick, part of which he covered
with an inch depth of damp garden mould, and then
lighted a fire on the surface of the mould; though the
fire was kept up by blowing, it was two hours before
the board was burnt through, and the earth prevented
it from flaming. The thicker the earth is laid on the
floors, the better; however, Dr Hales apprehends that
the depth of an inch will generally be sufficient; and
he recommends to lay a deeper covering on the stairs,
because the fire commonly ascends by them with
the greatest velocity.

Mr Hartley made several trials in the years 1775
and 1776, in order to evince the efficacy of a method
which he had invented for restraining the spread of fire
in buildings. For this purpose thin iron plates are
well nailed to the tops of the joists, &c. the edges of
the sides and ends being lapped over, folded together,
and hammered close. Partitions, stairs, and floors, may
be defended in the same manner; and plates applied
to one side have been found sufficient. The plates are
so thin as not to prevent the floor from being nailed on
the joists, in the same manner as if this preventive
were not used: they are kept from rust by being
painted or varnished with oil and turpentine. The
expense of this addition, when extending through a
whole building, is estimated at about five per cent.
Mr Hartley has a patent for this invention, and par-
liament has voted a sum of money towards defray-
ing the expense of his numerous experiments. The
same preservative may also be applied to ships, furni-
ture, &c.

Lord Mahon has also discovered and published a very
simple and effectual method of securing every kind of
building against all danger of fire. This method he
has divided into three parts, viz. under-flooring, extra-
lathing, and inter-sealing.

The method of under-flooring, is either single or dou-
ble. In single under-flooring, a common-strength lath
of oak or fir, about one-fourth of an inch thick, should
be nailed against each side of every joist, and of every
main timber, supporting the floor which is to be se-
cured. Other similar laths are then to be nailed along
the whole length of the joists, with their ends butting
against each other. The top of each of these laths
or fillets ought to be at 1½ inch below the top of the
joists or timbers against which they are nailed; and
they will thus form a sort of small ledge on each side
of all the joists. These fillets are to be well bedded in
a rough plaster hereafter mentioned, when they are
nailed on, so that there may be no interval between
them and the joists: and the same plaster ought to be
spread with a trowel upon the tops of all the fillets, and
along the sides of that part of the joists which is be-
tween the top of the fillets and the upper edge of the
joists. In order to fill up the intervals between the joists
that support the floor, short pieces of common laths,
whose length is equal to the width of these intervals,
should be laid in the contrary direction to the joists, and
close together in a row, so as to touch one another:
their ends must rest upon the fillets, and they ought to
be well bedded in the rough plaster, but are not to be
fastened with nails. They must then be covered with
one thick coat of the rough plaster, which is to be
spread over them to the level of the tops of the joists:
and in a day or two this plaster should be travelled
over close to the sides of the joists, without covering
the tops of the joists with it.

In the method of double flooring, the fillets and
short pieces of laths are applied in the manner already
described; but the coat of rough plaster ought to be
little more than half as thick as that in the former
method. Whilst this rough plaster is laid on, some
more of the short pieces of laths above mentioned must
be laid in the intervals between the joists upon the first
coat, and be dipped deep in it. They should be laid
as close as possible to each other, and in the same di-
rection with the first layer of short laths. Over this
second layer of short laths there must be spread another
ccoat of rough plaster, which should be travelled
level with the tops of the joists without rising above them.
The rough plaster may be made of coarse lime and
hair; or, instead of hair, hay chopped to about three
inches in length may be substituted with advantage.
One measure of common rough sand, two measures of
slaked lime, and three measures of chopped hay, will
form in general a very good proportion, when suffi-
ciently beat up together in the manner of common
mortar. The hay should be put in after the two other
ingredients are well beat up together with water.
This plaster should be made stiff; and when the floor-
ing boards are required to be laid down very soon, a
fourth or fifth part of quicklime in powder, formed
by dropping a small quantity of water on the limestone
a little while before it is used, and well mixed with
this rough plaster, will cause it to dry very fast. If any
cracks appear in the rough plaster work near the joists
when it is thoroughly dry, they ought to be closed by
washing them over with a brush wet with mortar wash:
this wash may be prepared by putting two measures of
quicklime and one of common sand in a pail, and
stirring the mixture with water till it becomes of the
consistency of a thin jelly.

Before the flooring boards are laid, a small quantity
of very dry common sand should be strewn over the
plaster work, and struck smooth with a hollow rule,
moved in the direction of the joists, so that it may lie
rounding between each pair of joists. The plaster
work and sand should be perfectly dry before the
boards are laid, for fear of the dry rot. The method
of
FIR

Fire of under-flooring may be successfully applied to a wooden staircase; but no sand is to be laid upon the rough plaster work. The method of extra-lathing may be applied to ceiling joists, to sloping roofs, and to wooden partitions.

The third method, which is that of inter-securing, is very similar to that of under-flooring; but no sand is afterwards to be laid upon it. Inter-securing is applicable to the same parts of a building as the method of extra-lathing, but is seldom necessary.

Lord Mahon has made several experiments in order to demonstrate the efficacy of these methods. In most houses it is only necessary to secure the floors; and the extra expense of under-flooring, including all materials, is only about ninepence per square yard, and with the use of quicklime a little more. The extra expense of extra-lathing is no more than sixpence per square yard for the timber side walls and partitions; but for the ceiling about ninepence per square yard. But in most houses no extra-lathing is necessary.

Fire-Enter. We have a great number of mountebanks who have procured the attention and wonder of the people by eating fire, walking on fire, washing their hands in melted lead, and the like tricks.

The most celebrated of these was our countryman Richardson, much talked of abroad. His secret, as related in the Journal de Scopam, of the year 1680, consisted in a pure spirit of sulphur, with which he rubbed his hands, and the parts that were to touch the fire; which burning and cauterizing the epidermis, hardened and enabled the skin to resist the fire.

Indeed this is no new thing: Amb. Parce assures us he has tried it on himself; that after washing the hands in urine, and with unguentum Aureum, one may safely wash them in melted lead.

He adds also, that by washing his hands in the juice of onions, he could bear a hot shovel on them while it melted lead.

Fire, in Theology. See HELL.

We read of the sacred fire in the first temple of Jerusalem, which came down from heaven: it was kept with the utmost care, and they were forbidden to carry any strange fire into the temple. This fire is one of the five things which the Jews confess were wanting in the second temple.

The Pagans had their sacred fires, which they kept in their temples with the most religious care, and which were never to be extinguished. Numa was the first who built a temple to Fire as a goddess at Rome, and instituted an order of priests for the preservation of it. See VESTALS.

Fire was the supreme god of the Chaldeans; the Magi were worshippers of fire; and the Greeks and Armenians still keep up a ceremony called the holy fire, upon a persuasion that every Easter day a miraculous fire descends from heaven into the holy sepulchre, and kindles all the lamps and candles there.

Fire kindled spontaneously in the human body. See Extraordinary Cases of Burning.

Fire-Barrel. See Fire-Ship, Note (b).

Fire-Bouins. Ibid. Note (q).

Fire-Arrow, in naval artillery, is a small iron dart furnished with springs and bars, together with a match impregnated with sulphur and powder, which is wound about its shaft. It is intended to fire the sails of the enemy, and is for this purpose discharged from a musquetoon or swirl gun. The match being kindled by the explosion, communicates the flame to the sail against which it is directed, where the arrow is fastened by means of its bars and springs. The weapon is peculiar to hot climates, particularly the West Indies, where the sails being extremely dry by reason of the great heat, they instantly take fire, and of course set fire to the masts and rigging, and lastly to the vessel itself.

Fire-Balls, in artillery, a composition of meal powder, sulphur, saltpetre, pitch, &c. about the bigness of a hand grenade, coated over with flux, and primed with the slow composition of a fusee. This is to be thrown into the enemy's works in the night time, to discover where they are, or to fire houses, galleries, or blinds of the besiegers; or they are then armed with spikes, or hooks of iron, that they may not roll off, but stick or hang where they are desired to have any effect. See Fire-Balls, and Light-Balls.

Balls of Fire, in Meteorology, a kind of luminous body, generally appearing at a great height above the earth, with a splendour surpassing that of the moon, and sometimes equaling her apparent size. They generally proceed in this hemisphere from north to south with vast velocity, frequently breaking into several smaller ones, sometimes vanishing with a report, sometimes not.

These luminous appearances no doubt constitute one part of the ancient prodigies, blazing stars or comets, which last they sometimes resemble in being attended with a train; but frequently they appear with a round and well-defined disk. The first of those of which we have any accurate account, was observed by Dr Halley and some other philosophers at different places, in the year 1715. From the slight observations they could take of its course among the stars, the perpendicular height of this body was computed at about 70 miles from the surface of the earth. The height of others has also been computed, and found to be various; though in general it is supposed to be beyond the limits assigned to our atmosphere, or where it loses its refractive power. The most remarkable of these on record appeared on the 18th of August 1799, about nine o'clock in the evening. It was seen to the northward of Shetland, and took a southerly direction for an immense space, being observed as far as the southern provinces of France, and one account says that it was seen at Rome also. During its course it appears frequently to have changed its shape; sometimes appearing in the form of one ball, sometimes of two or more; sometimes with a train, sometimes without one. It passed over Edinburgh nearly in the zenith, and had then the appearance of a well-defined round body, extremely luminous, and of a greenish colour; the light which it diffused on the ground giving likewise a greenish cast to objects. After passing the zenith it was attended by a train of considerable length, which continually augmenting, at last obliterated the head entirely; so that it looked like a wedge, flying with the obtuse end foremost. The motion was not apparently swift, by reason of its great height; though in reality it must have moved with great rapidity, on account of the vast space it travelled over in a short time. In other places its appearance,
FIR

Dear Sir,...

The appearance was very different. At Greenwich we are told, that "two bright balls parallel to each other led the way, the diameter of which appeared to be about two feet; and were followed by an expulsion of eight others, not elliptical, seeming gradually to mutate, for the last was small. Between each two balls a luminous serrated body extended, and at the last a blaze issued which terminated in a point. Minute particles dilated from the whole. The balls were tinted first by a pure bright light, then followed a tender yellow, mixed with azure, red, green, &c.; which, with a coalition of bolder tints, and a reflection from the other balls, gave the most beautiful rotundity and variation of colours that the human eye could be charmed with. The sudden illumination of the atmosphere, and the form and singular transition of this bright luminous, tended much to make it awful: nevertheless, the amazing vivid appearance of the different balls, and other rich connective parts not very easy to delineate, gave an effect equal to the rainbow in the full zenith of its glory."

Dr. Blagden, in a paper on this subject in the 74th volume of the Philosophical Transactions, has not only given a particular account of this and other meteors of the kind, but added several conjectures relating to the probable causes of them. The first thing which occurred to philosophers on this subject was, that the meteors in question were burning bodies rising from the surface of the earth, and flying along the atmosphere with great rapidity. But this hypothesis was soon abandoned, on considering that there was no power known by which such bodies could either be raised to a sufficient height, or projected with the velocity of the meteors. The next hypothesis was, that they do not consist of one single body, but of a train of sulphureous vapours, extending a vast way through the atmosphere, and being kindled at one end, display the luminous appearances in question by the fire running from one end of the train to the other. To this hypothesis, which was invented by Dr. Halley, Dr. Blagden objects that no just explanation is given of the nature of the vapours themselves, the manner in which they are raised up, or in which they can be regularly arranged in straight lines of such vast extent; or how they can be supposed to burn in such rarefied air. "Indeed, (says he) it is very difficult to conceive how vapours could be prevented, in those regions where there is in a manner no pressure, from spreading out on all sides in consequence of their natural elasticity, and instantly losing that degree of density which seems necessary for inflammation. Besides, it is to be expected, that such trains would sometimes take fire in the middle, and thus present the phenomenon of two meteors at the same time, receding from one another in a direct line."

For these and other reasons this hypothesis of Dr. Halley was abandoned, and another substituted in its place. This was, that the meteors we speak of are permanent solid bodies, not rising from the earth, but revolving round it in very eccentric orbits, and thus in their perigee moving with inconceivable rapidity. But the doctor shows, that, even on this supposition, the velocity of such bodies must scarce be one third of that with which fire-balls move, and which has been calculated at upwards of 1000 miles per minute. The hypothesis is likewise liable to a number of other objections which cannot be answered, particularly from the variations in their appearance: for it is impossible to show in what manner one solid and permanent body could assume the appearance of eight or ten, as was the case with the meteor of 1783: nor can it be shown why a body, which in passing over Edinburgh appeared with a disk evidently less than that of the sun, should, in passing over Greenwich, assume the appearance of two bodies, each of which had a disk considerably larger than the apparent disk of that luminary. To obviate, in some measure, objections of this kind, it has been supposed that the revolving bodies are surrounded by a kind of electrical atmosphere by which they are rendered luminous; but (says the doctor) think, who ever carefully pursues the various accounts of fire-balls, and especially ours of the 18th of August, when it divided, will perceive that their phenomena do not correspond with the idea of a solid nucleus involved in a subtile fluid, any more than with the idea of another learned gentleman, that they become luminous by means of a contained fluid, which occasionally explodes through the thick solid outer shell."

Another hypothesis, which Dr. Blagden has not mentioned, is, that the meteors in question are a kind of bodies which take fire as soon as they come within the atmosphere of the earth. But this cannot be supposed, without implying a previous knowledge of these bodies, which it is altogether impossible we can have. The only opportunity we have of seeing them is when they are on fire. Before that time they are in an invisible and unknown state; and it is surely improper to argue concerning them in this state, or pretend to determine any one of their properties, when we have not in our power to see and investigate them in the least. As the meteors therefore never manifest themselves to our senses, but when they are on fire, the only rational conclusion we can draw from thence is, that they have no existence in any other state; and consequently that their substance must be composed of that fluid which, when acting after a certain manner, becomes luminous and shows itself as fire; remaining invisible and eluding our researches in every other case. On this hypothesis we must conclude that the fire-balls are great bodies of electric matter, moving from one part of the heavens where, to our conception, it is superabundant, to another where it is deficient. This opinion is adopted by Dr. Blagden for the following reasons:

1. On account of their prodigious velocity, which is not less than 1200 miles in a minute, and seems incompatible with any other substance we know besides the electric fluid. "This (says he) is perhaps the only case in which the course or direction of that fluid is rendered perceptible to our senses, in consequence of the large scale on which the meteor moves."

2. Various electrical phenomena have been observed to attend them, such as lambent fires setting upon men, horses, &c.; and sparks coming from them, *or the whole meteor itself (adds our author), it is said, have damaged ships, houses, &c. after the manner of lightning." This last circumstance, however, we can believe only of another kind of fire-balls, of which we shall afterwards treat, which keep at a small distance from the earth, or run along its surface; for the great
meteors of which we now speak, flying at the distance of 50 or 60, or more miles from the surface of the earth, cannot be less from their apparent size than a mile and a half in diameter. Such an immense body of electric matter descending on the earth, would by its explosion ruin a large tract of country; and there is no probability that when engendered in such a rare atmosphere, it could break through the whole body of gross and dense air which lies between these regions and the earth, and which so strongly resists the passage of the electric fluid very strongly. Notwithstanding this, there is no impossibility that the atmosphere may be electrified to a great degree by such a meteor passing over it; and thus electrical appearances may attend these bodies, without any actual emission of their substance, as Dr Blagden supposes. "If there be really (says he) any hissing noise heard while the meteors are passing, it seems explicable on no other supposition than that of streams of electric matter issuing from them, and reaching the earth with a velocity equal to that of the meteor, namely, in two or three seconds. Accordingly, in one of our later meteors, the hissing was compared to that of electricity issuing from a conductor. The sparks flying off so perpetually from the body of fire-balls may possibly have some connexion with these streams. In the same manner the sound of explosions may perhaps be brought to us quicker than if they were propagated to us by the air alone. Should these ideas be well founded, the change of direction, which meteors seem at times to undergo, may possibly be attributed to the state of the surface of the earth on which they are passing, and to which the streams are supposed to reach. A similar cause may occasion the apparent explosion, the opening of new channels giving new vent and motion to the electric fluid. May not the deviation and explosion which appear to have taken place in the fire-ball of the 18th of August over Lincolnshire, have been determined by its approach towards the fens, and an attraction produced by that large body of moisture?

The explosion mentioned by our author over Lincolnshire does not seem to have been the only one which happened during the course of this meteor. Several people heard reports after it had vanished; and these were sometimes single and sometimes double. At Edinburgh two reports were heard, the one immediately following the other, at the distance of six or seven minutes after the meteor had passed. These reports no doubt indicated a temporary dissolution of the body; but it is by no means probable that the explosion could have taken place on our account of the state of the earth or atmosphere. We must consider that both earth and atmosphere are always full of electric fluid; and if there happens to be what is called a deficiency in one of them, the other instantly supplies it. It is impossible, therefore, that either the earth or atmosphere could receive such an immense additional quantity in one part without a vent being provided for it somewhere else. In thunder-storms we naturally conclude that a vast quantity of electrical matter is put in motion; but from the effects of lightning it appears that this quantity must be very trifling in comparison with what the meteor we now speak of contained. A violent flash of lightning has been known to perforate a looking-glass, and make only a hole of about an inch diameter. Now we have no reason to suppose that the flash, tremendous as it might appear to our eyes, was any other than an electric spark of an inch in diameter. The meteor, on the other hand, appears not to have been less than a mile in diameter; so that the disproportion betwixt it and a single flash of lightning appears almost beyond calculation; and we may reasonably conclude that it could not have been equalled by 10,000 thunder-storms. Had the immense body of electric fire descended through the atmosphere, and dissipated itself on the fens of Lincolnshire, it must have produced the most violent and unheard-of effects, not only in that place, but probably throughout the whole island. Its dissipation must therefore have been in the higher regions, where there was ample space to receive it; and where its explosion, whatever concusion it might make among the ethereal matter itself, could not affect our earth or atmosphere in any remarkable degree. Its re-appearance was owing to the same tendency in the fluid to circulate which had originally produced it; and which probably was the violent earthquake in Calabria, and the eruption in Iceland.

3. Another argument adduced by Dr Blagden in favour of the electrical origin of fire-balls, is their connexion with the aurora borealis, and the resemblance they bear to this phenomenon, which is now almost universally allowed to be electrical. "Instances (says he) are recorded, where northern lights have been seen to join, and form luminous balls, darting about with great velocity, and even leaving a train behind them like the common fire-balls. This train I take to be nothing else but the rarefied air left in such an electrified state as to be luminous; and some streams of the northern lights are very much like it." The aurora borealis appears to occupy as high, if not a higher region above the surface of the earth, as may be judged from the very distant countries to which it has been visible at the same time; indeed the great accumulation of electric matter seems to lie beyond the verge of our atmosphere, as estimated by the cessation of twilight. Also with the northern lights a hissing noise is said to be heard in some very cold climates: Gmelin speaks of it in the most pointed terms, as frequent and very loud in the north-eastern parts of Siberia; and other travellers have related similar facts.

4. Our author thinks that the strongest argument for the electrical origin of these meteors is the direction of their course, which is constantly either from the north or north-west quarter of the heavens, or towards it; or, as our author thinks, nearly in the direction of the meridional meridian. Such a course, however, seems only to belong to the very large fire-balls of which we now speak; the smaller ones, called Falling Stars, being moved in all directions; "perhaps (says the doctor), because they come further within the verge of our atmosphere, and are thereby exposed to the action of extraneous causes. That the smaller sort of meteors, such as shooting stars, are really lower down in the atmosphere, is rendered very probable by their swifter apparent motion: perhaps it is this very circumstance which occasions them to be smaller, the electric fluid being more divided in more resisting air. But as these masses of electric matter which move
Fire.

where there is scarce any resistance, so generally affect the direction of the magnetic meridian, the ideas which have been entertained of some analogy between these two obscure powers of nature seem not altogether without foundation. If the foregoing conjectures be just, distinct regions are allotted to the electrical phenomena of our atmosphere. Here below we have thunder and lightning, from the unequal distribution of the electric fluid among the clouds; in the loftier regions, whither the clouds never reach, we have the various gradations of falling stars; till, beyond the limits of our corporeal atmosphere, the fluid is put into motion in sufficient masses to hold a determined course, and exhibit the different appearances of what we call fire-balls; and probably at a still greater elevation above the earth, the electricity accumulates in a lighter and less condensed form, to produce the wonderfully diversified streams and coruscations of the aurora borealis.

The paper from whence these extracts are written before Mr Morgan’s account of the non-conducting power of a perfect vacuum made its appearance. The meteor in question, and others of the same nature, afford a proof of the theory of the deficiency of electric fluid proposed by some. Dr Halley, speaking of the fire-ball of 1719, the height of which he calculated at very little less than 70 miles, expresses his surprise that sound should be propagated through a medium near 300,000 times rarer than the common air, and the next thing to a perfect vacuum. Now it remains, and for ever will remain, to be proved, that Mr Morgan’s most perfect vacuum, formed by boiling quicksilver in a tube over so long, contains a medium more than 300,000 times rarer than the common atmosphere.

From Mr Cavallio’s experiments it appears, that when air is only rarefied 1000 times, the electric light is excessively weak; so that there is not the least probability that in an aerial medium 300,000 times rarer than the present, if indeed such a medium can exist, there could be any light made visible in the ordinary experiments. We see, however, by the many examples of meteors which have occurred at prodigious heights in the atmosphere, that the electric light in such a rarefied atmosphere is not only visible, but acts as vigorously in every respect as if it were on the surface of the earth. This circumstance therefore affords a complete demonstration of the fallacy of Mr Morgan’s argument, and a direct proof that the electric fluid pervades space as completely divested of air as the best artificial vacuum we can make; nay, where it is generally believed by mathematicians that the atmosphere has ceased altogether. His other arguments drawn à priori are still more inconclusive than that we have just mentioned. He tells us, that if a vacuum was a conductor, the whole quantity of electric matter contained in the earth and atmosphere would be perpetually flying off through the regions of infinite space, as being uncorrupted by a boundless conductance. But even this does not follow, though we should suppose these regions to be an absolute vacuity; for we know that electricity does not fly to a conducting substance merely because it is a conductor, but because it opens a passage to some place whether it has a tendency to go though the conductor was not there. Now, on the present hypothesis, as the conductor would lead to no place to which the electric matter had any previous tendency, we cannot assign any reason why it should acquire a tendency to fly off merely on account of the neighbourhood of a conductor, even though boundless. His other objection (that, on the supposition of a vacuum being capable of conducting electricity, the whole space in the universe would be filled with electric fluid) may be admitted in its fullest extent, without any detriment whatever to science; and indeed, if we saw the electric fluid to be only a modification of the light of the sun, we must own that the whole universe is filled with it. The meteors in question then will be no other than discharges of electricity from one part of its celestial spaces to another, similar to the discharges between the positive and negative side of an electric bottle; thus intimating, that a circulation has taken place in the fluid, which the meteor at once complete and puts an end to. See Meteorology.

Besides these already just mentioned of such magnitude, there are others much smaller and nearer the surface of the earth, rolling upon it, or falling upon it, exploding with violence, as is the case with those which appear in the time of thunder, and frequently producing mischievous effects. One of these is mentioned by some authors as falling in a serene evening in the island of Jamaica; exploding as soon as it touched the surface of the ground, and making a considerable hole in it. Another is mentioned by Dr Priestley as raining along the surface of the sea, then rising and striking the mast of a man of war, exploding, and damaging the ship. In like manner, we hear of an electric cloud at Java, in the East Indies; whence, without any thunder storm, there issued a vast number of fire-balls which did incredible mischief. This last phenomenon points out to us the true origin of balls of this kind, viz. an excessive accumulation of electricity in one part or a violent tendency to circulate, when, at the same time the place where the motion begins is at so great a distance, or meets with other obstacles of such a nature, that it cannot easily get thither. Urged on, however, by the vehement pressure from behind, it is forced to leave its place; but being equally unequal to displace the great quantity of the same fluid, which has no inclination to move the same way with itself, it is collected into balls, which run hither and thither, according as they meet with conductors capable of leading them into some part of the circle. This is even confirmed by an experiment related at the end of Dr Priestley’s fifth volume on Air. He relates, that a gentleman having charged, with a very powerful machine, a jar, which had the wire supporting the knob of a considerable length, and passed through the glass in a globe of fire was seen to issue out of it. This globe gradually ascended up the glass tube till it came to the top of the knob, where it settled, turning swiftly on its axis, and appearing like a red-hot iron ball of four quarters of an inch diameter. On continuing to turn the machine, it gradually gathered together in the jar; which if it had no sooner been done, than there issued a most violent explosion and flash, the jar being discharged and broken at the same time. This experiment, however, is singular in its kind; for neither the gentleman who performed it, nor any other, has yet been able to repeat it. Single as it is, however, we may yet gather from it, that a fire-ball will be the consequence of a
very violent electrification of any substance, provided at the same time that the air be in a very non-conducting state, so that the electricity may not evaporate into it as fast as it is collected; for this would produce only lucid streams and flashes, as in the common experiments with the Leyden phial; and it is probably an inattention to this circumstance which has hitherto prevented the repetition of the experiment above mentioned. The case is the same in thunder storms, where an excessive accumulation of electric matter always produces fire-balls, the most mischievous kind of lightning, as is explained under that article.

With regard to the uses which fire-balls serve in the system of nature, it is plain that they are the means of preserving the equilibrium in the electric fluid in the atmosphere, which would otherwise produce the most dreadful tempests. As there must be a constant current of electric matter through the clouds, as the earth from the equator to the poles, and from the poles to the equator, through the atmosphere, the great meteor serves for keeping up the equilibrium in this great atmospheric current, while the smaller ones answer a like purpose in the general mass of electric matter dispersed over the surface of the earth, and therefore are seen to move in all directions, as the equilibrium happens to require them in different parts. With regard to those which are observed in the lower regions of the earth, or on rolling on the surface of the ground itself, they undoubtedly answer purposes of a similar kind in these lower regions; for as fire-balls in general are produced by a great excess of electricity in one place, there must of course be an equal deficiency in another; and to restore the equilibrium, or, to speak more properly, to prevent a dangerous commotion from taking place throughout the whole mass of electric fluid, the fire-ball breaks forth, and either puts a stop at once to the disturbance by an explosion, or by a silent and invisible evaporation. From some accounts indeed it would seem that even the large celestial meteors detached part of their substance to accomplish this purpose; though, for the reasons already given, it would seem more probable that they operated by electrifying the atmosphere, or settling the fluid contained in it in motion, so as to produce small fire-balls of itself, rather than by detaching any part of their bodies to such a distance. Dr Blagden, in the paper above quoted, gives an account of an appearance of this kind. It was described in a letter to Sir Joseph Banks from the Abbé Mann, director of the academy at Brussels. “It happened (says the Abbé) at Mariakerke, a small village on the coast, about half a mile west of Ostend. The curate of the village was sitting in the dusk of the evening with a friend, when a sudden light surprised them, and immediately after, a small ball of light-coloured flame came through a broken pane of glass, crossed the room where they were sitting, and fixed itself on the chin of a door opposite to the window where it entered, and there died gradually away. It appeared to be a kind of phosphoric light carried along by the current of air. The curate and his friend, greatly surprised at what they saw, apprehended fire in the neighbourhood; but going out, found that the fire which had come in through the window had been detached from a large meteor in its passage.”

Fire-Cocks. Churchwardens in London and with

in the bills of mortality, are to fix fire cocks at proper
distances in streets, and keep a large engine and hand

engine for extinguishing fire, under the penalty of 10l.
stat. 6 Ann. c. 31.

On the breaking out of any fire in London or West
minster, the constables and beadles of parishes shall re
pair to the place with their staves, and assist in ex
tinguishing it, and cause the people to work for that
end, &c.

Fire-Engine. See Steam-Engine.

Fire-Flair, in Ichthyology. See RAJA, ICHTHYOLOGY Index.

Fire-Flies, a species of flies common in Guiana, of
which there are two species. The largest is more than
an inch in length, having a very large head connected
with the body by a joint of a particular structure, with
which at some times it makes a loud knock, particularly
when laid on its back. The fly has two feelers or
horns, two wings, and six legs. Under its belly is a
circular patch, which, in the dark, shines like a candle;
and on each side of the head near the eyes is a promi
nent, globular, luminous body, in size about one-third
larger than a mustard seed. Each of these bodies is like
a living star, emitting a bright, and not small, light;
since two or three of these animals, put into a glass
vessel, afford sufficient light to read without difficulty,
if placed close to the book. When the fly is dead,
these bodies will still afford considerable light, though
it is less vivid than before; and if bruised, and rubbed
over the hands or face, they become luminous in
the dark, like a board smeared over with phospho
rus. They have a reddish brown or chestnut-colour;
and live in rotten trees in the day, but are always abroad
in the night. The other kind is not more than half as
large as the former: their light proceeds from under
their wings, and is seen only when they are elevated,
like sparks of fire appearing or disappearing at every
second. Of these the air is full in the night, though
they are never seen in the day. They are common not
only in the southern but in the northern parts of Ame
rica, during the summer.

Fire-Lock, or Fusil, a small gun which fires with a
faint. It is distinguished from the old musket or match
lock, which was fired with a match. The firlock is
now in common use in the European armies.

Fire-Philosophers, or philosophi per ignem, a fanati
cal sect of philosophers who appeared towards the close
of the 15th century, and made a figure in almost all the
countries of Europe. The distinguishing tenet from
which they derived this appelliation was, that the inti
mate essences of natural things were only to be known
by the trying efforts of fire, directed in a chemical
process. They were also called Theosophists, from
their declaring against human reason as a dangerous
and deceitful guide, and representing a divine and
supernatural illumination as the only means of arriving
at truth; they were likewise denominated Paracelsists,
from the name of Paracelsus, the eminent physician and
chemist, who was the chief ornament and leader of this
extraordinary sect. It was patronized in England by
Robert Flood or Fluid, who endeavoured to illustrate
the philosophy of Paracelsus in a great number of trea
tises: in France it was zealously propagated by Riv
ier; in Denmark, by Severinus; in Germany, by
Kunrath, an eminent physician of Dresden; and in
Fire. other countries by warm and successful volaties, who assumed a striking air of piety and devotion, and proposed to themselves no other end than the advancement of the divine glory, and the restoration of peace and concord in a divided church: accordingly they were joined by several persons eminent for their piety, and distinguished by their zeal for the advancement of true religion. One of the most celebrated of these was Daniel Hoffman, professor of divinity in the university of Helmstadt, who, availing himself of some unguarded passages in the writings of Luther, extravagantly maintained, that philosophy was the mortal enemy of religion; that truth was divisible into two branches, the philosophical and theological; and that what was true in philosophy was false in theology. Hoffman was afterwards obliged, by the interposition of Henry Julius, duke of Brunswick, to retract his invectives against philosophy, and to acknowledge in the most open manner the harmony and union of sound philosophy with true and genuine theology.

Fire-Places are contrivances for communicating heat to rooms, and also for answering various purposes of art and manufacture. See Chimney, Furnace, and Stove.

The ingenious Dr Franklin, having recounted the inconveniences and advantages of fire-places in common use, proposes a new contrivance for this purpose, called the Pennsylvania fire-place.

1. This machine consists of a bottom-plate, or hearth-piece, fig. 1. Plate CCXVII. with a rising moulding before for a fender, two perforated ears E, G, for receiving two screw-rods; a long air-hole a a, through which the outward air passes into an air-box; and three smoke-holes, represented by dark squares in BC, through which the smoke descends and passes away; besides, double ledges for receiving between them the lower edges of the other plates. 2. A back-plate without holes, and furnished with a pair of ledges to receive.

3. The two side-plates, each of which has a pair of ledges, are fixed on the side edges of the front plate, with a shoulder on which it rests, and a pair of ledges to receive the side edges of the two middle plates which form the air-box, and an oblong air-hole near the top, through which the air warmed in the box is discharged into the room, and a wing or bracket as H, and a small hole as R, for the axis of the register to turn in. See fig. 2, which represents one of those plates. 4. An air-box, composed of the two middle plates DE and FG, fig. 3 and 4. The first has five thin ledges or partitions cast on it, the edges of which are received into so many pair of ledges cast in the other: the tops of all the cavities formed by these thin deep ledges are also covered by a ledge of the same form and depth cast with them; so that when the plates are put together, and the joints luted, there is no communication between the air-box and the smoke. In the winding passages of this box, fresh air is warmed as it passes into the room. 5. A front plate, which is arched on the under side, and ornamented with foliages, &c. 6. A top plate with a pair of ears, MN, (fig. 5.) answerable to those in the bottom plate, and perforated for the same purpose. It has also a pair of ledges running round the under side to receive the top edges of the front, back, and side plates. The air-box does not reach up to the top plate by 8 inches.
which the heated air of the room and smoke of tobacco, &c. may be carried off without incommoding the company. For a farther account of the manner of using this fire-place, the advantages attending it, answers to objections, and directions to the bricklayer in fixing it, the curious reader may consult Franklin's Letters and Papers on Philosophical Subjects, p. 284—318. edit. 1769.

Fire-Pots, in the military art, small earthen pots, into which is put a charged grenade, and over that powder enough till the grenade is covered; then the pot is covered with a piece of parchment, and two pieces of match across lighted; this pot being thrown by a handle of match where it is designed, it breaks and fires the powder, and burns all that is near it, and likewise fires the powder in the grenade, which ought to have no fuse, to the end its operations may be the quicker.

Fire-Reeds. See the next article, Note (c).

Fire-Ship, an old vessel filled with combustible materials, and fitted with grappling irons to hook, and set fire to, the enemies' ships at battle, &c.

As there is nothing particular in the construction of this ship, except the apparatus by which the fire is instantly conveyed from one part to another, and from thence to the enemy, it will be sufficient to describe the fire-room, where these combustibles are enclosed, together with the instruments necessary to grapple the ship intended to be destroyed.

The fire-room is built between decks, and limited on the after part by a bulk-head, $L$, behind the mainmast, from which it extends quite forward, as represented in Plate CCXVII. The train enclosed in this apartment is contained in a variety of wooden troughs, $D, G$, which intersect each other in different parts of the ship's length; being supported at proper distances by cross pieces and stanchions. On each side of the ship are six or seven ports, $H$, about 18 inches broad and 15 inches high; and having their lids to open downward, contrary to the usual method.

Against every port is placed an iron chamber (A), which, at the time of firing the ship, blows out the port-lid, and opens a passage for the flame. Immediately under the main and fore-shrouds is fixed a wooden funnel $M$; whose lower end communicates with a fire-barrel (B), by which the flame passing through the funnel is conducted to the shrouds. Between the funnels, which are likewise called fire-trunks, are two scuttles, or small holes, in the upper deck, serving also to let out the flames. Both funnels must be stopped with plugs, and have sailcloth or canvas nailed close over them, to prevent any accident happening from above to the combustibles laid below.

The ports, funnels, and scuttles, not only communicate the flames to the outside and upper works of the ship and her rigging; but likewise open a passage for the inward air, confined in the fire-room, which is thereby expanded so as to force impetuously through these outlets, and prevent the blowing up of the decks, which must of necessity happen from such a sudden and violent rarefaction of the air as will then be produced.

Or each side of the bulk-head behind is cut a hole, $L$, of sufficient size to admit a trough of the same dimensions as the others. A leading trough, $L'$, whose foremost end communicates with another trough within the fire-room, is laid close to this opening, from whence it extends obliquely to a sally-port, $I$, cut through the ship's side. The decks and troughs are well covered with melted resin. At the time of the firing

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(a) The iron chambers are 10 inches long and 3.5 in diameter. They are breached against a piece of wood fixed across the ports, and let into another a little higher. When loaded, they are almost filled with corn-powder, and have a wooden tampion well driven into their muzzles. They are primed with a small piece of quick-match thrust through their vents into the powder, with a part of it hanging out. When the ports are blown open by means of the iron chambers, the port-lids either fall downwards or are carried away by the explosion.

(b) The fire-barrels ought to be of a cylindrical form, as most suitable to contain the reeds with which they are filled, and more convenient for stowing them between the troughs in the fire-room. Their inside chambers should not be less than 21 inches, and 30 inches is sufficient for their length. The bottom parts are first well stored with short double-dipped reeds placed upright; and the remaining vacancy is filled with fire-barrel composition well mixed and melted, and then poured over them. The composition used for this purpose is a mass of sulphur, pitch, tar, and tallow.

There are five holes, of three-fourths of an inch in diameter and three inches deep, formed in the top of the composition while it is yet warm; one being in the centre, and the other four at equal distances round the sides of the barrel. When the composition is cold and hard, the barrel is primed by filling these holes with fuse composition, which is firmly driven into them, so as to leave a little vacancy at the top to admit a strand of quick-match twice doubled. The centre hole contains two strands at their whole length, and every strand must be driven home with sealed powder. The loose ends of the quick-match being then laid within the barrel, the whole is covered with a dipped curtain, fastened on with a hoop that slips over the head of the barrel, to which it is nailed.

The barrels should be made very strong, not only to support the weight of the composition before firing, when they are lowered or carried from place to place, but to keep them together whilst burning: for if the staves are too light and thin, so as to burn very soon, the remaining composition will tumble out and be dissipated, and the intention of the barrels, to carry the flame aloft, will accordingly be frustrated.

The curtain is a piece of coarse canvas, nearly a yard in breadth and length, thickened with melted composition, and covered with sawdust on both sides.
Fire. Stringing either of the leading troughs, the flame is immediately conveyed to the opposite side of the ship, whereby both sides burn together.

The spaces N. O, behind the fire-room, represent the cabins of the lieutenant and master, one of which is on the starboard, and the other on the larboard side. The captain's cabin, which is separated from these by a bulkhead, is exhibited also by P.

Four of the eight fire-barrels are placed under the four fire-trunks; and the other four between them, two on each side the fire-scuttles, where they are securely cleated to the deck. The longest reeds (c) are put into the fore and aft trough, and tied down: the shortest reeds are laid in the troughs athwart, and tied down also. The bavins (d), dipped at one end, are tied fast to the troughs over the reeds, and the curtains are nailed up to the beams, in equal quantities, on each side of the fire-room.

The remainder of the reeds are placed in a position nearly upright, at all the angles of every square in the fire-room, and there tied down. If any reeds are left, they are to be put round the fire-barrels, and other vacant places, and there tied fast.

Instructions to Prime.

Take up all your reeds, one after another, and strew a little composition at the bottom of all the troughs under the reeds, and then tie them gently down again: next strew composition upon the upper part of the reeds throughout the fire-room; and upon the said composition lay double quick-match upon all the reeds, in all the troughs: the remainder of the composition strewed over all the fire-room, and then lay your bavins loose.

Cast off all the covers of the fire-barrels, and hang the quick-match loose over their sides, and place leaders of quick-match from the reeds into the barrels, and from thence into the vent of the chambers, in such a manner as to be certain of their blowing open the pots, and setting fire to the barrels. Two troughs of communication from each door of the fire-room to the sally ports, must be laid with a strong leader of quick-match, four or five times double: also a cross-piece to go from the sally-port, when the ship is fired, to the communication trough, laid with leaders of quick-match, that the fire may be communicated in both sides at once.

What quick-match is left place so that the fire may be communicated to all parts of the room at once, especially about the ports and fire-barrels, and see that the chambers are well and fresh primed. [N.B. The port-fire used for firing the ship, burns about 12 minutes. Great care must be taken to have no powder on board when the ship is fired.]

The sheer hooks (represented by A) are fitted so as to fasten on the yard-arms of the fire-ship, where they hook the enemy's rigging. The fire-grapplings (B) are either fixed on the yard-arms, or thrown by hand, having a chain to confine the ships together, or fasten those instruments wherever necessary.

When the commanding officer of a fleet displays the signal to prepare for action, the fire-ships fix their sheer hooks, and dispose their grapplings in readiness. The battle being begun, they proceed immediately to prime, and prepare their fire-works. When they are ready for grappling, they inform the admiral thereof by a particular signal.

To avoid being disabled by the enemy's cannon during a general engagement, the fire-ships continue sufficiently distant from their line of battle, either to windward or to leeward.

They cautiously shun the openings or intervals of the line, where they would be directly exposed to the enemy's fire, from which they are covered by lying on the opposite side of their own ships. They are attentively to observe the signals of the admiral or his seconds, in order to put their designs immediately in execution.

Although no ship of the line should be previously appointed to protect any fire-ship, except a few of the smallest particularly destined to this service, yet the ship before whom she passes in order to approach the enemy, should escort her thither, and assist her with an armed boat, or whatever succour may be necessary in her situation.

The captain of the fire-ship should himself be particularly attentive that the above instructions are punctually executed, and that the yards may be so braced when he falls alongside of the ship intended to be destroyed, that the sheer-hooks and grapplings fastened to the yard-arms, &c. may effectually hook the enemy. He is expected to be the last person who quits the vessel; and being furnished with every necessary assistance and support, his reputation will greatly depend on the success of his enterprise.

Lambent Fires, as the shining of meat at certain seasons, the luminousness of the sea, of insects, vapours, &c. See Light, Chemistry Index; Fire-Flies, Entomology Index; Glow-Worm, &c.

Port-Fire. See Port-Fire.

Spur-Fire. See Spur-Fire.

Fire-Works, are preparations made of gunpowder, sulphur,

(c) The reeds are made up in small bundles of about a foot in circumference, cut even at both ends, and tied together in two places. They are distinguished into two kinds, viz. the long and short; the former of which are four feet, and the latter two feet five inches in length. One part of them are singly dipped, i.e. at one end; the rest are dipped at both ends in a kettle of melted composition. After being immersed about seven or eight inches in this preparation, and then dried, they are sprinkled over with pulverized sulphur upon a tanned hide.

(d) The bavins are made of birch, heath, or other brush-wood, which is tough and readily kindled. They are usually two or three feet in length, and have all their brush-ends lying one way, the other ends being tied together with small cords. They are dipped in composition at the bush-ends, whose branches are afterwards confined by the hand, to prevent them from breaking off by moving about; and also to make them burn more fiercely. After being dipped in the same manner as the reeds, they also are sprinkled with sulphur.
FIR

sulphur, and other inflammable and combustible ingredients, used on occasion of public rejoicings and other solemnities.

The invention of fire-works is by M. Mahudel attributed to the Florentines and people of Siena; who found out likewise the method of adding decorations to them of statues, with fire issuing from their eyes and mouths.

The art of preparing and managing these is called pyrotechny. See Pyrotechny.

FIRING, in the military art, denotes the discharge of the fire-arms; and its object is to do the utmost execution to the enemy.

The method of firing by platoons is said to have been invented by Gustavus Adolphus, and first used about the year 1618: the reason commonly given for this method is, that a constant fire may be always kept up. There are three different ways of platoon firing, viz. standing, advancing, and retreating. But previous to every kind of firing, each regiment or battalion must be told off in grand divisions, subdivisions, and platoons, exclusively of the grenadiers, which form two subdivisions or four platoons of themselves. In firing standing, either by divisions or platoons, the first fire is from the division or platoon on the right; the second fire from the left; the third from the right again; and so on alternately, till the firing comes to the centre platoon, which is generally called the colour platoon, and does not fire, remaining as a reserve for the colours. Firing advancing is performed in the same manner, with this addition, that before either division or platoon fires, it advances three paces forward. Firing retreating varies from either of the former methods; for before either division or platoon fires, if they are marching from the enemy, it must go to the right about, and after firing, to the left about again, and continue the retreat as slow and orderly as possible.

In hedge firing the men are drawn up two deep, and in that order both ranks are to fire standing. Oblique firing is either to the right and left, or from the right and left to the centre, according to the situation of the object. The Prussians have a particular contrivance for this purpose; if they are to level to the right, the rear ranks of every platoon make two quick, but small paced to the left, and the body of each soldier turns one-eighth of a circle, and vice versa. Parapet firing depends on the nature of the parapet over which the men are to fire, and also upon that of the attack made to possess it. This method of firing is sometimes performed by single ranks stepping on the banquette and firing; or one man instantly bending his arms to the centre rank of the same file, and taking his back in the room of it; and the centre rank giving it to the rear to load, and forwarding the arms of the rear to the front rank; by which means the front rank men can fire six or seven rounds in a minute with exactness. Parapet firing may also be executed two deep, when the banquette is three feet broad, or in field works where no banquettes are made. Square firing is performed by a regiment or body of men drawn up in a hollow square, in which case each front is generally divided into four divisions or firings, and the flanks of the square, being the weakest part, are covered by four platoons of grenadiers. The first fire is from the right division of each face; the second from the left division of each face, &c. and the grenadiers make the last fire. Street firing is practised in two ways; either by making the division or platoon that has fired to wheel by half-rank to the right and left outwards from the centre, and to march in that order by half divisions down the flanks on each side of the column, and to draw up in the rear, and go on with their priming and loading; or, to make the division or platoon, after firing, to face to the right and left outwards from the centre, and one half rank to fellow the other; and in that order to march in one centre file down on each side of the column into the rear, and there draw up as before.

Firing Iron, in Farriery, an instrument not unlike the blade of a knife; which being made red hot is applied to a horse's hams, or other places standing in need of it, as in preternatural swellings, farcy, knots, &c. in order to discuss them.

FIRKIN, an English measure of capacity for things liquid, being the fourth part of the barrel; it contains eight gallons of ale, soap, or herrings; and nine gallons of beer.

FIRLOT, a dry measure used in Scotland. The oat firlot contains 21.47h pints of that country; the wheat firlot contains about 2211 cubical inches; and the barley firlot, 31 standard pints. Hence it appears that the Scotch wheat firlot exceeds the English bushel by 33 cubical inches.

FIRMAMENT, in the ancient astronomy, the eighth heaven or sphere; being that wherein the fixed stars were supposed to be placed. It is called the eighth, with respect to the seven heavens or spheres of the planets which it surrounds.

It is supposed to have two motions; a diurnal motion, given it by the primum mobile, from east to west, about the poles of the ecliptic; and another opposite motion from west to east; which last it finishes, according to Tycho, in 25,412 years; according to Ptolemy, in 36,000; and according to Copernicus, in 25,800; in which time the fixed stars return to the same precise points wherein they were at the beginning. This period is commonly called Plato's year, or the great year.

In various places of Scripture the word firmament is used for the middle region of the air. Many of the ancients allowed, with the moderns, that the firmament is a fluid matter; though they, who give it the denomination of firmament, must have taken it for a solid one.

FIRMAN, is a passport or permit granted by the Great Mogul to foreign vessels, to trade within his territories of his jurisdiction.

FIRMICUS MATERNUS, JULIUS, an ecclesiastical writer, who lived about the middle of the fourth century. Nothing is known with certainty respecting his country, profession, or character, as we find no mention made of him in the writings of ancient authors. Some say that he was by birth a Sicilian, and practised in the forum as a barrister for some time, becoming a convert to Christianity when far advanced in years; which appears to derive considerable support from different passages in his writings. He was author of a treatise De errore profanarum religionum, which was dedicated to the emperors Constantius and Constans. This work must
First Fruits must have been written between 340 and 350, in which Constantine was slain by Magnentius. It is allowed to be a learned, able, and well-written performance, in which the reasonableness of the Christian religion is strongly contrasted with the absurdity and immorality of the gentile creed. It must not be dissembled, however, that he sometimes betrays such a spirit of intolerance as is wholly incompatible with the genius of the Christian religion, which breathes nothing but benevolence towards the whole human race. The arguments employed by him in its defence are disgraceful by an exhortation to the civil power to propagate it by force of arms, and to crush the advocates of error by severe edicts. This work was first published at Strasburg in 1562, at Heidelberg in 1559, and at Paris in 1610.

The greater part of critics ascribe to him a work entitled Astronomicorum, seu de Mathesi, lib. viii. In it he treats of the power and influence of the stars, agreeing to the doctrine of the Egyptians and Babylonians, blending a considerable degree of mathematical knowledge with the unmeaning jargon of judicial astrology. Those who imagine that so good a man as Firmicus could not have been the author of such an absurd performance, should remember that it was probably composed prior to his conversion, when such absurdities would constitute a part of his creed.

Firmicus, denotes the consistance of a body, or that state wherein its sensible parts cohere in such a manner, that the motion of one part induces a motion in the rest.

First Born. See Primogeniture, for the literal meaning of the term.

In Scripture it is also used often in a figurative sense for that which is first, most excellent, most distinguished in any thing. Thus it is said of Christ (Col. i. 5.), that he is "the first-born of every creature;" and in Revelation (i. 5.) he is called "The first-begotten of the dead;" that is, according to the commentators, begotten of the Father before any creature was produced; and the first who rose from the dead by his own power. "The first-born of the poor;" (Isa. xiv. 30.) signifies, The most miserable of all the poor; and in Job (xvii. 5.) "The first-born of death;" that is, The most terrible of all deaths.

First Fruits (primitiae), among the Hebrews, were oblations of part of the fruits of the harvest, offered to God as an acknowledgment of his sovereign dominion. The first of these fruits was offered in the name of the whole nation, being either two loaves of bread, or a sheaf of barley which was thrashed in the court of the temple. Every private person was obliged to bring his first fruits to the temple; and these consisted of wheat, barley, grapes, figs, apricots, olives, and dates.

There was another sort of first fruits which were paid to God. When bread was kneaded in a family, a portion of it was set apart and given to the priest or Levite who dwelt in the place; if there was no priest or Levite there, it was cast into the oven, and consumed by the fire. These offerings made a considerable part of the revenues of the Hebrew priesthood.

First Fruits are frequently mentioned in ancient Christian writers as one part of the church revenue. One of the councils of Carthage enjoins, that they should consist only of grapes and corn; which shows, that this was the practice of the African church.

First Fruits in the church of England, are the profits of every spiritual benefice for the first year, according to the valuation thereof in the king's books.

FISC, (Fiscus), in the Civil Law, the treasury of a prince or state; or that to which all things due to the public do fall. The word is derived from the Greek Φησις, "a great basket," used when they went to market. By the civil law, none but a sovereign prince has a right to have a fisc or public treasury.

At Rome, under the emperors, the term aurarium was used for the revenues destined for support of the charges of the empire; the fiscus for those of the emperor's own family. The treasury, in effect belonged to the people, and the fiscus to the prince. Hence the goods of condemned persons, if appropriated to the use of the public, were said publiores; if to the support of the emperor or prince, conficebatur.

FISCAL, in the Civil Law, something relating to the pecuniary interest of the prince or people. The officers appointed for the management of the fisc, were called procuratores fisci, and assessores fisci; and among the cases enumerated in the constitutions of the empire where it was their business to plead, one is against those who have been condemned to pay a fine to the fisc on account of their litigiousness or frivolous appeals.

FISCUS. See Fisc.

Fish, in Natural History, an animal that lives in the waters as the natural place of its abode.

Fishes form the fourth class of animals in the Linnean system. Their most general or popular division is into fresh and salt water ones. Some, however, are of opinion, that all fishes naturally inhabit the salt waters, and that they have mounted up into rivers only by accident. A few species only swim up into the rivers to deposit their spawn; but by far the greatest number keep in the sea, and would soon expire in fresh water. There are about 400 species of fishes (according to Linnaeus) of which we know something; but the unknown ones are supposed to be many more; and as they are thought to lie in great depths of the sea remote from land, it is probable that many species will remain for ever unknown.

For the subdivisions, characters, and natural history of this class of animals, see Ichthyology Index.

Blowing of Fish, is a practice similar to that of blowing flesh, poultry, and pigs, and adopted for the same deceitful purposes. The method of blowing fish, especially cod and whiting, is by placing the end of a quill or tobacco-pipe at the vent, and prickling a hole with a pin under the fin which is next the gill; thereby making the fish appear to the eye large and full, which when dressed will be flabby, and little else than skin and bones. But this imposition may be discovered by placing the finger and thumb on each side of the vent, and squeezing it hard; the wind may be perceived to go out, the skin will fall in, and the fish appear lank, and of little value.

Breeding of Fishes may be turned to great advantage; for, besides furnishing the table, obliging one's friends, and raising money, the land will be thereby greatly improved.
Feeding of Fishes. When they are fed in large pools or ponds, either malt boiled, or fresh grains, is the best food; thus carps may be raised and fed like capons, and trenches will feed as well. The case of feeding them is best committed to a gardener or the butler, who should be always on hand. When fed in a stew, any sort of grain boiled, especially peas, and malt coarsely ground, are proper food; also the grains after brewing, while fresh and sweet; but one bushel of malt not brewed will go as far as two of grains.

Stealing of Fish, by persons armed and disguised, is felony without benefit of clergy, by 5 Geo. I. cap. 12. See Black Ott. And by 3 Geo. III. cap. 14 the penalty of transportation for seven years is inflicted on persons stealing or taking fish in any water, within a park, paddock, orchard, or yard; and on the receivers, aiders, and abettors; and a forfeiture of five pounds to the owner of the fishery is made payable by persons taking or destroying (or attempting so to do) any fish in any river or other water within any enclosed ground, being private property.

Preserving of Fish for Cabinets. Linneus's method is, to expose them to the air; and when they acquire such a degree of putrefaction that the skin loses its cohesion to the body of the fish, it may be slid off almost like a glove; the two sides of this skin may then be dried upon paper like a plant, or one of the sides may be filled with plaster of Paris to give the subject a due plumpness.

A fish may be prepared, after it has acquired this degree of putrefaction, by making a longitudinal incision on the belly, and carefully dissecting the fleshy part from the skin, which is but slightly attached to it in consequence of the putrescence. The skin is then to be filled with cotton and the antiseptic powder as directed for birds; and, lastly, to be sewed up where the incision was made.

Gold Fish. See Cyprinus, Ichthyology Index. Gilding on Fish. In the posthumous papers of Mr. Hooke, a method is described of gilding live craw fish, carps, &c. without injuring the fish. The cement for this purpose is prepared, by putting some burgundy pitch into a new earthen pot, and warming the vessel till it receives so much of the pitch as will stick round it; then stirring some finely powdered amber before the pitch when growing cold, adding a mixture of three pounds of linseed oil and one of oil of turpentine, covering the vessel, and boiling them for an hour over a gentle fire, and grinding the mixture, as it is wanted, with so much pumice-stone in fine powder as will reduce it to the consistence of paint. The fish being wiped dry, the mixture is spread upon it; and the gold-leaf being then laid on, and gently pressed down, the fish may be immediately put into water again, without any danger of the gold coming off, for the matter quickly grows firm in water.

Fishes, in Heraldry, are the emblems of silence and watchfulness; and are borne either upright, impaled, extended, endorsed respecting each other, surmounting one another, fretted, &c.

In blazing fables, those borne feeding, should be deemed dervouring; all fishes borne upright and having
Fish ponds, those made for the breeding or feeding of fish.

Fish ponds are no small improvement of watery and boggy lands, many of which are fit for no other use. In making of a pond, its head should be at the lowest part of the ground, that the trench of the flood-gate or sluice, having a good fall, may not be too long in emptying. The best way of making the head secure, is to drive in two or three rows of stakes above six feet long, at above four feet distance from each other, the whole length of the pond head, whereof the first row should be rammed at least about four feet deep. If the bottom is false, the foundation may be laid with quick-lime; which slaking, will make it as hard as a stone. Some lay a layer of lime, and another of earth dug out of the pond, among the piles and stakes; and when these are well covered, drive in others as they see occasion, ramming in the earth as before, till the pond head be of the height designed.

The dam should be made sloping on each side, leaving a waste to carry off the over abundance of water in times of floods or rains; and as to the depth of the pond, the deepest part need not exceed six feet, rising gradually in shoals towards the sides, for the fish to sun themselves, and lay their spawn. Gravelly and sandy bottoms, especially the latter, are best for breeding; and a fat soil with a white fat water, as the washings of hills, commons, streets, sinks, &c. is best for fattening all sorts of fish. For storing a pond, carp is to be preferred for its goodness, quick growth, and great increase, as breeding five or six times a-year. A pond of an acre, if it be a feeding and not breeding one, will every year feed 200 carps of three years old, 300 of two years old, and 400 of a year old. Carps delight in ponds that have marl or clay bottoms, with plenty of weeds and grass, wherein they feed in the hot months.

Ponds should be drained every three or four years, and the fish sorted. In breeding ones, the smaller ones are to be taken out, to store other ponds with; leaving a good stock of females, at least eight or nine years old, as they never breed before that age. In feeding ponds, it is best to keep them nearly of a size.

Fisher, John, bishop of Rochester, was born at Beverley in Yorkshire, in the year 1459, and educated in the collegiate church of that place. In 1484, he removed to Michael house in Cambridge, of which college he was elected master in the year 1495. Having applied himself to the study of divinity, he took orders; and, becoming eminent as a divine, attracted the notice of Margaret countess of Richmond, mother of Henry VII. who made him her chaplain and confessor. In 1501, he took the degree of doctor of divinity, and the same year was elected chancellor of the university. In the year following, he was appointed Lady Margaret's first divinity professor; and in 1504, consecrated bishop of Rochester; which small bishopric he would never resign, though he was offered both Ely and Lincoln. It is generally allowed, that the foundation of the two colleges of Christ church and St John's, in Cambridge, was entirely owing to Bishop Fisher's persuasion and influence with the countess of Richmond: he not only formed the design, but superintended the execution. On the promulgation of Martin Luther's doctrine, our bishop was the first to enter the lists against him. On this occasion he exerted all his influence, and is generally supposed to have written the famous book by which Henry VIII. obtained the title of Defender of the Faith. Hitherto he was in favour with the king; but in 1527, opposing his divorce, and denying his supremacy, the implacable Harry determined, and finally effected, his destruction. In 1543, the parliament found him guilty of misprision of treason, for concealing certain prophetic speeches of a fanatical impostor, called the Holy Maid of Kent, relative to the king's death; and condemned him, with five others, in loss of goods and imprisonment during his majesty's pleasure; but he was released on paying 300l. for the king's use.

King Henry being now married to Anne Boleyn, his obsequious parliament took an oath of allegiance proper for the occasion. This oath the bishop of Rochester steadily refused; alleging, that his conscience could not be convinced that the king's first marriage was against the law of God. For refusal this oath of succession, he was attainted by the parliament of 1534; and committed to the Tower, where he was cruelly treated, and where he would probably have died a natural death, had not the pope created him a cardinal. The king, now positively determined on his destruction, sent Rich the solicitor general, under the presence of consulting the bishop on a case of conscience, but really with a design to draw him into a conversation concerning the supremacy. The honest old bishop spoke his mind without suspicion or reserve, and an indictment and conviction of high treason was the consequence. He was beheaded at Tower Hill on the 22d of June 1535, in the 77th year of his age. Thus died this good old prelate; who, notwithstanding his inflexible enmity to the Reformation, was undoubtedly a learned, pious, and honest man. He wrote several treatises against Luther, and other works, which were printed at Wurtzburg in 1597, in one volume folio. 

Fishery, a place where great numbers of fish are caught.

The principal fisheries for salmon, herrings, mackerel, pike, are along the coasts of Scotland, England, and Ireland; for cod, on the banks of Newfoundland; for whales, about Greenland; and for pears, in the East and West Indies.

Free fishery, in Law, or an exclusive right of fishing in a public river, is a royal franchise; and is considered as such in all countries where the feudal policy has prevailed: though the making such grants, and by that means appropriating, what it seems unnatural to restrain, the use of running water, was prohibited for the future, by King John's Great Charter; and the rivers that were fenced in his time were directed to be laid open, as well as the forests to be deforested. This opening was extended by the second and third charters of Henry III. to those also that were fenced under Richard I.; so that a franchise of free fishery ought now to be as old at least as the reign of Henry II. This differs from a several of piscary, because he that has a several fishery must also be the owner of the soil, which in a free fishery is not requisite. It differs also from a common fishery in that the free fishery is an exclusive right.
right, the common fishery is not so: and therefore, in a free fishery, a man has property in the fish before they are caught; in a common piscary, not till afterwards. Some indeed have considered a free fishery not as a royal franchise; but merely as a private grant of a liberty to fish in the several fishery of the grant. But the considering such right as originally a flower of the prerogative, till restrained by Magna Charta, and derived by royal grant (previous to the reign of Richard I.) as such as now claim it by prescription, may remove some difficulties in respect to this matter with which our law books are embarrassed.

FISHERY, denotes also the commerce of fish, more particularly the catching them for sale.

Were we to enter into a very minute and particular consideration of fisheries, as at present established in this kingdom, this article would swell beyond its proper bounds; because, to do justice to a subject of such concernment to the British nation, requires a very ample and distinct discussion. We shall, however, observe, that since the Divine Providence hath so eminently stored the coasts of Great Britain and Ireland with the most valuable fish; and since fisheries, if successful, become permanent nurseries for breeding expert seamen; it is not only a duty we owe to the Supreme Being, not to despise the wonderful plenty he hath afforded us, by neglecting to extend this branch of commerce to the utmost; but it is a duty we owe to our country, for its natural security, which depends upon the strength of our royal navy. No nation can have a navy where there is not a fund of business to breed and employ seamen without any expense to the public, and no trade is so well calculated for training up these useful members of society as fisheries.

The situation of the British coasts is the most advantageous in the world for catching fish: the Scottish islands, particularly those to the north and west, lie most commodiously for carrying on the fishing trade to perfection; for no country in Europe can pretend to come up to Scotland in the abundance of the finest fish, with which its various creeks, bays, rivers, lakes, and coasts, are replenished. Of these advantages the Scots seem indeed to have been abundantly sensible; and their traffic in herrings, the most valuable of all the fisheries, is noticed in history so early as the ninth century. The frequent laws which were enacted in the reigns of James III. IV. and V. discover a steady determined zeal for the benefit of the native subjects; and the full restoration of the fisheries, which the Dutch had latterly found means to engross, and do honour to the memory of those patriots whom modern times affect to call barbarians.

The expedition of James V. to the Hebrides and western parts of the Highlands, and his assiduity in exploring and sound the harbours, discovered a fixed resolution in that active prince, to civilize the inhabitants, to promote the valuable fisheries at their doors, and to introduce general industry. His death, at an early period, and the subsequent religious and civil commotions in the kingdom, frustrated those wise designs, and the western fisheries remained in their original state of neglect. At length, 1602, James VI. resumed the national purposes which had been thus chalked out by his grandfather. "Three towns. Vol. VIII. Part II."

(says Dr. Robertson) which might serve as a retreat for the industrious, and a nursery for arts and commerce, were appointed to be built in different parts of the Highlands; one in Cantire, another in Lochaber, and a third in the isle of Lewis; and in order to draw the inhabitants thither, all the privileges of the royal boroughs were to be conferred upon them. Finding it, however, to be no easy matter to inspire the inhabitants of those countries with the arts of industry, a resolution was taken to plant amongst them colonies from the more industrious counties. The first experiment was made in the isle of Lewis; and as it was advantageous for the fishing trade (a source from which Scotland ought naturally to derive great wealth), the colony transported thither was drawn out of Fife, the inhabitants of which were well skilled in that branch of commerce. But before they had remained there long enough to manifest the good effects of this institution, the islanders, enraged at seeing their country occupied by those intruders, took arms, and surprising them in the night time, murdered some of them, and compelled the rest to abandon the settlement. The king's attention being soon turned to other objects, particularly to his succession to the English crown, we hear no more of his salutary project."

The Scottish fisheries were, however, resumed by Charles I. who "ordained an association of the three kingdoms, for a general fishing within the balt seas and coasts of his majesty's said kingdoms; and for the government of the said association, ordained, that there should be a standing committee chosen and nominated by his majesty, and his successors from time to time," &c. &c. Several persons of distinction embarked in the design, which the king honoured with his patronage, and encouraged by his bounty. He also ordered Lent to be more strictly observed; prohibited the importation of fish taken by foreigners; and agreed to purchase from the company his naval stores and the fish for his fleets. Thus the scheme of establishing a fishery in the Hebrides began to assume a favourable aspect; but all the hopes of the adventurers were frustrated by the breaking out of the civil wars, and the very tragical death of their benefactor.

In 1661, Charles II. the duke of York, Lord Clarendon, and other persons of rank and fortune, resumed the business of the fisheries with greater vigour than any of their predecessors. For this purpose the most salutary laws were enacted by the parliaments of England and Scotland; in virtue of which, all materials used in, or depending upon the fisheries, were exempted from all duties and excises, or impost whatever. In England, the company were authorised to set up a lottery, and to have a voluntary collection in all parish churches; houses of entertainment, as taverns, inns, ale-houses, were to take one or more barrels of herrings, at the stated price of 30s. per barrel; and 2s. 6d. per barrel was to be paid to the stock of this company on all imported fish taken by foreigners. Some Dutch families were also invited, or permitted to settle in Stornoway. The herrings cured by the Royal English company gave general satisfaction, and, as mentioned above, brought a high price for those days. Every circumstance attending this new establishment seemed to be the result of a judicious plan and thorough knowledge of the business,
Fishery. Every encouragement was held out by go-

erment, both to the society, and to individuals who

might embark in this national business. A bounty of

50l. per ton was to be paid annually out of the cus-
moms, for 14 years, to the owners of all decked vessels or bous-

ners, from 20 to 80 tons burden, which should be built

after the commencement of the act, for the use of, and

fitted out and employed in, the said fisheries, whether

by the society or any other persons. At the same time

numerous pamphlets and newspaper essays came forth;

all pretending to elucidate the subject, and to convince

the public with what facility the herring fisheries might

be transferred from Dutch to British hands. This

proved, however, a mere arduous task than had been

foreseen by superficial speculators. The Dutch were

frugal in their expenditures and living; perfect masters

of the arts of fishing and curing; which they had carried

to the greatest height and perfection. They were in

full possession of the European markets; and their fish,

whether deserving or otherwise, had the reputation of

superior qualities to all others taken in our seas. With

such advantages, the Dutch not only maintained their

ground against this formidable company, but had also

the pleasure of seeing the capital gradually sinking,

without having procured an adequate return to the ad-

venturers; notwithstanding various aids and efforts of

government from time to time in their favour; particu-

larly in 1757, when an advance of 200l. per box was

added to the bounty.

In 1786 the public attention was again called to the

state of the British fisheries, by the suggestions of Mr

Dempster in the house of commons, and by different

publications that appeared upon the subject: in conse-

quence of which the minister suffered a committee to

be named, to inquire into this great source of national

wealth. To that committee it appeared, that the best

way of improving the fisheries was to encourage the in-

habitants living nearest to the east of them to become

fishers: And it being found that the north-western

cost of the kingdom, though abounding with fish and

with fine harbours, was utterly destitute of towns, an act

was passed for incorporating certain persons therein

named, by the style of "The British Society for exten-

sion of the fisheries and improving the sea coasts of the

country;" and to enable them to subscribe a joint

stock, and therewith to purchase lands, and build there-

on free towns, villages, and fishing stations, in the

Highlands and islands in that part of Great Britain

called Scotland, and for other purposes. The isle of

Mull, Loch Broom, the isles of Skye and of Connel, have

already been pitched upon as proper situations for

some of these towns. The progress of such an underta-

ing from its nature must be slow, but still slower when

carried on with a limited capital arising from the sub-

scriptions of a few public-spirited individuals. But it is

not to be doubted but that it will ultimately tend to

the increase of our fisheries, and to the improvement of

the Highland part of this kingdom. Its tendency is

also to lessen the emigration of a brave and industrious

race of inhabitants, too many of whom have already

removed with their families to America.

1. Anchovy Fishery. The anchovy is caught in the

months of May, June, and July, on the coasts of Can-

tonia, Provence, &c. at which season it constantly re-

pairs up the straits of Gibraltar, into the Mediterranean.
Collins says they are also found in plenty on the western coasts of England and Wales.

The fishing for them is chiefly in the night time; when a light being put on the stern of their little fishing vessels, the anchovies flock round, and are caught in the nets. But then it is asserted to have been found by experience, that anchovies taken thus by fire, are neither so good, so firm, nor so proper for keeping, as those, which are taken without fire.

When the fishery is over, they cut off the heads, take out their gall and guts, and then lay them in barrels and salt them. The common way of eating anchovies is with oil, vinegar, &c. in order to which they are first boned, and the tails, fins, &c. slipped off. Being put on the fire, they dissolve almost in any liquor. Or they are made into a sauce by mincing them with pepper, &c. Some also pickle anchovies in small delf or earthen pots, made on purpose, of two or three pounds weight, more or less, which they cover with plaster to keep them the better. Anchovies should be chosen small, fresh pickled, white on the outside and red within. They must have a round back; for those which are fat or large are often nothing but sardines. Besides these qualities, the pickle, on opening the pots or barrels, must be of a good taste, and not have lost its flavour.

2. Cod Fishery. There are two kinds of cod fish; the one green or white cod, and the other dried or curd cod; though it is all the same fish, differently prepared; the former being sometimes salted and barrelled, then taken out for use; and the latter having lain some competent time in salt, dried in the sun or smoke. We shall therefore speak of each of these apart, and first of the

Green. The chief fisheries for green cod are in the bay of Canada, on the great bank of Newfoundland, and on the island of St. Peter, and the island of Sable; to which places vessels resort from divers parts of Europe and America. They are from 300 to 500 miles from the shore, and will catch between 300 and 40,000 cod each. The most essential part of the fishery is, to have a master who knows how to cut up the cod, one who is skilled to take off the head properly, and above all a good salter, on which the preserving of them, and consequently the success of the voyage depends. The best season is from the beginning of February to the end of April; the fish, which in the winter retire to the deepest water, coming then on the banks and fattening extremely. What is caught from March to June keeps well; but those taken in July, August, and September, when it is warm on the banks, are apt to spoil soon. Every fisher takes but one at a time: the most expert will take from 350 to 400 in a day; but that is the most; the weight of the fish and the great coldness on the bank fatiguing very much. As soon as the cod is caught, the head is taken off; they are opened, gutted, and salted; and the salter stows them in the bottom of the hold, head and tail, in beds aathom or two square; laying layers of salt and fish alternately, but never mixing fish caught on different days. When they have lain thus three or four days to drain off the water, they are replaced in another part of the ship, and salted again; where they remain till the vessel is loaded. Sometimes they are cut in thick pieces, and put in barrels for the convenience of carriage.

Dry. The principal fishery for this article is, from Cape Rose to the Bay des Exports, along the coast of Placentia, in which compass there are divers commodious ports for the fish to be dried in. There, though of the same kind with the fresh cod, are much smaller, and therefore fitter to keep, as the salt penetrates more easily into them. The fishery of both is much alike; only this latter is most expensive, as it takes up more time and employs more hands, and yet scarce half so much salt is spent in this as in the other. The bait is herrings, of which great quantities are taken on the coast of Placentia. When several vessels meet and intend to fish in the same part, he whose tallest first touches ground becomes entitled to the quality and privileges of admiral: he has the choice of his station, and the refusal of all the wood on the coast at his arrival. As fast as the masters arrive, they unrig all their vessels, leaving nothing but the shrouds to maintain the mast; and in the mean time the mates provide a tent on shore, covered with branches of trees, and sails over them, with a scaffold of great trunks of pines, 12, 15, 16, and often 20 feet high, commonly from 40 to 60 feet long, and about one-third as much in breadth. While the scaffold is preparing, the crew are a-fishing; and as fast as they catch, they bring their fish ashore, and open and salt them upon moveable benches; but the main salting is performed on the scaffold. When the fish have taken salt, they wash and hang them to drain on rails; when drained, they are laid on kinds of stages, which are small pieces of wood laid across, and covered with branches of trees, having the leaves stripped off for the passage of the air. On these stages, they are disposed, a fish thick, head against tail, with the back uppermost, and are turned carefully four times every 24 hours. When they begin to dry, they are laid in heaps 10 or 12 thick, in order to retain their warmth; and every day the heaps are ended, till they become double their former bulk; then two heaps are joined together, which they turn every day as before; lastly, they are salted again, beginning with those first salted; and being laid in huge piles, they remain in that situation till they are carried on board the ships, where they are laid on the branches of trees disposed for that purpose, upon the ballast, and round the ship, with mats to prevent their contracting any moisture.

There are four sorts of commodities drawn from cod, viz. the sounds, the tongues, the roes, and the oil extracted from the liver. The first is salted at the fishery together with the fish, and put in barrels from 600 to 700 pounds. The tongues are done in like manner, and brought in barrels from 400 to 500 pounds. The roes are also salted in barrels, and serve to cast into the sea to draw fish together, and particularly pilchards. The oil comes in barrels, from 400 to 520 pounds, and is used in dressing leather. In Scotland they catch a small kind of cod on the coasts of Buchan and all along the Murray frith on both sides; as also in the friths of Forth, Clyde, &c. which is much esteemed. They salt and dry them in the sun upon rocks, and sometimes in the chimney.


4. Herring.
FIS [ 652 ]

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4. Herring Fishery. Our great stations for this fishery are off the Shetland and Western isles, and off the coast of Norfolk, in which the Dutch also share. There are two seasons for fishering herring; the first from June to the end of August; and the second in autumn, when they become very favourable for thickened fishering. The Dutch begin their herring fishing on the 24th of June, and employ a vast number of vessels therein, called busses, being between 45 and 60 tons burden each, and carrying three or four small cannon. They never stir out of port, without a convoy, unless there be enough together to make about 18 or 20 cannon among them, in which case they are allowed to go in company. Before they go out they make a verbal agreement, which has the same force as if it were in writing. The regulations of the admiralty of Holland are partly followed by the French and other nations, and partly improved and augmented with new ones; as, that no fisher shall cast his net within 100 fathoms of another boat: that while the nets are cast, a light shall be kept on the hind part of the vessel: that when a boat is by any accident obliged to leave off fishing, the light shall be cast into the sea; that when the greater part of a fleet leaves off fishing, and casts anchor, the rest shall do the same, &c.

Mr. Anderson gives to the Scots a knowledge of great antiquity in the herring fishery. He says that the Netherlanders resorted to these coasts as early as A.D. 826, to purchase salt fish of the natives; but, imposing on the strangers, they learned the art, and took up the trade, in after times, of such immense emolument to the Dutch.

Sir Walter Raleigh’s observations on that head, extracted from the same author, are extremely worthy the attention of the curious, and excite reflections on the vast strength resulting from the wisdom of well-applied industry.

In 1603, he remarks, the Dutch sold to different nations as many herrings as amounted to 1,759,000l. sterling. In the year 1615, they at once sent out 3000 busses, and employed in them 37,000 fishermen. In the year 1618, they sent out 3000 ships, with 50,000 men to take the herring, and 9000 more ships to transport and sell the fish; which by sea and land employed 150,000 men, besides those first mentioned. All this wealth was gotten on our coasts, while our attention was taken up in a distant whale fishery.

The Scottish monarchs seemed for a long time to direct all their attention to the preservation of the salmon fishery, probably because their subjects were such novices in sea affairs. At length James III. endeavoured to make his courtiers learn to fish; and having sent in letters to various parts of the kingdom, for his men to be made in each burgh; in number according to the substance of each burgh, and the least of them to be of twenty tons; and that all idle men be compelled by the sheriff in the country to go on board the same.

Numerous indeed have been the attempts made at different periods to secure this treasure to ourselves, but without success. In the late reign, a very strong effort was made, and bounties allowed for the encouragement of British adventurers: the first was of 30s. per ton to fisher, every bus of 70 tons and upwards. This bounty was afterwards raised to 50s. per ton, to be paid to such adventurers as were entitled to it by claiming it at the places of rendezvous. The busses are from 20 to 90 tons burden, but the best size is 60. A vessel of 80 tons ought to take 200 herring, or 300 barrels of herring, to clear expenses, the price of the fish to be allowed to be a guinea a barrel. A ship of this size ought to have 18 men, and three boats: one of 20 tons should have 6 men, and every five tons above require an additional hand. To every ton are 300 yards of nets; so a vessel of 60 tons carries 20,000 square yards: each net is 12 yards long, and 10 deep, and every boat takes out from 20 to 30 nets, and puts them together so as to form a long train; they are sunk at each end of the train by a stone, which weighs it down to the full extent: the top is supported by buoys, made of sheepskin, with a hollow stick at the mouth fastened tight: through this the skin is blown up, and then stopped with a peg, to prevent the escape of the air. Sometimes these buoys are placed at the top of the nets; at other times the nets are suffered to sink deeper, by the lengthening the cords fastened to them, every cord being for that purpose 10 or 12 fathoms long. But the best fisheries are generally in shallower water.

Of the Scots fishery in the Western isles, the following account is given by Mr. Pannet: The fishing is always performed in the night, unless by accident. The busses remain at anchor, and send out their boats a little before sunset: which continue out, in winter and summer, till day-light; often taking up and emptying their nets, which they do 10 or 12 times in a night, in case of good success. During winter it is a most dangerous and fatiguing employ, by reason of the greatness and frequency of the gales in these seas, and in such gales are the most successful captures: but by the Providence of heaven the fishers are seldom lost: and, what is wonderful, few are visited with illness. They go out well prepared, with a warm great coat, boots, and skin aprons, and a good provision of beef and spirits. The same good fortune attends the busses, which in the tempestuous season, and in the darkest nights, are continually shifting in these narrow seas, from harbour to harbour. Sometimes 80 barrels of herrings are taken in a night by the boats of a single vessel. It once happened in Loch Sliapann, in Skye, that a bus of 80 tons might have taken 200 barrels in one night, with 10,000 square yards of net; but the master was obliged to desist, for want of a sufficient number of hands to preserve the capture. The herrings are preserved by salting, after the entrance is taken out. This last is an operation performed by the country people, who get three-halfpence per barrel for their trouble; and sometimes, even in the winter, can gain fifteen pence a-day. This employs both women and children; but the salting is only intrusted to the crew of the busses. The fish are laid on their backs in the barrels, and layers of salt between them. The entrails are not lost, for they are boiled into an oil: 8000 fish will yield ten gallons, valued at one shilling the gallon. A vessel of 80 tons, takes out 144 barrels of salt; a drawback of 2s. 6d. is allowed for each barrel used by the foreign or Irish exportation of the fish; but there is a duty of 1s. per barrel for the home consumption, and the same
FISheries.

The mackerel is a summer fish of passage, found in large shoals, in divers parts of the ocean, not far north; but especially on the French and English coasts. The fishing is usually in the months of April, May, and June, and even July, according to the place. They enter the English channel in April, and proceed up the straits of Dover as the summer advances; so that by June they are on the coasts of Cornwall, Sussex, Normandy, Picardy, &c. where the fishery is most considerable. They are an excellent food fish; and not to be despised, when well prepared, pickled, and put up in barrels; a method of preserving them chiefly used in Cornwall.

The fish is taken two ways; either with a line or nets: the latter is the more considerable, and is usually performed in the night-time. The rules observed in the fishing for mackerel are much the same as those already mentioned in the fishery of herrings.

There are two ways of pickling them: the first is, by opening and getting them, and filling the belly with salt, crammed in as hard as possible, with a stick which done, they range them in struts or rows, at the bottom of the vessel, strewing salt between the layers. In the second way, they put them immediately into tubs full of brine, made of fresh water, and salt; and leave them to steep, till they have imbiber salt enough to make them keep; after which, they are taken out, and barrelled up, taking care to press them close down.

Mackerel are not cured or exported as merchandise, except a few by the Yarmouth and Leistoff merchants, but are generally consumed at home; especially in the city of London, and the sea-ports between Thames and Yarmouth, east, and the Land's End of Cornwall, west.

7. Oyster.
7. **Oyster Fishery**. This fishery is principally carried on at Colchester in Essex; Feversham and Milton in Kent; the Isle of Wight; the Swales of the Medway; and Tenby on the coast of Wales. From Feversham, and adjacent parts, the Dutch have sometimes loaded a hundred large boats with oysters in a year. They are also taken in great quantities near Portsmouth, and in all the creeks and rivers between Southampton and Chichester: many of which are carried by sea to London and to Colchester, to be fed in the pits about Wavenhoe and other places.

8. **Pearl Fishery**. See *Pearl*, *Conchology Index*, and *Ceylon*.

9. **Pilchard Fishery**. The chief pilchard fisheries are along the coasts of Dalmatia, on the coast of Bretagne, and along the coasts of Cornwall and Devonshire. That of Dalmatia is very plentiful: that on the coasts of Bretagne employs annually about 300 ships. Of the pilchard fishery on the coast of Cornwall the following account is given by Dr Borlase: "It employs a great number of men on the sea, training them thereby to naval affairs; employs men, women, and children, on land, in salting, pressing, washing and cleaning; in making boats, nets, ropes, casks, and all the trades depending on their construction and sale. The poor are fed with the offals of the captures, the land with the refuse of the fish and salt; the merchant finds the gains of commission and home commerce, the fishermen the gains of the fish. Ships are often freighted hither with salt, and into foreign countries with the fish, carrying off at the same time part of our tin. Of the usual produce of the great number of hogheads exported each year for ten years, from 1747 to 1756, inclusive, from the four ports of Fowey, Falmouth, Penzance, and St Ives, it appears that Fowey has exported yearly 1732 hogheads; Falmouth, 14,651 hogheads, and two thirds; Penzance and Mounts-Bay 12,149 hogheads and one-third; St Ives, 1280 hogheads: in all amounting to 29,795 hogheads. Every hoghead for ten years last past, together with the bounty allowed for each hoghead exported, and the oil made out of each hoghead, has amounted, one year with another at an average, to the price of 11. 13s. 6d.; so that the cash paid for pilchards exported has, at a medium, annually amounted to the sum of 49,532l. 10s."—The numbers that are taken at one shooting out of the nets are amazingly great. Mr Pennant says, that Dr Borlase assured him, that on the 4th of October 1767, there were at one time enclosed in St Ives Bay 7000 hogheads, each hoghead containing 35,000 fish; in all 245 millions.

The pilchards naturally follow the light, which contributes much to the facility of the fishery; the season is from June to September. On the coasts of France they make use of the roots of the cod fish as a bait; which, thrown into the sea, makes them rise from the bottom, and run into the nets. On our coasts there are persons posted ashore, who, spying by the colour of the water where the shoals are, make signs to the boats to go among them to cast their nets. When taken, they are brought on shore to a warehouse, where they are laid up in broad piles, supported with backs and sides; and as they are piled, they salt them with bay salt; in which lying to soak for 30 or 40 days, they run out a deal of blood with dirty pickle and bittern; then they wash them clean in sea water; and, when dry, barrel and press them hard down to squeeze out the oil, which issues out at a hole in the bottom of the cask.

10. **Salmon Fishery**. The chief salmon fishing in Europe are in England, Scotland, and Ireland, in the rivers and seas coasts adjoining to the river such. The most famous rivers for salmon in Scotland are the Tweed, the Clyde, the Tay, the Dee, the Dee, the Spey, the Ness, the Bewly, &c. in most of it is very common, about the height of summer, especially if the weather happens to be very hot, to catch four or five score salmon at a draught. The chief rivers in England for salmon are, the Tyne, the Trent, the Severn, and the Thames. The fishing is performed with nets, and sometimes with a kind of locks or weir made on purpose, which in certain places have in a wooden grates so disposed, in an angle, that being hulled by any force in a contrary direction to the course of the river, they may give way and open a little at a point of contact, and immediately shut again, thus the angle. The salmon, therefore, coming up into the rivers, are admitted into these grates, which open and suffer them to pass through, but shut again, and prevent their return. The salmon is also caught with spears, which they dart into him when they see in swimming near the surface of the water. It is customary likewise to catch them with a candle and bakes or wisp of straw set on fire; for the fish naturally following the light, are struck with the spear, or takes a net spread for that purpose, and lifted with a sail jerk from the bottom.

The capture of salmon in the Tweed, about the month of July (says Mr Pennant) is prodigious! In a good fishery, often a boat load, and sometimes two, are taken in a tide: some few years ago there was above 700 fish taken at one haul, but from 50 to 100 is very frequent. The cooperers in Berwick then begin to salt both salmon and grilles in pipes and other vessels, and afterwards barrel them to send abroad, having them far more than the London markets can take off their hands.

Most of the salmon taken before April, or in the setting in of the warm-weather, is sent fresh to London in baskets: unless now and then the vessel is disappointed by contrary winds of sailing immediately; in which case the fish is brought ashore again to the coopers' offices, and boiled, pickled, and salted, and sent to the London markets by the same ship, and fresh salmon put in the baskets in lieu of the stale ones. At the beginning of the season, when a ship is on the point of sailing, a fresh clean salmon will sell from a shilling to eighteenpence a pound; and most of the time that part of the trade is carried on, the prices are from to nine shillings per stone; the value rising and falling according to the plenty of fish, or the prospect of a bad or foul wind. Some fish are sent in this manner to London the latter end of September, when the weather grows cool; but then the fish are full of large roes, grow very thin balled, and are not esteemed either palatable or wholesome.

The season for fishing in the Tweed begins November 30th, but the fishermen work very little till after Christmas: it ends on Michaelmas day; yet the corporation of Berwick (who are conservators of...
There are on the river, at considerable fisheries, extending upwards about 14 miles from the mouth, where the above being of no great value, which are rented for near 1400l. per annum: the expense attending the servants wages, nets, boats, &c. amount to 500l. more: which together makes up the sum of 10,400l. Now, in consequence, the produce must defray all, and no less than 20 times that sum of fish will effect it; so that 208,000 salmon must be caught there one year with another.

Scotland possesses great numbers of fine fisheries on both sides of that kingdom. The Scotch in early times had most severe laws against the killing of this fish; for the third offence was made capital, by a law of James IV. Before that, the offender had power to redeem his life. They were thought in the time of Henry VI. a present worthy of a crowned head: for in that reign the queen of Scotland sent to the Duchess of Clarence 10 casks of salted salmon; which Henry directed to pass duty free. The salmon are cured in the same manner as at Berwick, and a great quantity is sent to London in the spring; but after that time, the adventurers begin to barrel and export them to foreign countries; but we believe that commerce is far less lucrative than it was in former times, partly owing to the great increase of the Newfoundland fishery, and partly to the general relaxation of the discipline of obstinence in the Romish church.

Ireland (particularly the north) abounds with this fish: the most considerable fishery is at Cranna, on the river Ban, about a mile and a half from Coleraine. When I made the tour of that hospitable kingdom in 1754, it was rented by a neighbouring gentleman for 620l. a-year; who assured me, that the tenant, his predecessor, gave 150l. per annum, and was a much greater gainer by the bargain, for the reasons before mentioned, and on account of the number of poachers who destroy the fish in the future month.

The mouth of this river faces the north; and is finely situated to receive the fish that roam along the coast in search of an inlet into some fresh water, as they do along that end of the kingdom which opposes itself to the northern ocean. We have seen near Ballycastle, nets placed in the sea at the foot of the promontories that jut into it, which the salmon strike into as they are wandering close to shore; and numbers are taken by that method.

In the Ban they fish with nets 18 score yards long, and are continually drawing night and day the whole season, which we think lasts about four months, two sets of 16 men each alternately relieving one another. The best drawing is when the tide is coming in: we were told, that at a single draught there were once 840 fish taken.

A few miles higher up the river is a wear where a considerable number of fish escape the nets are taken. We were lately informed, that, in the year 1760, about 320 tons were taken in the Cranna fishery.

Curing Salmon. When the salmon are taken, they open them along the back, take out the guts and gills, and cut out the greatest part of the bones, endeavouring to make the inside as smooth as possible: they then salt the fish in large tubs for the purpose, where they lie a considerable time soaking in brine; and about October they are packed close up in barrels, and sent to London, or exported up the Mediterranean. They have also in Scotland a great deal of salmon salted in the common way, which after soaking in brine a competent time, is well pressed, and then dried in smoke: this is called kipper, and is chiefly made for home consumption; and if properly cured and prepared, is reckoned very delicious.

Sturgeon: Fishery. The greatest sturgeon fishery is in the mouth of the Volga, on the Caspian sea, where the Muscovites employ a great number of hands, and catch them in a kind of enclosure, formed by huge stakes representing the letter Z repeated several times. These fisheries are open on the side next the sea, and close on the other; by which means the fish ascending in its season up the river, is embarrassed in these narrow angular retreats, and so is easily killed with a harping iron. Sturgeons, when fresh, eat deliciously; and in order to make them keep, they are salted or pickled in large pieces, and put up in casks from 30 to 50 pounds. But the great object of this fishery is the roe, of which the Muscovites are extremely fond, and of which is made the caviar, or kavi, so much esteemed by the Italians. See Caviar.

Tunny Fishery. The tunny (a species of Scomber) was a fish well known to the ancients, and made a great article of commerce: and there are still very considerable tunny fisheries on the coasts of Sicily, as well as several other parts of the Mediterranean. The nets are spread over a large space of sea by means of cables fastened to anchors, and are divided into several compartments. The entrance is always directed, according to the season, towards that part of the sea from which the fish are known to come. A man placed upon the summit of a rock high above the water, gives a signal of the fish being arrived; for he can discern from that elevation what passes under the waters infinitely better than any person nearer the surface. As soon as notice is given that the shoal of fish has penetrated as far as the inner compartment, or the chamber of death, the passage is drawn close, and the slaughter begins.

The undertakers of these fisheries pay an acknowledgment to the king, or the lord upon whose land they fix the main stay or foot of the tonnara; they make the best bargain they can; and, till success has crowned their endeavours, obtain this leave for a small consideration; but the rent is afterwards raised in proportion to their capture.

The tunny enters the Mediterranean about the vernal equinox, travelling in a triangular phalanx, so as to cut the waters with its point, and to present an extensive base for the tides and currents to set against, and impel forwards. These fish repair to the warm seas of Greece to spawn, steering their course thither along the European shores, but as they return, approach the African coast; the young fry is placed in the van of the squadron as they travel. They come back from the east in May, and abound on the coast of Sicily and Calabria about that time. In autumn they steer northward, and frequent the neighbourhood of Amalfi and Naples; but during the whole season stragglers are occasionally caught.

When
When taken in May, the usual time of their appearance in the Calabrian bays, they are full of spawn, and their flesh is then esteemed wholesome, apt to occasion headaches and vomit; the milks and roes are particularly so at that season. To prevent these bad effects, the natives fry them in oil, and afterwards salt them. The quantity of this fish consumed annually in the two Sicilies almost exceeds the bounds of calculation. From the beginning of May to the end of October it is eaten fresh, and all the rest of the year it is in use salted. The most delicate part is the muzelle. The belly salted was called tarentallum, and accounted a great delicacy by the Romans; its present name is surra. The rest of the body is cut into slices, and put into tubes.

Turbot Fishery. Turbot grows to a large size, some of them weighing from 25 to 50 pounds. They are taken chiefly off the north coast of England, and others off the Dutch coast. The large turbot (as well as several other kinds of flat fish) are taken by the hook and line, for they lie in deep water; the method of taking them in ear or staked nets being very precarious. When the fishermen go out to fish, each person is provided with three lines, which are coiled on a flat triple piece of wicker work; the hooks being baited, and placed regularly in the centre of the coil. Each line is furnished with 14 score of hooks, at the distance of six feet two inches from each other. The hooks are fastened to the lines upon sneds of twisted horse hair 27 inches in length. When fishing, there are always three men in each boat, and consequently nine of these lines are fastened together, and used in one line, extending in length near three miles, and furnished with 2720 hooks. An anchor and a buoy are fixed at the first end of the line, and one more of each at the end of each man’s line; in all four anchors, which are common perforated stones, and four buoys made of leather or cork. The line is always laid across the current. The tides of flood and ebb continue an equal time upon our coast, and, when undisturbed by winds, run each way about six hours; to so much, that the fishermen can only shoot and haul their lines at the turn of tide, and therefore the lines always remain upon the ground about six hours; during which time the maxima glutinoso of Linnaeus will frequently penetrate the fish that are on the hooks, and entirely devour them, leaving only the skin and bones. The same rapidity of tides prevents their using hand lines; and therefore two of the people commonly wrap themselves in the sail, and sleep, while the other keeps a strict look-out, for fear of being run down by ships, and to observe the weather. For storms often arise so suddenly, that it is with extreme difficulty they can sometimes escape to the shore, leaving their lines behind.

Besides the cod, the fishermen have also a five-man boat, which is 40 feet long and 15 broad, and 25 tons burden; it is so called, though navigated by six men and a boy, because one of the men is commonly hired to cook, &c. and does not share in the profits with the other five. This boat is decked at each end, but open in the middle, and has two large log sails. All our fishermen in these boats to the fishing fishery at Yarmouth, in the latter end of September, and return about the middle of November. The boats are then laid up till the beginning of Lent, at which time they go off in them to the edge of the Dogger, and other places to fish for turbot, cod, ling, skates, &c. and fishery. They always take two cables on board; and when they come upon their ground, anchor the boat, throw out the cables, and fish in the same manner as those who go from the shore in a cable; with this difference only, that here each man is provided with double the quantity of lines, and instead of waiting the return of the tide in the cable, return to their boat and bait their other lines; thus hauling one set and shooting another every turn of tide. They commonly run into harbour twice a-week to deliver their fish.

The best bait is fresh herring cut in pieces of a proper size; the five men boats are always furnished with nets for taking them. Next to herrings are the lesser lampreys. The next baits in esteem are small haddock cut in pieces, sand worms, and limpets, here called fiddlers; and when none of these can be had, they use hollock’s liver. The hooks are two inches and a half long in the shank, and near an inch wide between the shank and the point. The line is made of small cordage, and is always tanned before it is used.

Turbots are extremely delicate in their choice of baits; for if a piece of herring or haddock has been 12 hours out of the sea, and then used as bait, they will not touch it.

Whale Fishery. See Baleen, Cetology Index. Whales are chiefly caught in the north seas; the largest sort are found about Greenland or Spitzbergen. At the first discovery of this country, whales not being used to be disturbed, frequently came into the very bays, and were accordingly killed almost close to the shore; so that the blubber being cut off was immediately boiled into oil on the spot. The ships in those times took in nothing but the pure oil and the whalebone, and all the business was executed in the country; by which means a ship could bring home the product of many more whales than she can, according to the present method of conducting this trade. The fishery also was then so plentiful, that they were obliged sometimes to send more ships to fetch off the whale they had made, the quantity being more than the fishing ships could bring away. But time and change of circumstances have shifted the situation of this trade. The ships coming in such numbers from Holland, Denmark, Hamburgh, and other northern countries, all intruders upon the English, who were the first discoverers of Greenland, the whales were disturbed, and gradually, as other fish often do, forsaking the place, were not to be killed so near the shore as before: but are now found, and have been so ever since, in the openings and space among the ice, where they have deep water, and where they go sometimes a great many leagues from the shore.

The whale fishery begins in May, and continues all June and July; but whether the ships have good or bad success, they must come away, and get clear of the ice by the end of August; so that in the month of September at farthest they may be expected home; but a ship that meets with a fortunate and early fishery in May may return in June or July.

A particular account of the recent history and present state of the British fisheries will be found in the article Fishery, in the Supplement.

Fishguard, or Fisgard, a town of Pembroke-shire, situated on a steep cliff on the sea shore, 254 miles from
from London, at the influx of the river Gwaine into the sea, which here forms a spacious bay. It is governed by a mayor, a bailiff, and other officers; and here vessels may lie safely in five or six fathoms water. The inhabitants have a good trade in herrings, and annually cure, between Fair and Newport, above 1,000 barrels of them. The town sends one member to parliament.

**FISHING**, in general, the art of catching fish, whether by means of nets, of spears, or of the line and hook.

FISHING in the great, performed by the net, spear, or harpoon, for fish that go in shoals, has been explained in the preceding article. That performed by the rod, line, and hook, for solitary fish, is usually termed **ANGLING**. See that article; and for the particular manner of angling for the different kinds of fish, see their respective names, as DACE, EEL, PERCH, under **ICHTHYOLOGY**.

Here we shall give an account of the following:

1. The **Barbel**, (so called on account of the barb or beard that is under his chaps), though a coarse fish, gives considerable exercise to the angler's ingenuity. They swim together in great shoals, and are at their worst in April, at which time they spawn, but come soon in season; the places whither they chiefly resort, are such as are weedy and gravelly rising grounds, in which this fish is said to dig and root with his nose like a swine. In the summer he frequents the strongest, swiftest, currents of water, as deep bridges, weirs, &c., and is apt to settle himself among the piles, hollow places, and moss or weeds; and will remain there immoveable; but in the winter he retires into deep waters, and assists the female to make a hole in the sands to hide her spawn in, to hinder its being devoured by other fish. He is a very curious and cunning fish; for if his baits be not sweet, clean, well scoured, and kept in sweet moss, he will not bite; but well ordered and curiously kept, he will bite with great eagerness. The best bait for him is the spawn of a salmon, trout, or any other fish; and if you would have good sport with him, bait the places where you intend to fish with it a night or two before, or with large worms cut in pieces; and the earlier in the morning or the later in the evening that you fish, the better it will be. Your rod and line must be both strong and long, with a running plummet on the line; and let a little bit of lead be placed a foot or more above the hook, to keep the bullet from falling on it; so the worm will be at the bottom, where they always bite; and when the fish takes the bait, your plummet will lie and not choke him. By the bending of your rod you may know when he bites, as also with your hand you will feel him make a strong snatch; then strike, and you will rarely fail, if you play him well; but if you manage him not dexterously, he will break your line. When the time for fishing is about nine in the morning, and the most proper season is the latter end of May, June, July, and the beginning of August.

The **Bleak**, is an eager fish, caught with all kinds of worms bred on trees or plants; as also with flies, paste, sheep's blood, &c. They may be hooked for with half a score of hooks at once, if they can be all fastened on; he will also in the evening take a natural or artificial fly. If the day be warm and clear, the day is no fly so good for him as the small fly at the top of the water, which he will take at any time of the day, especially in the evening; but if the day is cold and cloudy, gentle and caddis are the best; about two feet under water. No fish yields better sport to a young angler than the bleak. It is so eager, that it will leap out of the water for a bait.

There is another way of taking bleak, which is by whipping them in a boat, or on a bank side in fresh water in a summer's evening, with a hazel top about five or six feet long and a line twice the length of the rod. But the best method is with a drabble, thus: Tie eight or ten small hooks across a line two inches above one another; the biggest hook the lowermost, (whereby you may sometimes take a better fish), and bait them with gentle, flies, or some small red worms, by which means you may take half a dozen or more at a time.

3. For the **Bream**, observe the following directions. Procure about a quart of large red worms; put them into fresh moss, well washed and dried every three or four days, feeding them with fat mould and chopped fennel, and they will be thoroughly scoured in about three weeks.

Let your lines be silk and hair, but all silk is the best; let the floats be either swan-quills or goose-quills. Let your plumb be a piece of lead in the shape of a pear, with a small ring at the little end of it; fasten the lead to the line, and the line hook to the lead, about ten or twelve inches space between lead and hook will be enough; and take care the lead be heavy enough to sink the float. Having baited your hook well with a strong worm, the worm will draw the hook up and down in the bottom, which will provoke the bream to bite the more eagerly. It will be best to fix up three or four rods or lines in this manner, and set them as will direct; and this will afford you much better sport. Find the exact depth of the water if possible, that your float may swim on its surface directly over the lead; then provide the following ground bait.

Take a peck of sweet gross-ground malt; and having boiled it a very little, strain it hard through a bag, and carry it to the water side where you have sounded; and in the place where you suppose the fish frequent, there throw in the malt by handfuls squeezed hard together, that the stream may not separate it before it comes to the bottom; and be sure to throw it in at least a yard above the place where you intend the hook shall lie, otherwise the stream will carry it down too far. Do this about nine o'clock at night, keeping some of the malt in the bag, and go to the place about three the next morning; but approach very warily, lest you should be seen by the fish; for it is certain that they have their centinels watching on the top of the water, while the rest are feeding below. Having baited your hook so that the worm may crawl up the hair, the better to allure the fish to bite, cast it in at the above place, where you find the fish to stay most, which is generally in the broadest and deepest part of the river, and so that it may rest about the midst of your bait that is on the ground. Cast in your second line so that it may rest a yard above that, and a third about a yard below it. Let your rods lie on the bank, with some stones to keep them down at the great ends; and then withdraw yourself, yet not so far but that you can have your eye upon...
upon all the boats; and when you see one bitten and carried away, do not be too hasty to run in, but give time to the fish to tire himself, and then touch him gently. When you perceive the float sink, creep to the water side, and give it as much line as you can. If it is a bream or carp, they will run to the other side; which strike gently, and hold your rod at a bent a little while; but do not pull, for then you will spoil all; but you must first tire them before they can be landed, for they are very shy. If there are any carps in the river, it is an even wager that you take one or more of them; but if there are any pike or perch, they will be sure to visit the ground bait, though they will not touch it, being drawn thither by the great resort of the small fish; and until you remove them, it is in vain to think of taking the bream or carp. In this case, bait one of your hooks with a small bleak, roach, or gudgeon, about two feet deep from your float, with a little red worm at the point of your hook; and if a pike be there, he will be sure to snap at it. This sport is good till nine o’clock in the morning; and in a gloomy day, till night; but do not frequent the place too much, lest the fish grow shy.

The Carps. A person who angles for carp must arm himself with abundance of patience, because of its extraordinary subtlety and policy; they always choose to lie in the deepest places, either of ponds or rivers, where there is but a small running stream.

Further, observe, that they will seldom bite in cold weather; and you cannot be too early or too late at the spot in hot weather; and if he bites, you need not fear his hold; for he is one of those leather-mouthed fish that have their teeth in their throat.

Neither must you forget, in angling for him, to have a strong rod and line; and since he is so very wary, it will be proper to entice him, by baiting the ground with a coarse paste.

He seldom refuses the red worm in March, the eel in June, or the grasshopper in June, April, and September.

This fish does not only delight in worms, but also in sweet paste; of which there is great variety; the best is made of honey and sugar, and ought to be thrown into the water some hours before you begin to angle; neither will small pellets thrown into the water two or three days before he worse for this purpose, especially if chicken’s guts, garbage, or blood mixed with bran and cow dung, be also thrown in.

But more particularly, as to a paste very proper for this use, you may make it in the manner following: Take a sufficient quantity of flour, and mingle it with a small, making it up with a compound of honey; then pound all together in a mortar till they are so tough as to hang upon the hook without washing off. In order to effect which the better, mingle whale wool with it; and if you keep it all the year round, add some virgin wax and clarified honey.

Again, if you fish with gentle, anoint them with honey, and put them on your hook, with a deep scarlet dipped in the like, which is a good way to deceive the fish.

Honey and crumbs of wheat bread, mixed together, make also a very good paste.

In taking a carp either in pond or river, if the angler intends to add profit to his pleasure, he must take a peck of ale-grains, and a good quantity of any blood to mix with the grains, baiting the ground with it where he intends to angle. This food will wonderfully attract the scale-fish, as carp, tench, roach, dace, and bream.

Let him angle in a morning, plumbing his ground, and angling for carp with a strong line: the bait must be either paste or a knotted red worm; and by this means he will have sport enough.

Description of proper Baits for the several sorts of Fish referred to in the annexed Table.

Fishes. 1. Stone fly, found under hollow stones at the sides of rivers, is of a brown colour, with yellow streaks on the back and belly, has large wings, and is in season from April to July. 2. Green drake, found among stones by river sides, has a yellow body striped with green, is long and slender, with wings like a butterfly, its tail turns on its back, and from May to midsummer is very good. 3. Oak fly, found in the body of an oak or ash, with its head downwards, is of a brown colour, and excellent from May to September. 4. Palmer fly or worm, found on leaves of plants, is commonly called a caterpillar, and when it comes to a fly is excellent for trout. 5. Ant fly, found in ant hills from June to September. 6. The May fly is to be found playing at the river side, especially against rain. 7. The black fly is to be found upon every hawthorn after the buds are come off.

Pastes. 1. Take the blood of sheep’s hearts, and mix it with honey and flour worked to a proper consistence. 2. Take old cheese grated, a little butter sufficient to work it, and colour it with saffron: is winter use rusty bacon instead of butter. 3. Crumbs of bread chewed or worked with honey or sugar, moistened with gum ivy water. 4. Bread chewed, and worked in the hand till stiff.

Worms. 1. The earth bob, found in sandy ground after ploughing; it is white, with a red head, and bigger than a gentle: another is found in heathy ground, with a blue head. Keep them in an earthen vessel well covered, and a sufficient quantity of the mould they harbour in. They are excellent from April to November. 2. Gentles to be had from potrid flesh: let them lie in wheats bran a few days before used. 3. Flag worms, found in the roots of flags; they are of a pale yellow colour, are longer and thinner than a gentle, and must be covered like them. 4. Cow-turd bob, or clam bait, found under a cow turd from May to Michaelmas; it is like a gentle, but larger. Keep it in its native earth like the earth bob. 5. Caddis worm, or red bait, found under loose stones in shallow rivers; they are yellow, bigger than a gentle, with a black or blue head, and are in season from April to July. Keep them in flannel bags. 6. Lob worm, found in gardens; it is very large, and has a red head; a streak down the back, and a flat broad tail. 7. Marsh worms, found in marshy ground; keep them in moss ten days before you use them: their colour is a bluish red, and are a good bait from March to Michaelmas. 8. Brandling red worms, or blood worms, found in rotten dunghills and tanners bark; they are small red worms, very good for all small fish, have sometimes a yellow tail, and are called tag-tail.
Fishing Flies, a bait used in angling for divers kinds of fish. See Fishing.

The fly is either natural or artificial.

I. Natural flies are innumerable. The more usual for this purpose are mentioned in the preceding page.

There are two ways to fish with natural flies; either on the surface of the water, or a little underneath it.

In angling for chevin, roach, or dace, move not your natural fly swiftly when you see the fish make at it; but rather let it glide freely towards him with the stream; but if it be in a still and slow water, draw the fly slowly sideways by him, which will make him eagerly pursue.

II. The artificial fly is seldom used but in blasting weather, when the waters are so troubled by the winds, that the natural fly cannot be seen, nor rest upon them. Of this artificial fly there are reckoned not less than 12 sorts, of which the following are the principal.

1. March, the dun fly; made of dun wool, and the feathers of the partridge's wing; or the body made of black wool, and the feathers of a black drake. 2. For April, the stone fly; the body made of black wool, dyed yellow under the wings and tail. 3. For the beginning of May, the ruddy fly; made of red wool, and bound about with black silk, with the feathers of a black capon hanging dangling on his sides next his tail. 4. For June, the greenish fly; the body made of black wool, with a yellow list on either side, the wings taken off the wings of a buzzard, bound with black broken hemp. 5. The moorish fly, the body made of dusky wool, and the wings of the blackish mail of a drake. 6. The tawney fly, good till the middle of June; the body made of tawney wool, the wings made contrary one against the other of the whitish mail of a white drake. 7. For July, the wap Fly; the body made of black wool, cast about with yellow silk, and the wings of a teal. 8. The pike fly; good in the middle of July; the body made with greenish wool, cast about with the feathers of a peacock's tail, and the wings made of those of the buzzard. 9. For August, the drake fly; the body made with black wool cast about with black silk; his wings of the mail of a black drake, with a black head.

The best rules for artificial fly fishing are,

1. To fish in a river somewhat disturbed with rain; or in a cloudy day, when the waters are moved by a gentle breeze; the south wind is best; and if the wind blow high, yet not so but that you may conveniently guard your tackle, the fish will rise in plain deeps; but if the wind be small, the best angling is in swift streams.

2. Keep as far from the water side as may be; fish down the stream with the sun at your back, and touch not the water with your line.

3. Ever angle in clear rivers, with a small fly and slender wings; but in muddy places, use a larger.

4. When, after rain, the water becomes brownish, use an orange fly; in a clear day, a light-colored fly; a dark fly for dark waters.

5. Let the line be twice as long as the rod, unless the river be encumbered with wood. 6. For every sort of fly, have several of the same differing in colour; to suit with the different complications of several waters and weathers.

7. Have a nimble eye, and active hand, to strike presently with the rising of the fish; or else he will be apt to spout out the hook.

8. Let the fly fall first into the water, and not the line, which will scare the fish.

9. In slow rivers, or still places, cast the fly across the river, and let it sink a little in the water, and draw it gently back with the current.

Salmon flies should be made with their wings standing one behind the other, whether two or four. This fish delights in the gaudiest colours that can be; chiefly in the wings, which must be long, as well as the tail.

Fishing by means of birds, a method peculiar to the Chinese, who train certain birds for the purpose in the same manner as falcons are taught to pursue game. For this purpose they have trained a species of pheasant, resembling the common corvornat, which they call the Lew-tac, or fishing bird. Sir George Staunton, who, when the embassy was proceeding on the southern branch of the great canal, saw those birds employed, tells us, that on a large lake, close to the east side of the canal, are thousands of small boats and rafts, built entirely for this species of fishery. On each boat or raft are ten or a dozen birds, which, at a signal from the owner, plunge into the water; and it is astonishing to see the enormous size of fish with which they return, grasped within their bills. They appeared to be so well trained, that it did not require either ring or cord about their throats to prevent them from swallowing any portion of their prey, except what their master was pleased to return to them for encouragement and food.

The boat used by these fishermen is of a remarkable light make, and is often carried to the lake, together with the fishing birds, by the men who are there to be supported by it.

The same author saw the fishermen busy on the great lake Wiu-chang-he; and he gives the following account of a very singular method practised by them for catching the fish of the lake without the aid of birds, of net, or of hooks. To the one side of a boat a flat board, painted white, is fixed, at an angle of about 45 degrees, the edge inclining towards the water. On moonlight nights the boat is so placed that the painted board is turned to the moon, from whence the rays of light striking on the whitened surface, give to it the appearance of moving water; on which the fish being tempted to leap on their element, the boatsmen raising with a string the board, turn the fish into the boat.

Water-fowl are much sought after by the Chinese, and are taken upon the same lake by the following ingenious device. Empty jars or gourds are suffered to float about upon the water, that such objects may become familiar to the birds. The fisherman then wades into the lake with one of these empty vessels upon his head, and walks gently towards a bird; and lifting up his arm, draws it down below the surface of the water without any disturbance or giving alarm to the rest, several of whom he treats in the same manner, until he fills the bag he had brought to hold his prey. The contrivance itself is not so singular, as it is that the exactness should have occurred in the new continent, as Ulton asserts, to the natives of Carthagena, upon the lake Cienega de Tesias.

Fishing Floats, are little appendages to the line, serving
An Epitome of the whole art of Fishing, wherein is shown, (at one view), the harbours, seasons, and depths, for catching all sorts of fish usually angled for, also the various baits for each, so digested as to contain the essence of all the treatises ever written on the subject, exempt from the superfluities, which tend more to perplex than instruct.

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<td>Still deep mud bottom, pond or</td>
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<td>Gudgeon</td>
<td>Gravel shoals</td>
<td>May to Oct.</td>
<td>All the year</td>
<td>Touch ground</td>
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<td>Pike</td>
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<td>Perch</td>
<td>River in stream</td>
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<td>Three inches from bottom</td>
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<td>Pond deepest part</td>
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<td>Pêche</td>
<td>Deep holes in rivers</td>
<td>May to Oct.</td>
<td>All day</td>
<td>Six inches from bottom</td>
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<td>Roach</td>
<td>Deep holes in rivers</td>
<td>May to Oct.</td>
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<td>Salmon</td>
<td>Deep rivers</td>
<td>Mar. to Sept.</td>
<td>3 to 9, 3 to 6</td>
<td>Mid way to the bottom</td>
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<td>Smelts</td>
<td>Ships sterns and docks</td>
<td>Mar. to Sept.</td>
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<td>Mid way to the bottom</td>
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<td>Trout</td>
<td>Parling stream and eddies of</td>
<td>Mar. to Mich.</td>
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<td>Cold weather, 6 inches to 9</td>
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<td>Mud bottom, river or pond</td>
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<td>Umbre or</td>
<td>Clay bottom, swift stream</td>
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FISTULA, in the ancient music, an instrument of the wind kind, resembling our flute or flageolet.

The principal wind instruments of the ancients, were the tibia and the fistula. But how they were constituted, wherein they differed, or how they were played upon, does not appear. All we know is, that the fistula was at first made of reeds, and afterwards of other matters. Some had holes, some none; some again were single pipes; others a combination of several; witness the syringa of Pan.

FISTULA, in Surgery, a deep, narrow, and callous ulcer, generally arising from abscesses.

It differs from sinus, in its being callous, the latter not.

See SURGERY Index.

FISTULA, in Farriery. — See FARRIER INDEX.

FISTULARIA, or TOBACCO-PIPE FISH; a genus of fishes, belonging to the order of abdominales. See ECHTHYLOGY INDEX.

FIT. — See PAROUSIA.

Dr. Obeyes is of opinion, that sins of all kinds, whether epileptic, hysteric, or apoplectic, may be cured solely by milk diet, of about two quarts of cows milk a day, without any other medicine.

FITCHES, in Husbandry, a sort of pulse, more generally known by the name of chick-pea. See Cicer, BOTANY AND AGRICULTURE INDEX.

Fitches are cultivated either for feeding cattle, or improving the land. They make a wholesome and nourishing food, whether given in the straw or threshed out. When sown only to improve the soil, they are ploughed in as they begin to blossom, by which means a tough stiff clay soil is much enriched.

FITCHET, a name used in some places for the weasel, called also the fowmaster. See MUSKET, MAMMALIA INDEX.

FITCHY, in Heraldry, (from the French fisht), i.e., fixed; a term applied to a cross when the lower branch ends in a sharp point: and the reason of it Mackenzie supposes to be, that the primitive Christians were wont to carry crosses with them wherever they went; and when they stopped on their journey at any place, they fixed those portable crosses in the ground for devotion’s sake.

FITZ, makes part of the surname of some of the natural sons of the kings of England, as Fitzroy; which is purely French, and signifies the “king’s son.”

FITZHERBERT, Sir Anthony, a very learned lawyer in the reign of King Henry VIII. was descended from an ancient family, and born at Norbury in Derbyshire. He was made one of the judges of the court of common pleas in 1523; and distinguished himself by many valuable works, as well as by such an honourable discharge of the duties of his office, as made him esteemed an oracle of the law. His writings are, The Grand Abridgement; The Office and Authority of Justices of Peace; the Office of Sheriffs, Bailiffs of Liberties, Escheators, Constables, Coroners, &c. Of the Diversity of Courts; The New Natural Brivium; Of the Surveying of Lands, and The Book of Husbandry. He died in 1538.

FITZ-STEPHEN, William, a learned monk of Canterbury, of Norman extraction, but born of respectable parents in the city of London. He lived in the 12th century; and being attached to the service of Archbishop Becket, was present at the time of his murder.
In the year 1174, he wrote in Latin, *The Life of St Thomas, archbishop and martyr*; in which, as Becket was a native of the metropolis, he introduces a description of the city of London, with a miscellaneous detail of the manners and usages of the citizens: this is deservedly considered as a great curiosity, being the earliest professed account of London extant. Fitz-Stephen died in 1191.

**FIVES, or VIVES. See FARRIERY.**

**FIXATION, in Chemistry, the rendering any volatile substance fixed, so as not to fly off upon being exposed to a great heat: hence,**

**FIXED BODIES, are those which bear a considerable degree of heat without evaporating, or losing any of their weight. Some of the most fixed bodies are diamonds, gold, &c.**

**Fixed or Fixable Air, an invisible and permanently elastic fluid, superior in gravity to common atmospheric air and most other aerial fluids, exceedingly destructive to animal life; produced in great quantities, naturally from combustible bodies, and artificially by many chemical processes. From its acid properties it has obtained the name of aceral acid, cretaceous acid, and carbonic acid; from its noxious qualities, it has been called nefitic air, or nefitic gas; and, from the circumstance of being produced in vast quantities during the combustion of charcoal, it first obtained from Van Helmont the name of gas sylvestre. The term fixed air has been given from its property of readily losing its elasticity, and fixing itself in many bodies, particularly those of the calcareous kind; and though some objected to the propriety of the term, the fluid in question is so well known by the name of fixed air, that we choose still to retain it. See CHEMISTRY INDEX.**

**For an account of the apparatus for impregnating water with fixed air or carbonic acid, see MATERIAL MEDICA INDEX.**

**Fixed Stars, are such as constantly retain the same position and distance with respect to each other; by which they are distinguished from erratic and wandering stars, which are continually shifting their situation and distance. The fixed stars are properly called stars; the rest have the peculiar denomination of planet and comet. See ASTRONOMY INDEX.**

**FIXITY, or Fixedness, in Chemistry, is in a peculiar manner used for the affection opposite to volatility; i.e. the property whereby bodies bear the action of the fire, without being dissipated in fumes.**

**FIXLMULLNER, PLACIDUS, an eminent astronomer, was born at Achleiten near Linz, in Austria, on the 28th of May, 1720. He received the rudiments of his education in the monastery of Kremsmunster, of which his uncle Alexander was abbot. Here he studied during six years, and delighted so much in drawing straight and curve-line figures, that his mother called him the almanack-maker. He went afterward to Salzburg, where he studied a regular course of philosophy, and particularly turned his attention to mathematics under a professor Stuard, whose method of teaching that science was truly extraordinary, as he never made use of any figures, and yet conveyed such a clear idea of every proposition as made it perfectly easy. He was admitted as a novice into the Kremsmunster in 1737, and the next year he took the solemn vow in presence of his uncle. After being two years in this monastery, during which time he devoted every leisure hour to the study of mathematics and philosophy, he went to Salzburg to finish his studies in divinity and jurisprudence, acquiring at that time a competent knowledge of oriental and modern languages, history and antiquities. In the year 1745, he obtained the degree of D.D. after which he received priest's orders in his own monastery, and was created professor of ecclesiastical law, which office he held for 40 years, discharging the duties belonging to it till within a few days of his death. He was also chosen dean of the higher schools, and regent of the young nobility, which he retained during life. He wrote a commentary on the *Jus Canonum*, notwithstanding his extensive epistolary correspondence, and the management of the whole business of the monastery; but this work was never published. He was, by the intreaties of his friends, induced to publish his *Rerum publicarum origines divinas*, seu *Ecclesie Christi exteriori fundamentum, imperium, et hierarchia, ex primigeniis aetate et demonstrata*. His commendable diligence procured him universal esteem, but it was his knowledge of astronomy which rendered him illustrious. His uncle Alexander fitted up an apartment for containing the instruments necessary for the dissemination of mathematical knowledge, and he also erected as observatory, which was begun in 1748, and completed in 1758, under the direction of Anselm Dering of Emsdorf, a celebrated architect. While the observatory was building, Fixlmullner led a life of retirement, and severe study, his favourite subject during these ten years being astronomy. When it was finished, one Dobler, a celebrated mathematician, was appointed first astronomer; but the successors of Fixlmullner's uncle having discovered his extensive mathematical knowledge, made him an offer of the astronomical department, and the sole direction of the observatory. This place he accepted in the year 1762, still retaining his chair as professor of ecclesiastical law. He was not yet master of the learning which practical astronomy requires, to remedy which defect he attentively perused Lalande's *Exposition du Calcul Astronomique*, soon after which he obtained the large astronomical work of the same great man; and, in 1766 he published his *Meridiana speculac Astronomicae Cremonensi*, by which he acquired considerable reputation. Ten years after this period he gave the world his *Decennium Astronomicum*, containing many curious and important particulars respecting the theory and practice of astronomy, his *Acta Astronomica Cremonensis*, which did not appear till after his decease, still further increased his astronomical reputation; and he was a large contributor to many periodical publications in different countries. He made and collected a number of observations of the planet Mercury, which were at that period both scarce and difficult, the importance of which was publicly acknowledged by Lalande, as they greatly assisted him in constructing his tables of that planet. Fixlmullner was one of the first astronomers who calculated the orbit of the new planet Uranus (Georgium Sidus), and his tables respecting it may be seen in the Berlin almanack for 1789. He also proved the truth of what was formerly conjectured, that the 34th star of Taurus, which Flamsteed observed in 1690, was the new planet. It may be said of most philosophers, that they observe a great
FLA [ 663 ] FLA

The conduct of Fixmuller was exactly the reverse. He turned his attention to the observation of the solar spots more than any of his predecessors, which he noticed in the years 1767, 1775, 1777, 1778, and 1782, from which he deduced important inferences respecting the revolution of the sun on his axis.

He had a genius uncommonly adapted to the study of mechanics, by which he was enabled to invent a new micrometer, and a machine for grinding concentric circles. As an additional proof of his profound inventive genius, he resided in the country, by which means he was in a great measure deprived of literary assistance, yet to the very close of life he was a singular instance of the most indefatigable zeal, diligence, and perseverance. He was little subject to the influence of the turbulent passions;—perhaps less so than most other men. Like the laws of nature, which it was his chief delight to study, he was simple, uniform, and constant; and such were the mildness and integrity of his character, that he could not fail to acquire the love and esteem of mankind. His high reputation never inspired him with vanity, and he rather wished to conceal than to propagate what was written in his praise. It gave general joy to his monastic brethren to celebrate the anniversary of the fiftieth year of his residence in it, which he did not long survive. His health was very much impaired by his intense application, and he finished his career on the 28th of August 1792, in the 71st year of his age.

FLACCUS, CAIUS VALERIUS, an ancient Latin poet, of whom we have very imperfect accounts remaining. He wrote a poem on the Argonautic expedition; of which, however, he did not live to finish the eighth book, dying at about 50 years of age. John Baptisto Pius, an Italian poet, completed the eighth book of the Argonauts; and added two more from the fourth of Apollonius; which supplement was first added to Aldus's edition in 1523.

FLAGS, in the army, are small banners of distinction stuck in the baggage wagons to distinguish the baggage of one brigade from another; and of one battalion from another; that they may be marshalled by the waggon-master general according to the rank of their brigades, to avoid the confusion that might otherwise arise.

FLAG, in the marine, a certain banner or standard, by which an admiral is distinguished at sea from the inferior ships of his squadron; also the colours by which one nation is distinguished from another. See Plate CCXVIII.

In the British navy, flags are either red, white, or blue; and are displayed from the top of the main-mast, fore-mast, or mizen-mast, according to the rank of the admiral. When a flag is displayed from the flag-staff on the main-mast, the officer distinguished thereby is known to be an admiral; when from the foremast, a vice-admiral; and when from the mizen-mast, a rear-admiral.

The first flag in Great Britain is the royal standard, which is only to be hoisted when the king or queen are on board the vessel: the second is that of the anchor of hope, which characterizes the lord high admiral, or lords commissioners of the admiralty: and the third is the union flag, in which the crosses of St George and St Andrew are blended. This last is appropriated to the admiral of the fleet, who is the first military officer under the lord high admiral.

The next flag after the union is that of the white squadron at the main-mast head; and the last, which characterizes an admiral, is the blue, at the same mast head.

For a vice-admiral, the first flag is the red, the second the white, the third the blue, at the flag staff on the fore-mast.

The same order proceeds with regard to the rear-admirals, whose flags are hoisted on the top of the mizen-mast: the lowest flag in our navy is accordingly the blue on the mizen-mast.

To lower or strike the flag, is in the marine, to pull it down upon the cap, or to take it in, out of the respect, or submission, due from all ships or fleets inferior to those any way justly their superiors. To lower or strike the flag in an engagement is a sign of yielding.

The way of leading a ship in triumph is to tie the flags to the shrouds, or the gallery, in the deck part of the ship, and let them hang down towards the water, and to tow the vessels by the stern. Livy relates, that this was the way the Romans used those of Carthage.

To heave out the flag, is to put out or put abroad the flag.

To hang out the white flag, is to ask quarter; or it shows when a vessel is arrived on a coast, that it has no hostile intention, but comes to trade or the like. The red flag is a sign of defiance and battle.

FLAG is also used for a sedge, a kind of rush.

Corn-Flag. See GLADIOLUS, BOTANY INDEX.

Sweet-scented Flag. See ACORUS, BOTANY INDEX.

Flag-Officers, those who command the several squadrons of a fleet; such are the admirals, vice-admirals, and rear-admirals.

The flag officers in our navy, are the admiral, vice-admiral, and rear-admiral, of the white, red, and blue. See ADMIRAL, FLAG, and FLEET.

Flag-Ship, a ship commanded by a general or flag-officer, who has a right to carry a flag, in contradistinction to the secondary vessels under the command thereof.

Flag-Stone, a kind of sand-stone of a slaty structure, on account of which it is much employed for the purpose of paving foot-paths or the floors-of apartments in which wood is unsuitable.

FLAGELLANTES, a set of wild fanatics who chastised and disciplined themselves with whips in public.

The sect of the Flagellantes had its rise in Italy in the year 1260; its author was one Rainier a hermit; and it was propagated from hence through almost all the countries of Europe. It was in all probability no more than the effect of an indiscreet zeal. A great number of persons of all ages and sexes made processions, walking two by two with their shoulders bare, which they whipped till the blood ran down, in order to obtain mercy from God, and appease his indignation against the wickedness of the age. They were then called the devout; and having established a superior, he was called the general of the devotion. Though the primitive Flagellantes were exemplary in point of morals,
Flagellant, yet they were joined by a turbulent rabble who were infected with the most ridiculous and impious opinions; so that the emperors and pontiffs thought proper to put an end to this religious frenzy, by declaring all devout whipping contrary to the divine law, and prejudicial to the soul's eternal rest.

This sect revived in Germany towards the middle of the next century, and rambling through many provinces, occasioned great disturbances. They held among other things, that flagellation was of equal virtue with baptism and the other sacraments; that the forgiveness of all sins was to be obtained by it from God without the merits of Jesus Christ; that the old law of Christ was soon to be abolished, and that a new law enjoining the baptism of blood to be administered by whipping was to be substituted in its place; upon which Clement VII. by an injudicious as well as unrighteous policy, thundered out anathemas against the Flagellantes, who were burnt by the inquisitors in several places; but they were not easily extirpated. They appeared again in Thuringia and Lower Saxony in the 15th century, and rejected not only the sacraments, but every branch of external worship, and placed their only hopes of salvation in faith and flagellation, to which they added other strange doctrines concerning evil spirits. Their leader Conrad Schmidt and many others were committed to the flames by German inquisitors in and after the year 1474.

FLAGOELET, or FLAGEOLET, a little flute, used chiefly by shepherds and country people. It is made of box or other hard wood, and sometimes of ivory; and has six holes besides that at the bottom, the mouth-piece, and that behind the neck. FLAIL, an instrument for thrashing corn. It consists of the following parts: 1. The hand-staff, or piece held in the thrasher's hand. 2. The swingle, or that part which strikes out the corn. 3. The caplins, or strong double leathers, made fast to the tops of the hand-staff and swingle. 4. The middle band, being the leather thong or fish skin that ties the caplins together.

FLAIR, in sea language. The seamen say that the work doth flair over, when a ship is housed in near the water, so that the work hangs over a little too much, and this is let out broader aloft than the due proportion will allow.

FLAKE, in the cod fishery, a sort of scaffold or platform, made of hurdles, and supported by stanchions, used for drying cod fish in Newfoundland. These flakes are usually placed near the shores of fishing harbours.

FLAKE, in Gardening, a name given by the florists to a sort of carnations which are of two colours only, and have very large stripes, all of them going quite through the leaves.

White FLAKE, in Painting, is lead corroded by means of the pressing of grapes, or a cerasse prepared by the acid of grapes. It is brought from Italy, and far surpasses, both with regard to the purity of its whiteness and the certainty of its standing, all the cerasse or white lead made with us in common. It is used in oil or varnish painting for all purposes where a very clean white is required. The white flake should be procured in lumps as it is brought over and levigated by those who use it; because that which the colourmen sell in a prepared state is levigated and mixed up with starch, and often with white lead, and worse sophistications.

FLAMBEAU, or ELAMBOY, a luminary made of several thick wicks, covered over with wax, serving to burn at nights in the streets; as also at funeral processions, illuminations, &c.

Flambeaux differ from lamps, torches, and tapers. They are made square, sometimes of white wax and sometimes of yellow. They usually consist of four wicks or branches near an inch thick, and about three feet long, made of a sort of coarse hempen yarn half twisted. They are made with the ladle much as torches or tapers are; viz., by first pouring the melted wax on the top of the several suspended wicks, and letting it run down to the bottom. This they repeat twice. After each wick has thus got its proper cover of wax, then lay them to dry; then roll them on a table, and so join four of them together by means of a red hot iron. When joined, they pour on more wax till the flambeau is brought to the size required, which is usually from a pound and a half to three pounds. The last thing is to finish their form or outside, which they do with a kind of polishing instrument of wood by running it along all the angles formed by the union of the branches.

The flambeaux of the ancients were different from ours. They were made of woods dried in furnaces or otherwise. They used divers kinds of wood for this purpose; the wood most usually was pine. Pliny says, that in his time they frequently also burnt oak, elm, and hazel. In the seventh book of the Æneid, mention is made of a flambeau of pine; and Servius on that passage remarks, that they also made them of the cornel-tree.

FLAMBOROUGH HEAD, in Geography, a cape or promontory on the eastern coast of Yorkshire, five miles east of Burlington, and 215 from London.—E. Long. 20°. N. Lat. 54°. 15'.—This was the Flamburg of the Saxons; so called, as some think, from the lights made on it to direct the landing of Jus, who in 547 joined his countrymen in these parts with a large reinforcement from Germany, and founded the kingdom of Northumberland. In the time of Edward the Confessor, Flamborough was one of the mansions of Harold, earl of the West Saxons, afterwards king of England. On his death, the Conqueror gave it to Hugh Lupus; who, in perpetual alms, bestowed it on the monastery of Whitby.—The town is on the north side, and consists of about 150 small houses, entirely inhabited by fishermen; few of whom, as is said, die in their beds, but meet their fate in the element they are so conversant in. The cliffs of the Head are of a tremendous height and amazing grandeur. Beneath are several vast caverns; some closed at the end, others pervious, formed with a natural arch. In some places the rocks are inscribed, and of a pyramidal figure, soaring up to a vast height. The bases of most are solid, but in some pierced through and arched. The colour of all these rocks is white, from the dung of the innumerable flocks of migratory birds, which quite cover the face of them, filling every little projection, every hole that will give them leave to rest.

FLAME, is a general name for every kind of luminous vapour, provided the light it emits hath any considerable degree of intensity. The name flame, however,
ever, is most generally applied to such as are of a conical figure, like those arising from our common fires; without this they are commonly called luminous vapours, or simple lights.

According to Sir Isaac Newton, flame is only red-hot smoke, or the vapour of any substance raised from it by fire, and heated to such a degree as to emit light copiously. This definition seems to be the most accurate and expressive of any. It is certain, that bodies are capable of emitting flame only in proportion to the quantity of vapour that rises from them. Thus wood, coals, &c. which emit a great quantity of vapour, flame violently; while lead, tin, &c. which emit but a small flame, can scarce be perceived to flame at all.

This rule, however, is by no means to be depended upon in all cases. Some vapours seem to be in their own nature unflammable, and capable of extinguishing flame; as those of water, the mineral acids, sal-ammoniac, arsenic &c. whilst others take fire on the slightest approach of a flaming substance; such as ether, spirit of wine, &c. These last-mentioned substances also exhibit a remarkable phenomenon; namely, that they cannot be made to flame without the approach of some substance actually in flames beforehand. Thus, spirit of wine poured on a red-hot iron, though instantaneously dissipated in vapour, will not flame; but if a burning candle touches its surface, the whole is set in a flame at once. The case is otherwise with oils, especially those of the grosser kind; for the vapours will readily be changed into flame by the mere increase of heat, without the approach of any flaming substance.

There is, however, no kind of vapour, perhaps, that is incapable of being converted into flame, provided it is exposed to a sufficient degree of heat. Thus the vapour of water made to pass through burning coals produces an exceedingly strong and bright flame. It is remarkable, that this kind of vapour seems to be more powerful than almost any other in absorbing heat, and detaining it in a latent state. When any quantity of aequous vapour is condensed, more heat will be separated from it than would have been sufficient to heat an equal bulk of iron red hot. It is most probably to this property which all vapours have of absorbing heat, and detaining it in a latent state, that we are to attribute the phenomena of flame, and also the exceeding great elasticity of steam. It is certain, that vapours, of water at least, have a much greater power of absorbing and retaining heat, than the water from which they are raised. In open vessels, water cannot be heated more than to 212 degrees of Fahrenheit's thermometer; but in Papin's digester, where the vapour is forcibly confined, it has been heated to 400 of the same degrees; and, no doubt, might have been heated a great deal more, had the vessels been strong enough to bear the expansile force of the steam. On opening the vessels, however, the excess of heat was found to have resided entirely in the vapour; for the water in the vessel very soon sunk down to 212, while the steam issued forth with great violence.

From these experiments it appears, that the steam of water, after it has absorbed as much heat in the latent state as it can contain, continues to absorb or detain, among its particles, an unlimited quantity of sensible heat; and if the steam could be confined till this quantity became great enough to be visible by emission of light, there cannot be the least doubt that the vapour would then be converted into flame.

In what manner the heat is detained among the particles of steam, is perhaps impossible to be explained; but to this heat we must undoubtedly ascribe the violent expansive force of steam of every kind. It seems probable, that when smoke is converted into flame, the latent heat with which the vapour had combined, or rather that which made an essential part of it, breaks forth, and adds to the quantity of sensible heat which is already present. This seems probable, from the sudden explosion with which all flames break out. If a vessel full of oil is set over the fire, a smoke or vapour begins to arise from it; which grows gradually thicker and thicker; and at last begins to shine in some places very near the surface of the oil, like an electric light, or sulphur just kindled. At this time the oil is very hot, as well as the steam which issues from it. But this last is continually giving off its sensible heat into the atmosphere; so that at the distance of an inch or two from the surface of the oil, the heat of the steam will not exceed 400 degrees of Fahrenheit, or perhaps may not be so much; but if a burning candle is held in the steam for a moment, the whole is immediately converted into flame, with something like an explosion; after which the oil burns quietly until it is all consumed. The flame, as soon as it appears, is not only much hotter than the steam from whence it was produced, but even than the oil which lies below it. Whence, then, has this sudden and great increase of heat arisen? It could not be the sensible heat of the vapour, for that was greatly inferior; nor could it be communicated from the oil, for that could communicate no more than it had to itself. The candle, indeed, would communicate a quantity of heat to the vapour which touched its flame; but it is impossible that this quantity should extend permanently over a surface perhaps 100 times larger than the flame of the candle, in such a manner as to make every part of that surface equally hot with the flame of the candle itself; for this would be to suppose it to communicate 100 times more heat than really was in it. The heat therefore must have originally resided in the vapour itself; and as, in the freezing of water, its latent heat is extracted and becomes sensible, and the water thereupon loses its fluidity; so, in the ascension of vapour, the latent heat breaks forth with a bright flash, and the vapour is then totally decomposed, and converted into steam, ashes, or water, according to the different nature of the substances which produce it, or according to the intensity of the heat. Several other hypotheses have been invented to solve the phenomena of burning and flaming bodies; for an account of which, see IGNITION and HEAT, CHEMISTRY INDEX.

Flames are of different colours, according to the substances from which they are produced. Thus, the flame of sulphur and spirit of wine is blue; the flame of nitre and zinc, of a bright white; that of copper, of a greenish blue, &c. — These varieties afford an opportunity of making a number of agreeable representations in fireworks, which could not be done if the flame produced from every different substance was of the same colour. See PYROTECHNICS.

FLAMEN, in Roman antiquity, the name of an order.
FLAMINIANIUS, or FLAMINIO, Mark Antony, one of the best Latin poets in the 16th century, of Italy, son and grandson of very learned men. The pope had chosen him secretary to the council in 1545; but he refused that employment, because, favouring the new opinions, he would not employ his pen in an assembly where he knew those opinions were to be condemned. He paraphrased 36 of the psalms in Latin verse, and also wrote notes on the Psalms; and some letters and poems which are esteemed. He died at Rome in 1550.

FLAMSTED, a town of Hertfordshire in England, five miles from St. Albans and Dunstable, stands on the river Ver, and was of old called Verlamstede. The land in the vicinity is a clay so thickly mixed with flints, that, after a shower, nothing appears but a heap of stones; and yet it bears good corn even in dry summers. This fertility is impeded to a warmth in the flat, which preserves it from cold in the winter; and to its closeness, which keeps it from the searching rays of the sun in the summer. Edward VI, when an infant, was brought hither for his health; and, it is said, the bedstead he lay on, which is curiously wrought, is still preserved in the manor house near the town.

FLAMSTEED, John, an eminent English astronomer, and the first who obtained the appointment of astronomer-royal, was born at Derby in the year 1646. He was educated at the free school of Derby, where he was head scholar at 14 years of age, at which period his constitution, naturally tender and delicate, was much tried by a severe illness. When some of his companions went to the university, the state of his health prevented him from accompanying them. He afterwards met with a book De Sphera, written by John Saccobosco, which was perfectly suited to the natural turn of his genius, and therefore he pursued it with uncommon satisfaction, translating as much of it into English as he thought could be necessary for him; and from the Astronomia Carolina of Strit he learned the method of calculating eclipses, and ascertaining the places of the planets. Mr Hatton, a mathematician, sent him Kepler's Teésis Rudiohina, and Riccioli's Almagestum Novum, together with some other astronomical works to which he was as yet a stranger. In 1669 he calculated an eclipse of the sun, which had been omitted in the Ephemerides for the following year, together with five appulses of the moon to fixed stars, and sent them to Lord Brusnecer, president of the Royal Society, who submitted them to the examination of that learned body, by which they were greatly applauded, and he received a letter of thanks from Mr Oldenburg the secretary. He likewise received a letter of thanks from Mr Collins, one of the members. In 1670 he was invited to come up to London by his father, that he might become personally acquainted with his learned correspondents, of which he gladly accepted, and had an interview with Mr Oldenburg and Mr Collins, by the latter of whom he was introduced to Sir Jonas Moore, who became the warm friend and patron of Mr Flamsteed. In consequence of this journey he became acquainted with many astronomical instruments, and was presented by Sir Jonas Moore with Twynley's micrometer, who also assisted him in procuring glasses at a moderate rate for the construction of telescopes. On his way home again he returned by Cambridge, where he paid a visit to the celebrated Dr
In the year 1672, he made large extracts from the letters of Cascoigne and Crabtree, by which his knowledge of dioptrics was very much improved; and during the same year he made a number of celestial observations when the weather would permit, which were afterwards published in the Philosophical Transactions. In 1673 he composed a treatise on the true and apparent diameters of the planets, when at their greatest and least distance from the earth, which even the great Newton did not scruple to borrow, and made some use of it in his Principia in 1687. He published an Ephemeris in 1674, in which he exposed the folly and absurdity of astrology, and the same year he drew up a table of the tides for the use of the king, with an astronomical account of their ebbing and flowing, which Sir Jonas Moore assured him would be well received by his majesty. Sir Jonas received from Mr. Flamsteed a pair of barometers, with directions how to use them, which he presented to the king and the duke of York, to whose notice he embraced every opportunity of introducing Mr. Flamsteed.

Having taken the degree of M. A. at Cambridge, he formed the resolution of entering into holy orders, when Sir Jonas wrote to him to come to London, where he had an appointment for him very different from that of the church. But as he found that nothing could make him abandon the resolution he had formed, he obtained a situation for him which was perfectly consistent with the character of a clergyman. This was the new office of astronomer to the king, with a salary of 100l. per annum. He received ordination at Ely-house by Bishop Gunning, in Easter 1675; and on the 10th of August in the same year the foundation stone of the royal observatory at Greenwich was laid, which received the designation of Flamsteed house, in honour of the first astronomer royal. Till this edifice was erected, he made his observations in the queen’s house at Greenwich, and in 1681 his Doctrine of the Sphæra was published by Sir Jonas Moore in his System of the Mathematics. Notwithstanding his extraordinary merit, he never rose higher in the church than to the living of Burslaw in Surrey, although he was deservedly esteemed by the greatest men in the nation. He corresponded with the great Newton, Dr. Halley, Mr. W. Molyneux, Dr. Wallis, and many others; and M. Cassini and he imparted their discoveries to each other with the utmost confidence and cordiality. But none of his works contributed so much to render his name immortal as his “Historia Coelestis Britannica,” in three volumes.

Mr. Flamsteed was suddenly carried off by a strangury on the 31st of December 1719; and notwithstanding the extreme delicacy of his constitution and incessant labours, he reached the 73rd year of his age.

FLANDERS, a province of the Netherlands, bounded by the German sea and the United Provinces on the north, by the province of Brabant on the east, by Hainault and Artois on the south, and by another part of Artois and the German sea on the west; being about 60 miles long and 50 broad.

Flanders is a perfectly champaign country, with not a rising ground or hill in it, and watered with many fine rivers and canals. Its chief commodities are fine lace, linen, and tapestry.

In this country some important arts were invented and improved. Weaving in general was greatly improved, and that of figures of all sorts in linen was invented; also the art of dyeing cloths and stuffs, and of oil colours, the curing of herrings, &c. The manufactures of this country are now not in the flourishing state they were formerly; yet silk, cotton, and woollen stuffs, &c. are still manufactured here in great quantities. This province had counts of its own from the ninth century to the year 1369, when it went by marriage to the dukes of Burgundy; and afterwards from them, by marriage also, to the house of Austria, France, in 1667, seized the southern part; and the States General obtained the northern. It was overrun by the French in 1794, but was united to the new kingdom of the Netherlands in 1814.

For a more particular history of Flanders, see the article NETHERLANDS.

FLANNEL, or FLANNEL, a kind of slight, loose, woollen stuff, composed of a wool and warp, and wove on a loom with two treddles, after the manner of baize.

Dr. Black assigns as a reason why flannel and other substances of the kind keep the body warm, that they compose a rare and spongy mass, the fibres of which touch each other so lightly, that the heat moves slowly through the interstices, which being filled only with air, and that in a stagnant state, give little assistance in conducting the heat. From the experiments of Count Rumford, it appears, that there is no relation between the power which the substances usually worn as clothing have of absorbing moisture, and that of keeping the body warm. Having provided a quantity of each of these substances mentioned below, he exposed them, spread out upon clean china plates, for the space of 24 hours to the warm and dry air of a room which had been heated by a German stove for several months, and during the last six hours had raised the thermometer to 85° of Fahrenheit; after which he weighed equal quantities of the different substances with a very accurate balance. They were then spread upon a china plate, and removed into a very large uninhabited room upon the second floor, where they were exposed 48 hours upon a table placed in the middle of the room, the air of which was at 45° of Fahrenheit. At the end of this space they were weighed, and then removed into a damp cellar, and placed on a table in the middle of the vault, where the air was at the temperature of 45°, and which by the hygrometer seemed to be fully saturated with moisture. In this situation they were suffered to remain three days and three nights; the vault being all the time hung round with wet linen cloths, to render the air as completely damp as possible. At the end of three days they were weighed, and the weights at the different times were found as in the following table.
FLATUS, Flatulence, in Medicine; vapours generated in the stomach and intestines, chiefly occasioned by a weakness of these parts. They occasion distress, uneasy sensation, and sickness, and often a considerable degree of pain. See Medicine Index.

FLAVEL, John, an eminent non-conformist minister, was educated at University-college, in Oxford; and became minister first of Deptford, and afterwards of Dartmouth in Devonshire, where he resided the greatest part of his life, much respected and admired for his preaching; although he was persecuted on account of his principles, when in 1685, several of the aldermen of the town, attended by the rabble, carried about a ridiculous effigy of him, to which they affixed the Bill of Exclusion and the Covenant. Upon this occasion, he thought it prudent to withdraw from the town; not knowing what treatment he might meet with from a riotous mob, headed by magistrates who were themselves among the lowest of mankind. Part of his Diary, printed with his Remains, must give the reader a good idea of his piety. He died in 1691, aged 61; and after his death, his works, which consists of many pieces of practical divinity, were printed in two volumes folio.

Among these, the most famous are his “Navigation Spiritualiz'd, or a New Compass for seamen, consisting of 32 points of pleasant observations and serious reflections,” of which there have been several editions in 8vo; and his “Hubandry Spiritualiz'd, &c. with occasional meditations upon beasts, birds, trees, flowers, rivers and several other objects,” of which there have been many editions in 8vo.

FLAX, in Botany. See LINUM, Botany Index. The following particulars with regard to the manner of raising flax, have been some years past warmly recommended by the trustees for fisheries, manufactories, and improvements in Scotland.

Of the choice of the Soil, and preparing the ground for FLAX. A skilful flax-reisher always prefers a free open deep loam; and all grounds that produced the preceding year a good crop of turnip, cabbage, potatoes, barley, or broad clover, or have been formerly laid down rich, and kept for some years in pasture.

A clay soil, the second or third crop after being limed, will answer well for flax; provided, if the ground be still stiff, that it be brought to a proper mould, by tilling after harvest to expose it to the winter frosts.

All new grounds produce a strong crop of flax, and pretty free of weeds. When a great many mole hens appear upon new ground, it answers the better for flax, after one tilling.

Flax seed ought never to be sown on grounds that are either too wet or dry; but on such as retain a natural moisture; and such grounds as are inclined to weeds ought to be avoided, unless prepared by a careful summer fallow.

If the linseed be sown early, and the flax not allowed to stand for seed, a crop of turnip may be got after the flax that very year; the second year a crop of bearn or barley may be taken; and the third year, grass seeds are sometimes sown along with the linseed. This is the method mostly practised in and about the counties of Lincoln and Somerset, where great quantities of flax and hemp are every year raised, and where these crops have long been capital articles. There, old ploughed grounds are never sown with linseed, unless the soil be very rich and clean. A certain worm, called in Scotland the coup worm, abounds in grounds newly broken up, and greatly hurts every crop but flax. In enclosures surrounded with trees or high hedges, the flax, for want of free air, is subject to fall before it be ripe; and the droppings of rain and dew from the trees prevent the flax, within the reach of the trees, from growing to any perfection.

Of preceding crops, potatoes and hemp are the best preparation for flax. In the fields of Lincoln, upon proper ground of old tillage, they sow hemp, dunging well the first year; the second year, hemp without dung; the third year, flax without dung; and that same year, a crop of turnip eaten on the ground by sheep; the fourth year, hemp with a large coat of dung; and so on for ever.

If the ground be free and open, it should be but once ploughed; and that as shallow as possible, not deeper than 2 ½ inches. It should be laid flat, reduced to a fine garden mould by much harrowing, and all stones and sods should be carried off.

Except a little pigeons dung for cold or sour ground, no other dung should be used preparatory for flax; because it produces too many weeds, and throws up the flax thin and poor upon the stalk.

Before sowing, the bulky clods should be broken, or carried off the ground; and stones, quickenings, and every other thing that may hinder the growth of the flax should be removed.

Of the choice of Linseed. The brighter in colour, and heavier the seed is, so much the better; that which when bruised appears of a light or yellowish green, and fresh in the heart, oily and not dry, and smells and tastes sweet, and not fusty, may be depended upon.

Dutch seed of the preceding year’s growth, for the most part, answers best; but it seldom succeeds if kept another year. It ripens sooner than any other foreign seed. Philadelphia seed produces fine lint and few bolls, because sown thick, and answers best in wet cold soils. Riga seed produces coarser lint, and the greatest quantity of seed. Scots seed, when well winnowed and kept, and changed from one kind of soil to another, sometimes answers pretty well; but should be sown thick, as many of its grains are bad, and fail. It springs well, and its flax is sooner ripe than any other; but its produce afterwards is generally inferior to that from foreign seed.

A kind has been lately imported called Mossseal seed; which looks well, is short and plump, but seldom grows above eight inches, and on that account ought not to be sown.

Of sowing Linseed. The quantity of linseed sown should be proportioned to the condition of the soil; for if the ground be in good heart, and the seed sown thick, the crop will be in danger of falling before it is ready for pulling. From 11 to 12 pecks Linithgow measure of Dutch or Riga seed, is generally sufficient for one Scots acre; and about 10 pecks of Philadelphia seed, which, being the smallest grained, goes farthest. Riga linseed, and the next year’s produce of it, is preferred in Lincolnshire.

The time for sowing linseed is from the middle of March to the end of April, as the ground and season answer.
Late sow lintseed may grow long, but the flax upon the stalk will be thin and poor. After sowing, the ground ought to be harrowed till the soil is well covered, and then, supposing the soil, as before mentioned, to be free and reduced to a fine mould, it ought to be rolled. When a farmer sows a large quantity of lintseed, he may find it proper to sow a part earlier and part later, that in the future operations of weeding, pulling, watering, and grassing, the work may be the easier and more conveniently gone about. It ought always to be sown on a dry bed. Of Weeding Flax. It ought to be weeded when the crop is about four inches long. If longer deferred, the weeder will so much break and crock the stalks, that they will never perhaps recover their straightness again; and when the flax grows crooked, it is more liable to be hurt in the rippling and swinging. Quicken grass should not be taken up; for, being strongly rooted, the pulling of it always loosens a deal of the lint. If there is an appearance of a settled drought, it is better to defer the weeding, than by that operation to expose the tender roots of the flax to the drought. How soon the weeds are got out, they ought to be carried off the field, instead of being laid in the furrows, where they often take root again, and at any rate obstruct the growth of the flax in the furrows. Of Pulling Flax. When the crop grows so short and branchy, as to appear more valuable for seed than flax, it ought not to be pulled before it be thoroughly ripe; but if it grows long and not branchy, the seed should be disregarded, and all the attention given to the flax. In the last case it ought to be pulled after the bloom has fallen, when the stalk begins to turn yellow, and before the leaves fall, and the bolts turn hard and abscessed. When the stalk is small, and carries few bolts, the flax is fine: but the stalk of coarse flax is gross, rank, branchy, and carries many bolts. When the flax has fallen, and lies, such as lies ought to be immediately pulled, whether it has grown enough or not, as otherwise it will rot altogether. When parts of the same field grow unequally, so that some parts are ready for pulling before other parts; only what is ready should be pulled, and the rest should be suffered to stand till ready. The flax-raise ought to be at pains to pull and keep by itself, each different kind of lint which he finds in his field; what is both long and fine, by itself; what is both long and coarse, by itself; what is both short and fine, by itself; what is both short and coarse, by itself; and in like manner every other kind by itself that is of the same size and quality. If the different kinds be not thus kept separate, the flax must be much damaged in the watering and the other succeeding operations. What is commonly called under-growth may be neglected as useless. Few persons that have seen pulled flax, are ignorant of the method of laying it in handfuls across each other; which gives the flax sufficient air, and keeps the handfuls separate and ready for the rippler. Of Stacking up Flax during the Winter, and Winning the Seed. If the flax be more valuable than the seed, it ought by no means to be stacked up; for its own natural juice assists it greatly in the watering; whereas, if kept long unwatered, it loses that juice, and the harle adheres so much to the boon, that it requires longer time to water, and even the quality of the flax becomes thereby harsher and coarser. Besides, the flax stacked up over year, is in great danger from vermin and other accidents; the water in spring is not so soft and warm as in harvest; and near a year is thereby lost of the use of the lint: but if the flax be so short and branchy as to appear most valuable for seed, it ought, after pulling, to be stooked and dried upon the field, as is done with corn; then stacked up for winter, rippled in spring; and after sheeding, the seed should be well cleaned from bad seeds, &c.

Of Ripping Flax. After pulling, if the flax is to be regarded more than the seed, it should be allowed to lie some hours upon the ground to dry a little, and so gain some firmness, to prevent the skin or harle, which is the flax, from rubbing off in the ripping; an operation which ought by no means to be neglected, as the bolts, if put into the water along with the flax, breed vermin there, and otherwise spoil the water. The bolts also prove very inconvenient in the grassing and breaking.

In Lincolnshire and Ireland, they think that rippling hurts the flax; and therefore, in place of ripping, they strike the bolts against a stone. The handfuls for rippling should not be great, as that endangers the lint in the rippling comb. After rippling, the flax-raiser will perceive, that he is able to assort each size and quality of the flax by itself more exactly than he could before.

Of Watering Flax. A running stream wastes the lint, makes it white, and frequently carries it away. Ledges, by the great quantity and motion of the water, also waste and whiten the flax, though not so much as running streams. Both rivers and lakes water the flax quicker than canals.

But all flax ought to be watered in canals, which should be dugged in clay ground if possible, so that sail retains the water best: but if a firm retentive soil cannot be got, the bottom or sides of the canal, or both the bottom and sides, may be lined with clay; or instead of lining the sides with clay, which might fall down, a ditch may be dug without the canal, and filled with clay, which will prevent both extraneous water from entering, and the water within from running off.

A canal of 40 feet long, sixty broad, and four deep, will generally water the growth of an acre of flax.

It ought to be filled with fresh soft water from a river or brook, if possible, two or three weeks before the flax is put in, and exposed all that time to the heat of the sun. The greater way the river or brook has run, the softer, and therefore the better, will the water be. Springs, or short runs from hills, are too cold, unless the water is allowed to stand long in the canal.

Water from coal or iron is very bad for flax. A little of the powder of galls thrown into a glass of water, will
Of Grassing Flax. Short heath is the best field for
grassing flax; as, when wet, it fastens to the heath,
and is thereby prevented from being blown away by
the wind. The heath also keeps it a little above the
earth, and so exposes it the more equally to the
weather. When such heath is not to be got, links or
clear old less ground is the next best. Long grass
grounds should be avoided, as the grass growing
through the lint frequently spoils, tends to, or rots it,
and grounds exposed to violent winds should also be
avoided.

The flax, when taken out of the water, must be
spread very thin upon the ground; and, being then
very tender, must be gently handled. The thinner
it is spread the better, as it is then the more equally
exposed to the weather. But it ought never to
be spread during a heavy shower, as that would wash
and waste the harle too much, which is then excessively
tender, but soon after becomes firm enough to bear the
rains, which, with the open air and sunshine, clean,
sifts, and purifies the harle to the degree wanted,
and makes it blister from the boom. In short, after the
flax has got a little firmness by being a few hours
spread in dry weather, the more rain and sunshine it
gets the better.

If there be little danger of heavy winds carrying off
the flax, it will be much the better of being turned
about once a week. If it is not to be turned, it ought
to be very thin spread. The spreading of flax and
hemp requires a deal of ground, and enriches it
greatly.

The skilful flax-rather spreads his first row of flax
at the end of the field opposite to the point from
whence the most violent wind commonly comes, pla-
cing the root-ends foremost; he makes the root-ends
of every other row overlap the crop ends of the former
row three or four inches, and binds down the last row
with a rope; by which means the wind does not easily
get below the lint to blow it away; and as the crop
ends are seldom so fully watered as the root-ends,
the aforesaid overlapping has an effect like giving the crop
ends more watering. Experience only can fully teach
a person the signs of flax being sufficiently grasped: then
it is of a clearer colour than formerly; the harle is blis-
tered up, and easily parts with the boom, which is then
become very brittle. The whole should be sufficiently
grasped before any of it is lifted for if a part be lifted
sooner than the rest, that which remains is in great
danger from the winds.

A dry day ought to be chosen for taking up the
flax; and if there is no appearance of high wind, it
should be loosened from the heath or grass, and left loose
for some hours, to make it thoroughly dry.

As a great quantity of flax cannot be equally
watered and grasped, and as the different qualities
will best appear at lifting the flax off the grass; there-
fore at that time each different kind should be gathered
together, and kept by itself; that is, all of the same col-
our, length, and quality.

The smaller the beets lint is made up in, the better
for drying; and the more convenient for stacking, hous-
ing, &c., and in making up these beets, as in every
other operation upon flax, it is of great consequence
that the lint be laid together as it grew, the root ends
together, and the crop ends together.
Flax

Follows an estimate of the Expence, Produce, and Profit of a Scots Acre of Flax—supposing the season favourable, that no accidental losses happen, and that the farmer is neither unskilful nor negligent.

<table>
<thead>
<tr>
<th>Ground rent, labouring the ground, and leading the flax</th>
<th>A medium crop</th>
<th>A great crop</th>
<th>An extra crop</th>
</tr>
</thead>
<tbody>
<tr>
<td>Linseed from 2l. to 4l. per hoghead, the medium 3s. 4d. per peck</td>
<td>L. 2 10 0</td>
<td>L. 3 10 0</td>
<td>L. 5 0 0</td>
</tr>
<tr>
<td>Clodding and sowing</td>
<td>x 16 8 for 11 pecks</td>
<td>x 10 0 for 9 pecks</td>
<td>x 6 8 for 8 pecks</td>
</tr>
<tr>
<td>Weeding</td>
<td>o 2 0</td>
<td>o 2 0</td>
<td>o 2 0</td>
</tr>
<tr>
<td>Pulling, rippling, putting in, and covering in the water</td>
<td>o 12 0</td>
<td>o 8 0</td>
<td>nothing</td>
</tr>
<tr>
<td>Taking out of the water, grassing, and stacking</td>
<td>o 14 0</td>
<td>o 15 0</td>
<td>1 0 0</td>
</tr>
<tr>
<td>Breaking and scutching, at 2s. per stone</td>
<td>o 8 0</td>
<td>o 12 0</td>
<td>o 18 0</td>
</tr>
<tr>
<td>Total expence</td>
<td>3 0 0</td>
<td>4 0 0</td>
<td>6 0 0</td>
</tr>
<tr>
<td>for 30 stones.</td>
<td>for 40 stones.</td>
<td>for 60 stones.</td>
<td></td>
</tr>
<tr>
<td>Produce at 10s. per stone</td>
<td>L. 9 2 8</td>
<td>L. 10 17 0</td>
<td>L. 14 6 8</td>
</tr>
<tr>
<td>Linseed sold for oil at 1s. per peck</td>
<td>L. 15 0 0</td>
<td>L. 20 0 0</td>
<td>L. 30 0 0</td>
</tr>
<tr>
<td>The chaff of the hollis is well worth the expence of drying the seed; as it is good food, when boiled and mixed with bear, for horses.</td>
<td>0 16 0</td>
<td>0 18 0</td>
<td>1 0 0</td>
</tr>
<tr>
<td>Total produce</td>
<td>L. 15 16 0</td>
<td>L. 20 18 0</td>
<td>L. 31 0 0</td>
</tr>
<tr>
<td>Balance for profit</td>
<td>L. 6 14 4</td>
<td>L. 10 1 0</td>
<td>L. 16 13 4</td>
</tr>
</tbody>
</table>

The above estimate being made several years ago, the expence and profit are now different; but the proportions of each are probably the same. There is nothing stated here as expence of the canal in which the flax is watered; because that varies much according to circumstances.

It is a certain fact, that the greater the crop is, the better is the quality of the same kind of flax.

The advantage of having both a crop of flax and a crop of turnips the same year—or of sowing grass seeds along with the linseed—and of reducing the ground to a fine garden mould, free of weeds, ought to be attended to.

For Cambric and fine Lawn. The ground must be a rich light soil, rather sandy, but cannot be too rich.

It ought to be ploughed in September, or the beginning of October, first putting a little hot rotten dung upon it. In January it ought to have a second ploughing, after a hard frost; and when you intend to sow it, plough it a third time, or rather hoe it, reducing the clods very fine; but make no furrows: the land must be made level like a garden; but never work the land when wet.

The seed should be sown the beginning of April, and about double the quantity that is generally sown by our farmers; if the land be very rich, it will require rather more than double.

As soon as sown (if the weather be dry) it will be necessary to roll the ground.

The lint must be weeded very clean when about three inches high; directly after which you must set forked sticks, of about one and a half inch thick (which ought to be prepared before), every four or five feet, according to the length of the poles you are to lay upon them; they should be well fixed in the ground, the forked part to receive the poles about six or seven inches above the lint; each row of poles should be two, three, or four feet asunder, according to the length of the brushwood you are to lay upon them.

The poles ought to be from 10 to 15 feet long, and strong enough to support the brush across the poles; take the longest brushwood you can get; the more branchly the better, very thick, filling up the vacancies with smaller brush, and any of the branches that rise higher than 18 or 20 inches ought to be lopped off to make the brush lie as level as possible: any sort of brush will do except oak, as that tinges the lint.

Your lint must be pulled as soon as the seed is fully formed, which is a few days after it is out of the bloom, before the lint turn yellow.

It must be pulled above the brushwood, and every handful laid upon it as soon as possible: if it is fine weather, leave it four or five hours in that manner: then carry it to a screen near a barn, to put it under a cover in case of rain; there it must be spread four or five days, and always put in the barn at night, or when it appears to rain: the bundles must be opened in the barn, or made hollow, to prevent it from heating.

These operations must be performed until the lint is perfectly dry, and out of danger of heating; taking care all the time to keep the roots as even as possible, and if possible keep it from rain or wet: if you cannot prevent it from being wet, it will be better to leave it on the grass till dry; because when once wet, the putting it under cover before dry will make it turn black; a thing which must be prevented at all events.

If any of the lint upon the border, or through the piece of ground, be coarser than another, it must be separated from the rest.
The utmost care must be taken to preserve the lint entire or unbroken; for this reason they beat off the seed with a round mull or bittle.

The most proper ground is summer fallow, or after potatoes or lea; if possible near a wood, to prevent the expense of carrying brush.

As soon as the seed is off, if you intend to water it that season, it must be tied in bundles about as large as you can grasp with your two hands.

The water proper for it, is a very small rivulet or soft spring free of any mineral matter; taking care that no flood or foul water enters your pit; which must be at least five feet deep, about nine or ten broad at the top, and seven or eight at the bottom; the length will depend on the quantity of flax you have to water.

A very small stripe of water, when clear, should always be running in and off from your pit when the lint is in it.

The pit ought to be made three or four months before it be used.

You must drive poles about four inches thick, with a hook inclining downwards, in this form γ, all along the sides of the pit; above five feetounder. The books must be level with, or rather under, the surface of the water. A long pole, the whole length of the pit, must be fixed into these books on each side; and cross poles put under that, to keep the lint under water; but the cross poles are not used till the lint is put in. You must order it so, that all the lint should be three or four inches under water. You next bring your lint to the sides of the pit; then put your sheaves head to head, causing each to overlap the other about one-third, and take as many of these as make a bundle of two or two and a half feet broad, layering the one above the other; till it is about four or four and a half feet high; then you tie them together in the middle, and at each root end: after this you wrap your bundle in straw, and lay it in the water, putting the thin or broad side undermost, taking care that none of your lint touches the earth; after it is fully pressed under water, put your cross poles to keep it under. The bundles ought to lie in the pit a foot separate from each other. This renders it easy to take out; for, if the bundles entangle, they will be too heavy to raise.

The time of watering depends so much upon the weather, and softness or hardness of the water, that it is impossible to fix any certain time. This must be left to the skill of the farmer. If the flax be intended for spinning yarn soft and fit for cambric, it ought to be spread upon short grass for four or five days before you put it into the water; but if for laws, lace, or thread, it is best to dry it outright. In either case avoid as much as possible to let it get rain; as much rain blanches and washes out the oil, which is necessary to preserve the strength.

The great property of this flax is to be fine and long. Thick sowing raises all plants fine and slender; and when the ground is very rich, it forces them to a great length. Pulling green prevents that coarse hardness which flax has when left stand till it be full ripe, and gives it the fine silky property. The brushwood, when the flax springs up, catches it by the middle, and prevents it from lying down and rottling; infallible consequences of sowing thick upon rich ground. It likewise keeps it straight, moist, and soft at the roots; and by keeping it warm, and shaded from the sun, greatly promotes its length. The keeping it from rain, beating, taking proper care of your water, preserves the colour, and prevents those bars in cloth so much complained of by bleachers.

Flax-Dressing. For many ages it was the practice to separate the boon or core from the flax, which is the bark of the plant, by the following simple hand methods. First, for breaking the boon, the stalks in small parcels were beat with a mallet; or, more dexterously, the break (Plate CCXVIII. fig. 1. and 2.) was used thus: The flax being held in the left hand across the three under teeth or swords of the break (A, fig. 1. and fig. 1. and 2.), the upper teeth (B, fig. 1. and b, fig. 2.) were with the right hand quickly and often forced down upon the flax, which was artfully shifted and turned with the left hand. Next, for clearing the flax of the broken boon; the workman with his left hand held the flax over the stock (fig. 3. and 4.), while with his right hand he struck or thrashed the flax with the scutcher (fig. 5.).

These methods of breaking and scutching the flax being slow and very laborious, a water-mill was invented in Scotland about the year 1750; which, with some improvements, makes great dispatch, and in skilful and careful hands gives satisfaction. It has been generally constructed to break the boon by three-dented rollers, placed one above the other. The middle one of which, being forced quickly round, takes the other two along with it, and one end of the handful of the flax being by the workman directed between the upper and middle rollers, the flax is immediately drawn in by the rollers; a curved board or plate of tin behind the rollers directs the flax to return again between the middle and undermost rollers; and thus the operation is repeated until the boon be sufficiently broke. Great weights of timber or stone at the ends of levers, press the upper and under rollers towards the middle one.

The scutching is next carried on by the mill in the following manner: Four arms, something like the hand-scutchers before described, project from a perpendicular axle; a box around the axle encloses these projecting scutchers; and this box is divided among the workmen, each having sufficient room to stand and handle his flax, which, through slits in the upper part and sides of the box, they hold in to the stroke of the scutchers; which, moving round horizontally, strike the flax across or at right angles, and so thrash out or clear it to the boon.

The breaking of the flax by rollers is scarcely subject to any objection, but that it is dangerous to workmen not sufficiently on their guard, who sometimes allow the rollers to take hold of their fingers, and thereby their whole arm is instantly drawn in: thus many have lost their arms. To avoid this danger, a break, upon the general principles of the hand-break before described, has been lately adapted to water-machinery, and used in place of rollers. The horizontal stroke of the scutchers was long thought too severe and wasteful of the flax; but very careful experiments have discovered that the waste complained of must be charged to the unskilfulness or negligence of the workmen, as in good hands the mill carries away nothing but what, if not so scutched off, must
be taken off in the Heckling, with more loss both of time and flax. But to obviate this objection of the violence of the horizontal Scutchers, an imitation of hand Scutching has lately been applied to water. The Scutchers are fixed upon a horizontal axle, and move like the arms of a check reel, striking the flax neither across nor perpendicularly down, but sloping in upon the parcel exactly as the flax is struck by the hand Scucher. The sloping stroke is got by raising the Scutching stock some inches higher than the centre of the axle, and by raising or lowering the stock over which the flax is held, or screwing it nearer to or farther from the Scutchers, the workman can temper or humour the stroke almost as he pleases.

A lint mill, with horizontal Scutchers upon a perpendicular axle, requires a house of two stories, the rollers or break being placed in the ground story, and the Scutchers in the loft above; but a mill with vertical Scutchers on a horizontal axle, requires but one ground story for all the machinery.

Another method of breaking and scutching flax, more expeditious than the old hand methods, and more gentle than water-mills, has also been invented in Scotland. It is much like the break and scucher, giving the sloping stroke last described, moved by the foot. The treadle is remarkably long, and the Scutchers are fixed upon the rim of a fly wheel. These foot machines are very useful where there are no water-mills, but they are far inferior to the mills in point of expedition.

The next operation that flax undergoes after scutching is heckling. The Heckle (fig. 6.) is firmly fixed to a bench before the workman, who strikes the flax upon the teeth of the heckle, and draws it through the teeth. To persons unacquainted with that kind of work this may seem a very simple operation; but, in fact, it requires as much practice to acquire the slight of heckling well, and without wasting the flax, as any other operation in the whole manufacture of linen. They use coarser and wider toothed heckles, or finer, according to the quality of the flax; generally putting the flax through two heckles, a coarser one first, and next a fine one.

Flax for Cambric and fine Lawn, Thread, and Lace, is dressed in a manner somewhat different. It is not scutched so thoroughly as common flax; which from the scutch proceeds to the heckle, and from that to the spinner: whereas, this fine flax, after a rough scutching, is scraped and cleansed with a blunt knife upon the workman’s knee covered with his leather apron; from the knife it proceeds to the spinner, who, with a brush made for the purpose, straightens and dresses each parcel just before she begins to spin it.

The following observations on this subject, first published in the Gentleman’s Magazine for June, 1787, seem worthy of particular attention.

Of the Watering of Flax by a new method, so as to shorten labour, to add probably to the strength of the flax, and to give it a much finer colour, which would render the operation of bleaching safer and less tedious.

Though the following reflections have for their object an improvement in the very essential article of watering of flax, yet I must advise the reader, that they are only theory, and must depend entirely for their truth and justification upon future experiments, skillfully and judiciously made. The repeated trials prove the advantage of the new method supposed, we may venture to affirm, that it would be an improvement that would increase the national income in the agricultural branch many thousand pounds annually, would add greatly to the perfection of the linen manufacture, and over and above would suppress a very disagreeable nuisance, which the present method of watering flax occasions during some part of the summer in every flax-growing country.

The intention of watering flax, is, in my opinion, to make the boon more brittle or friable, and, by soaking, to dissolve that gummy kind of sap that makes the bark of plants and trees adhere in a small degree to the woody part. The back of flax is called the harle; and when separated from the useless woody part, the boon, this harle itself is called flax. To effect this separation easily, the practice has long prevailed, of soaking the flax in water to a certain degree of fermentation, and afterwards drying it. For this soaking some prefer rivulets that have a small current, and others stagnant water in ponds and lakes. In both methods the water acts as in all other cases of infusion and maceration; after two or three weeks it extracts a great many juices of a very strong quality, which is ponds give the water an inky tinge and offensive smell; and in rivulets mix in the stream and kill the fish. Nay, if this maceration be too long continued, the extracted and fermented sap will completely kill the flax itself. For if, instead of two or three weeks, the new flax were to lie soaking in the water four or five months, I presume it would be good for nothing but to be thrown upon the dunghill; both harle and boon would in time be completely rotted; yet the harle or flax, when entirely freed from this sap, and manufactured into linen, or into ropes, might lie many months under water without being much damaged; as linen, it may be washed and steeped in scalding water twenty times without losing much of its strength; and as paper, it acquires a kind of incorruptibility.

It appears then essential to the right management of new flax, to get rid of this pernicious vegetable sap, and to macerate the boon; but from the complaints made against both the methods of watering now in use, there is reason to think that there is still great room for improvement in that article. In rivulets, the vegetable sap, as it is dissolved, is carried off by the current to the destruction of the flax. This prevents the flax from being stained; but the operation is tedious, and not complete, from the uncertainty of knowing when it is just enough, and not too much, or perhaps from neglect. In ponds, the inky tinge of the water often serves as a kind of dye to the flax, which imbibes it so strongly, that double the labour in bleaching will hardly bring the linen made of such flax to an equality in whiteness with linen made of flax untinged. This seems to be equally unwise, as though we were to dye cotton black first, in order to whiten it afterwards. These ponds, besides, become a great nuisance to the neighbourhood; the impregnated water is often of such a pernicious quality, that cattle,
cattle, however thirsty, will not drink of it; and the effluvia of it may perhaps be nearly as infectious as it is offensive. If this effluvia is really attended with any contagious effects in our cold climate, a thing worth the inquiring into, how much more pernicious must its effects have been in the hot climate of Egypt, a country early noted for its great cultivation of flax?

"I have often thought that the process of watering might be greatly improved and shortened by plunging the new flax, after it is rippled, into scalding water; which, in regard to extracting the vegetative sap, would do in five minutes more than cold water would do in a fortnight, or perhaps more than cold water could do at all, in respect to the clearing the plant of sap. Rough almonds, when thrown into scalding water, are blanched in an instant; but perhaps a fortnight's macerating those almonds in cold water would not make them part so easily with their skins, which are the same to them as the harle is to the flax. Were tea leaves to be infused in cold water a fortnight, perhaps the tea produced by that infusion would not be so good to the taste, or so strongly tinged to the eye, as what is effected by scalding water in five minutes. By the same analogy, I think, flax or any small twig would be made to part with its bark much easier and quicker by being dipped in boiling water, than by being steeped in cold water."

This reflection opens a door for a great variety of new experiments in regard to flax. I would therefore recommend to gentlemen cultivators and farmers, to make repeated trials upon this new system, which would soon ascertain whether it ought to be adopted in practice or rejected. One thing, I think, we may be certain of, that if the Egyptians watered their flax in our common manner, they undoubtedly watered it in very warm water, from the great heat of their climate, which would probably make them neglect to think of water heated by any other means than that of the sun. A general practice can only be established upon repeated trials. Though one experiment may fail, another with a little variation may succeed; and the importance of the object desired to be obtained will justify a good degree of perseverance in the prosecution of the means. In this view, as the Chinese thread is said to be very strong, it would be worth while to acquaint the practice of that distant nation, in regard to the rearing and manufacturing of flax, as well as with the methods used by the Flemings and the Dutch.

"Boiling water perhaps might at once clear the new flax from many impurities, which when not removed till it be spun into yarn, are then removed with difficulty, and with loss of substance to the yarn. Why should not the longitudinal fibres of the flax, before they be spun into yarn, be made not only as fine but as clean as possible? Upon the new system proposed, the act of bleaching would begin immediately after the rippling of the flax; and a little done then might perhaps save much of what is generally done after the spinning and weaving. To spin dirty flax with a view of cleaning it afterwards, appears to be the same impropriety as though we were to reserve part of the dressing given to leather till after it is made into a glove."

"Should the pluming of the flax into the boiling water not suffice to make the boon brittle enough, as I am inclined to think it would not, then the common watering might be added; but in that case probably half the time usually given to this watering would suffice, and the flax might then be laid in clear rivulets, without any apprehension of its infecting the water and poisoning the fish, or of being discoloured itself; for the boiling water into which it had been previously put, would have extracted all the poisonous vegetative sap, which I presume is what chiefly discolours the flax or kills the fish.

"On the supposition that the use of boiling water in the preparation of flax may be found to be advantageous and profitable, I can recollect at present but one objection against its being generally adopted. Every flax-grower, it may be said, could not be expected to have conveniences for boiling water sufficient for the purpose; the consumption of water would be great; and some additional expense would be incurred. In answer to this I shall observe, that I presume any additional expense would be more than reimbursed by the better marketable price of the flax; for otherwise any new improvement, if it will not quit cost, must be dropped, were it even the searching after gold. In a large caldron a great deal of flax might be dyed in the same water, and the consumption perhaps would not be more than a quart to each sheep. Even a large household pot would be capable of containing one sheep after another; and I believe the whole objection would be obviated, were the practice to prevail with us, as in Flanders and Holland, that the flax-grower and the flax-dresser should be two distinct professions.

"I shall conclude with recommending to those who are inclined to make experiments, not to be discouraged by the failure of one or two trials. Perhaps the flax, instead of being just plunged into the scalding water, ought to be kept in it five minutes, perhaps a quarter of an hour, a whole hour. Should five minutes or a quarter of an hour, or an hour, not be sufficient to make the boon and harle easily separate, it might perhaps be found expedient to boil the flax for more than an hour; and such boiling when in this state might in return save several hours boiling in the article of bleaching. It is not, I think, at all probable that the boiling of the flax with the boon in it would prejudice the harle; for in the course of its future existence, it is made to be exposed 35 or 40 times to this boiling trial; and if not detrimental in the one case, it is to be presumed it would not be detrimental in the other. Perhaps after boiling, it would be proper to pile up the flax in one heap for a whole day, or for half a day, to occasion some fermentation; or perhaps immediately after the boiling, it might be proper to wash it with cold water. The great object, when the flax is pulled, is to get the harle from the boon with as little loss and damage as possible; and if this is accomplished in a more complete manner than usual, considerable labour and expence will be saved in the future manufacturing of the flax. On this account I think much more would be gained than lost, were the two or three last inches of the roots of the stems to be chopped off, or clipped off, previous to the flax being either watered or boiled. When the flax is watered, care should be taken not to spread it out to dry.
dry, when there is a hazard of its being exposed in its wet state to frost."

To what we have now said we shall add the following short account of the flax husbandry of Ireland, in a letter which appeared in the Farmers Magazine, vol. vii. p. 35. "Having for several years (says the writer) been engaged in the culture of flax, I devoted a part of last summer to a tour through the manufacturing districts of Ireland. Here that branch of husbandry has long been established over a large extent of the country, and conducted with very considerable success. As some of the processes in this culture, which are followed with advantage, are either unknown to the Scots farmers, or are performed in a very awkward and inefficient manner, it might, I conceive, prove of no small benefit, were some of your intelligent correspondents induced to lay before them a plain sketch of the peculiar management observed by the Irish peasants in this important article. I am the more desirous it should appear in your pages, because a periodical work on husbandry, conducted by a practical farmer, appears before the public with manifest advantage, and is received with that sort of deference which is due to experience and authority. The discussions of actual cultivators regarding the objects of their own profession, however new they may as yet be in the animal of agriculture, are far more likely to prove useful, that the writings of those volunteers in this favourite science, who are merely speculative and theoretical. I freely confess to you, Sir, that I found with pleasure your work widely circulated in the sister kingdom; and that the cause uniformly given for its popularity, was a degree of confidence placed in the practical skill of its conductor.

"During my progress through Ireland, the several processes of steeping, drying, and sketching, were in hand, and I think I found a peculiarity of management in these sufficient to affect the success of the whole business, and to confer a decided superiority on the produce of an acre of flax in Ireland over that in Scotland, both in quantity and value. It is no uncommon thing for a farmer in this country, who wishes to make up a sum for his rent, to sell a part of his lint on the foot, as it is termed; and for this he will commonly receive from 30 to 40 guineas per acre.

"1. The method of Steeping.—As soon as the crop has attained the proper degree of ripeness, (which is somewhat below your standard of maturity,) the flax is pulled, and carried to a stagnant pool, dug for this purpose, and placed deep. It is allowed to remain there only from five to seven days, according to the temperature of the weather. After the fermentation in the steeping process has been carried to a degree sufficient to produce the requisite laxity of fibre, the flax is taken out of the pool, and spread very thinly on the stubble of the hay meadow. There, instead of remaining till it is merely dried, it is continued for three or four weeks; till the grower conceives it ready for sketching. This bleaching process, if I am allowed to call it so, which, in Scotland, is either unknown, or continued merely till the crop is dried, has many advantages; the most obvious one is, that it enables the farmer, every time he examines it, to ascertain exactly (by rubbing on his hand) the precise point at which the fermentation has arrived, and thus to perceive the tenacity and strength of his flax; while the adhesion of the fibre has been sufficiently weakened, to admit of the skouter cleansing it completely of the woody parts. It is, I am apprehensive, only the practical flax farmer who is able to judge of the importance and delicacy of this part of the husbandry. It is so remarkable, that of two acres of flax, under precisely the same seed and water, and of equal fertility, it frequently happens that the one shall yield a produce thrice the value of the other, merely from superior accuracy in ascertaining the proper time of continuing the steeping and bleaching processes. In Scotland, therefore, I suspect the practice is faulty and defective; because there the whole process of fermentation is completed by steeping alone; whereas, in Ireland, it is begun only in the steep, and completely by bleaching on the meadow, to that precise point which the safety of the produce requires.

"2. Smooching and Drying.—The Irish peasant seems to possess another advantage, almost equally decisive, in his mode of drying the flax, before he submits it to the skutter or beater. After the lint has remained a sufficient length of time on the bleaching green, it is gathered up a second time into sheafs, (beats, provisionally,) and seems tolerably dry. In this state it is deemed by the Scots growers fairly prepared for the flax-mill; but far otherwise the Irish farmer, who never submits it to the hands of the beatem till it has undergone a thorough smoking over a peat fire. For this purpose, he raises, at the back of a ditch, a small huddle thinly wrought with osiers, and places it on four posts of wood, at the height of six feet above the level of the ground. A pretty strong fire of peats is kindled below, and heat and smoke pervade every part of the flax, which is placed perpendicularly above the hurdle. This process is continued, and fresh quantities of flax regularly added, till the whole crop is brought to a state of dryness, which, in this moist climate, can never be effected by the sun and the weather alone; by this operation a degree of brittleness and friability is produced on the straw, which greatly facilitates the ensuing work, and admits of an easy separation of the fibre from the wood. It is evident, that the less friction required in sketching, the less waste or diminution must be occasioned in cleaning the flax; and consequently, the greater must be the grower's produce from the mill. This part of the process is equally delicate with that described above, and requires, if possible, still greater attention on the part of the workmen, since it is clear that, by a careless management of the fire, the whole crop may be destroyed.

"3. Cleansing and Dressing.—The flax husbandry of Ireland derives so small benefit from the application of hand-labour in the beating and sketching of lint, that superseding the use of the mill. The most careful and expert workmen are not always able to temper the velocity of machinery so exactly, as to preserve flax that has been oversteeped or bleached to excess; while the steady and regulated impetus of the hand sketch can easily be modified, as the circumstances of each case may require; a matter of obvious advantage, because the best flax-mills seldom produce an equal quantity of lint, nor equally clean, wish that which is obtained by the hand. Besides this, the price of labour in this part of the united kingdom, still continues so moderate, as to preclude any considerable degree of saving in ex-
pence by the use of machinery. In proof of this, the
flax millers in Scotland, I find, are charging this se-
ason from three to four shillings for dressing a stone of
flax; while, at the place I am now writing, the same
quality is dressed by hand, for this business of
flax-dressing in Scotland, where hands are scarce,
and the price of labour consequently high, I certainly
would not recommend the disuse of the mill; on
the contrary, I am persuaded that it is chiefly owing to
our superior machinery, and excellent implements of
husbandry, that we are at all enabled to maintain a
competition with our neighbours in the present state of
our skill in flax husbandry, and subjected to the dis-
advantage of paying double price for labour.

4. Preservation of Flax seed. — The last peculiarity
of management, which I shall at present notice as ad-
vantageous to the flax husbandry of Ireland, is the inven-
tion of a flax barn for the preservation of seed. Enjoy-
ing a climate perhaps still more moist and unsteady than
that of Great Britain, the farmers here were, for a long
series of years, unable to supply themselves with this
article, and were obliged to commission seed annually
from America and the Baltic, to supply the increased
demands of an extended culture, to the large amount of
200,000l sterling. The annual expenditure of cash long
continued to operate as a drain on the stock of the
labouring farmer, and prevented the accumulation of
his capital; an evil of the most serious magnitude, un-
der which the Irish peasantry still labour, and from
which, till very lately, they had not even a prospect of
relief. By the practice in universal use, if the farmer
stowed up his lint in the barn-yard with the rest of his
crop in harvest, he might, it is true, preserve his seed;
but in doing so, he uniformly lost his flax to a far
greater value from over dryness, when brought in the
spring.

If, on the other hand, he attempted to separate his
seed during the lint harvest by means of the ripples-
comb, he had no means of preventing it from being
almost invariably destroyed by the wetness of the climate.
Various methods had been attempted to overcome this
difficulty, but without success; till Robert Tennant,
Esq. of Strangmore, linen inspector, near Dungannon,
contrived the plan of a flax barn, which seems perfect-
ly competent to the preservation of seed. It has al-
ready been erected, and has proved successful on a small
scale; the seed cured is it remained during the winter
perfectly fresh, and nothing seems wanting to complete
this improvement in our flax husbandry, but a larger
capital in the hands of a few of our farmers. This flax
barn is constructed on wooden posts, roofed on the top,
but left perfectly open at each side; it is supplied with
various stages of floors of basket-work, placed regu-
larly at two feet distance above each other. Thus,
the air, having free access to the seed on all sides,
preserves it fresh and well colored for any length of
time.

This contrivance was suggested to Mr Tennant, it is
said, almost casually, by noticing the great effect pro-
duced on cloth, by drying-houses in flaxfields. He had
in fact been employed by the Linnen Board of Ire-
land, in teaching the new process of bleaching to the
manufacturers, by means of the oxymuriate of lime;
and, in the course of seven or eight years, this method
of whitening linnen has been established over the whole
kingdom, with the exception of hardly a single field.

Lord Northland and Mr Foster, who invited this
gentleman from Scotland, and patronized him in this
part of the kingdom, have enjoyed the satisfaction of
sustaining a more essential improvement on the flax
linen manufacture, in the short space already
mentioned, than had ever taken place in a century
before.

It was my intention, when I began this letter, to
have presented you a more minute description of a flax
farm, and to have laid before your readers, a more de-
tailed account of the flax husbandry of Ireland in gen-
eral. I find, however, that I have already exceeded
the ordinary bounds prescribed to the contributors to
your useful work; therefore conclude, with expressing
a hope, that the few hints already offered, will incline
some of your correspondents to treat of a subject cer-
donably of sufficient importance to merit attention.
For a branch of husbandry cannot be deemed contemptible,
which affords sustenance to upwards of two millions of
people; and which, at the same time, adds to the gen-
eral resources of the empire, no less a sum than seven
millions sterling annually. These circumstances, too,
I trust, will plead my excuse for holding up a portion
of Irish husbandry to the imitation of your numerous
readers among the cultivators of Scotland, who are at
present justly celebrated for their agricultural know-
ledge in every part of the world.

Flax made to resemble Cotton. In the Swedish Trans-
actions for the year 1747, a method is given of pre-
paring flax in such a manner as to resemble cotton in
whiteness and softness, as well as in coherence. For
this purpose a little sea water is to be put into an
iron pot or an untinned copper kettle, and a mixture
of equal parts of birch ashes and quicklime strewed
upon it: A small bundle of flax is to be opened and
spread upon the surface, and covered with more of the
mixture, and the stratification continued till the vessel
is sufficiently filled. The whole is then to be boiled
with sea water for ten hours, fresh quantities of water
being occasionally supplied in proportion to the eva-
poration, that the water may never become dry.
The boiled flax is to be immediately washed in the sea
by a little at a time, in a basket, with a smooth stick
at first while hot; and when grown cold enough to
be borne by the hands, it must be well rubbed,
washed with soap, laid to bleach, and turned and
watered every day. Repetitions of the washing with
soap expedite the bleaching; after which the flax is
to be beaten, and again well-washed; when dry it
is to be worked and carded in the same manner as com-
mon cotton, and pressed between two boards for 48
hours. It is now fully prepared and fit for use. It
loses in this process near one half its weight, which is
abundantly compensated by the improvement made
in its quality.

The filamentous parts of different vegetables have
been employed in different countries for the same me-
chanical uses as hemp and flax among us. See Fil-
ament.

Earth-Flax. See Amianthus, Botany Index.
New Zealand Flax Plant. See Phormium, Bot-
any Index.

Toad-Flax. See Linaria, Botany Index.
Flea. See Pulic, Entomology Index.
FLEA-BITE, that colour of a horse which is white or gray, spotted all oer with dark reddish spots.

FLEAM, in Surgery and Surgery, an instrument for letting blood of a man or horse. A case of fleas, as it is called by farriers, comprehends six sorts of instruments: two hooked ones, called drawers, and used for cleansing wounds; a pin knife; a sharp-pointed lancet for making incisions; and two fleas, one sharp and the other broad pointed. These last are somewhat like the point of a lancet, fixed in a flat handle, and no longer than is just necessary to open the vein.

FLECHIER, ESIR, bishop of Nimes, one of the most celebrated preachers of his age, and the publisher of many panegyrics and funeral orations, was born at Perse in Avignon in 1632. He was nominated to the bishopric of Lavaur in 1655, and translated to Nimes in 1657. At this latter place he founded an academy, and took the presidency upon himself: his own palace was indeed a kind of academy, where he applied himself to train up orators and writers, who might serve the church, and do honour to the nation. He published, besides his panegyrics and funeral orations, 1. A History of the Emperor Theodosius, that of Cardinal Ximenes, and that of Cardinal Campanello. 2. Several Sermons. 3. Miscellany Works. 4. Letters, &c. He died in 1710.

FLECKNOE, Richard, an English poet in the reign of Charles II. more remarkable for Mr. Dryden's satire on him than for any works of his own. He is said to have been originally a Jesuit, and to have had good English connexions in the Catholic interest. When Dryden lost the place of poet laureat on the Revolution, its being conferred on Flecknoe, for whom he had a settled averse, gave occasion to his poem entitled Mac Flecknoe; one of the best written satires in our language, and from which Pope seems to have taken the hint for his Dunciad. Flecknoe wrote some plays; but could never get more than one of them acted, and that was famed.

FLEECING, the covering of wool shorn off the bodies of sheep. See Wool.

Golden Fleece. See Argonauts, and Golden Fleece.

FLEET, commonly implies a company of ships of war, belonging to any prince or state: but sometimes it denotes any number of trading ships employed in a particular branch of commerce.

The admirals of his Britannic Majesty's fleet are divided into three squadrons, viz. the red, the white, and the blue. When any of these officers are invested with the command of a squadron or detachment of men of war, the particular ships are distinguished by the colours of their respective squadron: that is to say, the ships of the red squadron wear an ensign whose union is displayed on a red field; the ensigns of the white squadron have a white field; and those of the blue squadron a blue field; the union being common to all three. The ships of war, therefore, are occasionally annexed to any of the three squadrons, or shifted from one to another.

Of whatsoever number a fleet of ships of war is composed, it is usually divided into three squadrons; and these, if numerous, are again separated into divisions. The admiral, or principal officer, commands the centre; the vice admiral, or second in command, superintends the van guard; and the operations of the rear are directed by the rear admiral, or the officer next in rank.

See the article DIVISION.

The disposition of a fleet, while proceeding on a voyage, will in some measure depend on particular circumstances; as the difficulty of the navigation, the necessity of dispatch, according to the urgency or importance of the expedition, or the expectation of an enemy in the passage. The most convenient order is probably to range it into three lines or columns, each of which is parallel to a line close hauled according to the tack on which the line of battle is designed to be formed. This arrangement is more useful than any, because it contains the advantages of every other form, without their inconveniences. The fleet being thus more enclosed will more readily observe the signals, and with greater facility form itself into the line of battle, a circumference which should be kept in view in every order of sailing. See Naval Tactics.

FLEET, is also a noted prison in London, where persons are committed for contempt of the king and his laws, particularly of his courts of justice; or for debt, where any person will not or is unable to pay his creditors.

There are large rules and a warden belonging to the Fleet prison; which had its name from the fleet or fleet of the river or ditch, on the side whereof it stands.

FLEETWOOD, William, a very learned English bishop in the beginning of the 18th century, of an ancient family in Lancashire. He distinguished himself during King William's reign, by his Inscriptionem Antiquarum Sylisoge, by several sermons he preached on public occasions, and by his Essay on Miracles. He was designed by King William to a canonry of Windsor. The grant did not pass the seals before the king's death; but the queen gave it him, and he was installed in 1703. In 1703, he took a resolution to retire; and in 1707, published, without his name, his Chronicon Pretermon. In 1708, he was nominated by the queen to the see of St. Asaph. The change of the queen's ministry gave him much regret. In 1715, he published a pamphlet entitled, "The 39th chapter of the Romans vindicated from the abusive senses put upon it." In 1714, he was translated to the bishopric of Ely; and died in 1723, aged 67. He published several other sermons and tracts, and was a man of great learning and exemplary piety.

FLEMINGIANs, or Flemishmen, in ecclesiastical history, a sect of rigid Anabaptists, who acquired this name in the 16th century, because most of them were natives of Flanders, by way of distinction from the Waterlandians. In consequence of some dissensions among the Flemingians relating to the treatment of excommunicated persons, they were divided into two sects, distinguished by the appellations of Flemishmen and Frieslandens, who differed from each other in their manners and discipline. Many of these in process of time came over to the moderate community of the Waterlandians, and those who remained separate are still known by the name of the old Flemingians or Flemishmen; but they are comparatively few in number. These maintain the opinion of Mennon with respect to the incarnation of Christ; alleging, that his body
body was produced by the creating power of the Holy Ghost, and not derived from her mother Mary.

FLEMISH, or the FLEMISH TONGUE, is that which we otherwise call Low Dutch, to distinguish it from the German, whereas it is a corruption and a kind of dialect. See German.

It differs from the Walloon, which is a corruption of the French language. The Flemish is used throughout all the provinces of the Netherlands.

FLEMISH BRICKS, a neat, strong, yellow kind of bricks, brought from Flanders, and commonly used in various yards, stables, &c. being preferable for such purposes to the common bricks. See the article BRICKS.

FLESH, in Anatomy, a compound substance, consisting of the various softer solids of the animal body, and so denominated in contradistinction to bones. See Anatomy, possess.

FLESH is also used, in Theology, in speaking of the mysteries of the incarnation and eucharist. "The word was made flesh." Verbum caro factum est.

The Romanists hold, that the bread in the sacrament of the supper is turned into the real flesh of Jesus Christ. See Transubstantiation.

FLESH is sometimes also used by botanists for the soft pulpy substance of any fruit, enclosed between the outer rind or skin and the seeds or stone; or for that part of a root, fruit, &c. to be eaten.

FLESH-COLOUR. See Carnation.

FLETA, the name given to an unknown writer who lived about the end of the reign of Edward II. and beginning of Edward III. and who being a prisoner in the Fleet, wrote there an excellent treatise on the common law of England.

FLETCHER. See Beaumont and Fletcher.

FLETCHER, Andrew, of Salton, a celebrated Scots patriot and political writer, was descended from an ancient family who trace their origin to one of the followers of William the Conqueror. He was the son of Sir Robert Fletcher of Salton and Innerpeffer, and born in the year 1650. The tuition of our author was committed by his father, or his deathbed, to Mr. (afterwards Bishop) Burnet, then his parish minister; by whose care he received a pious, learned, and polite education. Endowed with uncommon genius, and possessed of virtues and abilities peculiarly united to the times in which he lived, Mr. Fletcher quickly arose to the ornament of his country, and the champion of its freedom. Having in the course of his classical studies and historical reading been impressed with an enthusiastic admiration both of ancient and modern republics, he had early contracted an ardent love of liberty, and an aversion to arbitrary rule. Hence his spirit the more readily took alarm at the measures in the reign of Charles II. Being knight of the shire for Lothian to that parliament where the duke of York was commissioner, he openly opposed the designs of that prince and the bill of succession. He had a share, with Lord Viscount Stair in framing the test act, by which the duke of York complained that he lost Scotland. On these accounts he became peculiarly obnoxious to the duke; and was at last obliged to fly to Holland, to avoid the fatal consequences of prosecutions which on various pretences were commenced against him. Being cited before the privy council and justiciary courts, and not appearing, he was declared traitor, and his estate confiscated.

In Holland, he and Mr. Baillie of Jerviswood were the only persons whom the earl of Argyll consulted concerning the designs which were then in agitation. In 1681 they came over to England, in order to concert matters with those in that country; and were the only two who were intrusted so far as to be admitted to the secrets of Lord Lovat's council of six. Mr. Fletcher managed his part of the negotiation with so much address, that administration could find no pretext for seizing him; nor could they fix upon him those articles on account of which Mr. Baillie was condemned; to whose honour let it be remembered, that although offered a pardon on condition of his accusing his friend, he persisted in rejecting the proposal with indignation.

Mr. Fletcher having joined the duke of Monmouth upon his landing, received a principal command under him; but the duke was deprived of his services on the following occasion, as related by Sir John Dalrymple. Being sent upon an expedition, and not estimating "times of danger" to be times of ceremony, he had seized for his own riding the horse of a country gentleman [the mayor of Lynn] which stood ready equipped for its master. The master, bearing this, ran in a passion to Fletcher, gave him opprobrious language, shook his cane, and attempted to strike. Fletcher, though rigid in the duties of morality, having been accustomed to foreign service both by sea and land, in which he had acquired high ideas of the honour of a soldier and a gentleman, and of the affront of a cane, pulled out his pistol, and shot him dead on the spot. The action was unpopular in countries where such refinements were not understood. A clamour was raised against it among the people of the country; in a body they waited upon the duke with their complaints; and he was forced to desist the only soldier, and almost the only man of parts, in his army, to abandon him. With Fletcher all Monmouth's chance of success in war left him." But, in a manuscript memoir belonging to the family, we have the following notice concerning Mr. Fletcher's connection with Monmouth, in which his separation from that prince is very differently accounted for: "To Lord Marischal Mr. Fletcher explained the motives which first induced him to join, and afterwards abandon, the duke of Monmouth. The former he ascribed to the duke's manifesto in Scotland relating to religion, and in England to liberty. For the latter he accounted by the disgust produced in his own mind and that of his associates, when the duke declared himself king, and broke faith with all who embarked with him on his principles. He complained heavily of the account commonly given of the death of the mayor of Lynn: and mentioned to Lord Marischal, in proof of the contrary, that he did not leave the duke till he came to Taunton, where he was proclaimed King, several weeks after the death of the mayor of Lynn."

Seeing all the efforts of himself and his friends in favour of liberty frustrated at Taunton, he endeavoured to secure his own personal freedom by taking his passage in the first ship bound to a foreign country. It was his misfortune to land in Spain; where he was immediately arrested, cast into prison, and guarded by
three different bands of soldiers, till a vessel should be prepared to carry him a victim in chains to the court of London. But on the morning before the ship could sail, whilst he looked passive through the bars that secured the windows of his dungeon, the venerable personage who made signs to speak with him, the prison doors he found open; and whilst his friendly conductor waved to him to follow him, he passed through three different guards of soldiers all fast asleep. Without being permitted to offer his thanks to his deliverer, he found himself obliged to prosecute with all speed the journey, in which he was directed by a person concerning whom he could never collect any information; and in disguise he proceeded in safety through Spain. He felt a peculiar pleasure in relating to his friends instances of the care of Providence which he had experienced during his exile; and entertained them often with narratives of this kind, which he always mingled with religious reflections. Of these, another may be here mentioned. Happening in the evening to pass the skirt of a wood at a few miles distance from a city where he intended to lodge, he came to a place where two roads met. After he had entered upon the road on the right, he was accosted by a female of a respectable figure, who warned him to turn back, and take the road to the left; for that in the other there was danger which he could not escape if he continued to proceed. His friendly monitor suddenly retired into the wood, out of which she had issued no less unexpectedly. Having arrived at the city, the inhabitants were soon after alarmed by an account of the robbery and murder of several travellers who that evening had fallen into the hands of a banditti upon the very way in which he had intended to travel. From these and other instances of preservation from dangers, the devotion of his mind, habituated from his infancy to an intercourse with heaven, led him to conclude that he was in a peculiar manner the care of Providence, and that in critical cases his understanding received its direction from a supernatural impulse.

During his exile, he maintained a frequent and extensive correspondence with the friends of liberty at home; and he partly employed himself in making a curious collection of books, which compose the best private library in Scotland. But his genius also prompted him to engage in more active employments. He repaired to Hungary, and served several campaigns as a volunteer under the duke of Lorraine with great reputation. At length, understanding that the great design then projected in Holland, and upon the issue of which he considered the liberties of Britain were suspended, had attained a considerable degree of maturity, he hastened thither; where his counsels and address were of eminent service. He came over with King William; and in zeal, activity, penetration, and political skill, proved inferior to none of the leaders in the Revolution.

Such, however, was his magnanimity, that from a survey of King William's papers, it appears that while others laboured to turn this grand event to the emolument of themselves and the aggrandisement of their family, Mr. Fletcher asked nothing. His estate had been forfeited, and his house abandoned to military discretion; his fortune was greatly shattered, and his family reduced to circumstances of distress. Nothing was given him in recompense of all his sufferings. On the contrary, he, together with the duke of Hamilton, was distinguished by marks of royal and ministerial dislike. Still, whatever private resentment he might entertain, it appeared that his ruling principle was the good of his country; and that to this grand object of his heart he was willing to sacrifice all personal considerations. For when, in 1692, the abdicated king meditated an invasion, Mr. Fletcher addressed a letter (preserved in Sir John Dalrymple's collection) to the duke of Hamilton, in which every argument is employed with skill and energy to engage his grace to forget his injuries, and in the present crisis to employ the extensive influence and authority he then possessed in the cause of freedom and of his country. This letter produced its full effect; and the duke returned to his duty, from which he had in part begun to deviate.

To follow our author through all the mazes of his political life subsequent to the Revolution, is beyond our purpose, and would exceed our limits. One or two circumstances more shall therefore suffice. Being elected a member for the parliament 1683, he showed an uniform zeal for the interest of his country. The thought of England's dominion over Scotland was what his generous soul could not endure. The indignities and oppression which Scotland lay under galled him to the heart; so that in his learned and elaborate discourses, he exposed them with undaunted courage and pathetical eloquence. In that great event, the Union, he performed essential service. He got the act of security passed, which declared that the two crowns should not pass to the same head till Scotland was secured in her liberties civil and religious. Therefore Lord Godolphin was forced into the Union, to avoid a civil war after the queen's demise. Although Mr. Fletcher disapproved of some of the articles, and indeed of the whole frame of the Union; yet, as the act of security was his own work, he had all the merit of that important transaction.

We must not omit mentioning, that in the arduous of his political career Mr. Fletcher forgot not the interests of the place that gave him birth. He esteemed the education of youth one of the noblest objects of government. On this subject he wrote a treatise, still extant, most characteristic of himself; and he established at Salton a foundation for the same purpose, of great utility while it lasted.

This great man died at London 1716, aged 66. His remains were conveyed to Scotland, and deposited in the family vault at Salton.

That Mr. Fletcher received neither honours nor emoluments from King William, may perhaps be in part attributed to himself; a circumstance, however, which must add greatly to the lustre of his character. His uncomplying virtue, and the sternness of his principles, were ill calculated to conciliate courtly favour. He was so zealous an assertor of the liberties of the people, that he was too jealous of the growing power of all princes; in whom he thought ambition so natural, that he was not for trusting the best of kings with the power which ill ones might make use of against their subjects; he was of opinion that all princes were made by, and for the benefit of, the people; and that they should have no power but that of doing good. This, which
James, led him also to oppose the giving so much power to King William, whom he would never see after his establishment. So we are told by the author of "Short Political Characters," a MS. in the library of the late T. Rawlinson, Esq.—Mr. Lockhart, in his Memoirs, p. 72, expresses a belief that his aversion to the English and to the Union was so great, that, in revenge to them, he was inclined to side with the abdicated family: "But (adds he) as that was a subject not fit to be entered upon with him, this is only a conjecture from some ineptitudes I have heard him make; but so far is certain, he was, if not at times, commended, and conversed with high-flying Tories, more than any other set of men; acknowledging them to be the best countrymen, and of most honour, integrity, and ingenuity." It seems difficult to reconcile this with Mr. Fletcher's avowed principles and the general tenor of his conduct. May we suppose, that chagrin, if not at the neglect for the ill treatment which he had himself received from government since the Revolution, yet at the public measures relating to his native country, might have occasioned him to relent in his sentiments with regard to the exiled family?—In the family memoirs already quoted, we are informed, that, "Lord Marischal held Mr. Fletcher's character in high admiration;" and that, "when governor of Neufchatel, where Rousseau resided about the year 1766, he prevailed with this very extraordinary genius to write the life of a man whose character and actions he wished to have transmitted to posterity with advantage. For this purpose his lordship applied to an honourable relation of Mr. Fletcher's for materials: which by him were transmitted to Lord Marischal: but the design failed through Rousseau's sallow views and capricious disposition." This anecdote must appear incompatible with the known loyalty and attachments of the Earl Marischal, unless we suppose him to have been privy to some such sentiments of Mr. Fletcher as those alluded to by Mr. Lockhart; for how could we suppose him anxious to promote a composition, in which the task would be to celebrate principles diametrically opposite to his own, and to applaud actions subversive of that royal family in whose cause he had ventured his life, and forfeited his fortune, and foregone his country!—But however these circumstances may be reconciled, as the integrity, disinclination, and public spirit of Mr. Fletcher, have been universally acknowledged, there is reason to believe, that all his sentiments and actions were founded in honour, and that he never once pursued a measure further than he judged it to be for the interest of his country.

Mr. Fletcher was master of the English, Latin, Greek, French, and Italian languages; and well versed in history, the civil law, and all kinds of learning. In his travels, he had not only acquired considerable knowledge in the art of war, but also became versant in the respective interests of the several princes and states of Europe. In private life, he was affable to his friends, and free from all manner of vice. He had a penetrating, clear, and lively apprehension; but is said to have been too much wedded to opinions, and impatient of contradiction. He possessed an uncommon elevation of mind, accompanied with a warmth of temper, which would suffer him to brook from no rank
FLINTSHIRE, a county of Wales, bounded on the north-east and east by an arm of the sea, which is properly the mouth of the river Dee; on the north-west by the Irish sea; and on the south-south-west and west by Denbighshire. It is the least of all the counties in Wales, being but 33 miles in length and 9 in breadth. It is divided into five hundreds; in which are two market towns and 28 parishes; and the population in 1811 was 46,518. The greatest part of this county lies in the diocese of St Asaph, and the rest belongs to that of Chester. It sends two members to parliament, one for the county and one for Flint; and pays one part of the land tax. The soil is cold, but healthful. It is full of hills, interspersed with a few valleys, which are very fruitful, producing some wheat and plenty of rye. The cows, though small, yield a great quantity of milk in proportion to their size, and are excellent beef. The mountains are well stored with lead, coal, and millstones. This county also produces good butter, cheese, and honey. See FLINTSHIRE, SUPPLEMENT.

FLIP, a sort of sailors' drink, made of malt liquor, brandy, and sugar mixed.

FLOAT, a certain quantity of timber bound together with rafters athwart, and put into a river to be conveyed down the stream; and even sometimes to carry burdens down a river with the stream.

FLOAT-BOARDS, those boards fixed to water wheels of undershot mills, serving to receive the impulse of the stream, whereby the wheel is carried round. See the articles WHEEL and MILL.

It is no advantage to have too great a number of float-boards; because, when they are struck by the water in the best manner that it can be brought to come against them, the sum of all the impulses will be but equal to the impulse made against one float-board at right-angles, by all the water coming out of the waterwheel through the opening, so as to take place on the float-board. The best rule in this case is to have just so many, that each of them may come out of the water as soon as possible, after it has received and acted with its full impulse. As to the length of the float-board, it may be regulated according to the breadth of the mill. See MILL.

FLOATS FOR FISHING. See FISHING FLOATS.

FLOATAGES, all things floating on the surface of the sea or any water; a word much used in the commissions of water bailiffs.

FLOATING BODIES are those which swim on the surface of a fluid, the most interesting of which are ships and vessels employed in war and commerce. It is known to every seaman, of what vast moment it is to ascertain the stability of such vessels, and the positions they assume when they float freely on the surface of the water. To be able to accomplish this, it is necessary to understand the principles on which that stability and these positions depend. This has been done with great ingenuity by Mr Atwood, of whose reasoning the following is a summary account, taken from the Philosophical Transactions for 1756.

A floating body is pressed downwards by its own weight in a vertical line passing through its centre of gravity; and it is supported by the upward pressure of a fluid, which acts in a vertical line that passes through the centre of gravity of the part which is under the water;
Floating Bodies.

water; and without a coincidence between these two lines, in such a manner as that both centres of gravity may be in the same vertical line, the solid will turn on an axis, till it gains a position in which the equilibrium of floating will be permanent. From this it is obviously necessary to find what proportion the part immersed to the whole, to do which the specific gravity of the floating body must be known, after which it must be found by geometrical methods, in which positions the solid can be placed on the surface of the fluid, so that both centres of gravity may be in the same vertical line, when any given part of the solid is immersed under the surface. These things being determined, something is still wanting, for positions may be assumed in which the circumstances now mentioned concur, and yet the solid will assume some other position wherein it will permanently float. If the specific gravity of a cylinder be to that of the fluid on which it floats as 3 to 4, and its axis to the diameter of the base as 2 to 1; if it be placed on the fluid with its axis horizontal, it will sink to a depth equal to a diameter and a half of the base; and while its axis is preserved in a vertical position by outward force, the centres of gravity of the whole solid and immersed part will remain in the same vertical line; but when the external force is removed, it will deviate from its upright position, and will permanently float with its axis horizontal. If we suppose the axis to be half the diameter of the base, and placed vertically, the solid will sink to the depth of three-eighths of its diameter, and in that position it will float permanently. If the axis be made to incline to the vertical line, the solid will change its position till it permanently settles with its axis perpendicular to the horizon.

Whether a solid floats permanently, or oververts when placed on the surface of a fluid, provided the centre of gravity of the solid and that of the immersed part be in the same vertical line, it is said to be in a position of equilibrium, of which there are three kinds; the equilibrium of stability, in which the solid permanently floats in a given position; the equilibrium of instability, in which the solid spontaneously oververts, if not supported by external force; and the equilibrium of indifference, or the insensible equilibrium, in which the solid rests on the fluid indifferent to motion, without tendency to right itself when inclined, or to incline farther.

If a solid body floats permanently on the surface of a fluid, and external force be applied to turn it from its position, the resistance opposed to this inclination is termed the stability of floating. Some ships at sea yield to a given impulse of the wind, and suffer a greater inclination from the perpendicular than others. As this resistance to heeling, duly regulated, has been considered of importance in the construction of vessels, many eminent mathematicians have laid down rules for ascertaining the stability of ships from their known dimensions and weight, without recurring to actual experiment. Bouguer, Euler, Chapman, and others, have laid down theorems for this purpose, founded on the supposition that the inclinations of ships from their quiescent positions are vanishing, or very small in a practical point of view. But ships at sea have been found to heel 10°, 20°, or 30°, and therefore it may be doubted how far such rules are applicable in practice. If statics can be applied to naval architecture, it seems necessary that the rules should be extended to these cases in which the angles of inclination are of any magnitude, likely to occur in the practice of navigation. A solid body placed on the surface of a lighter fluid, at such a depth as corresponds to the relative gravities, cannot alter its position by the joint action of its own weight and the pressure of the fluid, except by turning on some horizontal axis passing through the centre of gravity; but, as many axes may be drawn through this point of the floating body, in a direction parallel to the horizon, and the motion of the solid regards only one axis, this must be determined by the figure of the body and the particular nature of the case. When this axis of motion is ascertained, and the specific gravity of the solid found, the positions of permanent floating will be determined, by finding the several positions of equilibrium through which the solid may be conceived to pass, while it turns round the axis of motion; and by determining in which of these positions the equilibrium is permanent, and in which of them it is momentary.

The whole of Mr Atwood's valuable paper relates to the theory of naval architecture, in so far as it is dependent on the laws of pure mechanics. If the proportions and dimensions adopted in the construction of individual vessels are obtained by exact geometrical measurement, and observations are made on the performance of these vessels at sea; a sufficient number of experiments of this nature, judiciously varied, are the proper grounds on which theory may be effectually applied, in reducing to system those hitherto unperceived causes, which contribute to give the greatest degree of excellence to vessels of every description. Naval architecture being reckoned among the practical branches of science, every voyage may be viewed in the light of an experiment, from which useful truths are to be deduced. But inferences of this nature cannot well be obtained, except by acquiring a thorough knowledge of all the proportions and dimensions of each part of the ship, and by making a sufficient number of observations on the qualities of the vessel, in all the varieties of situation to which a ship is commonly subject in the practice of navigation.

The following is an ingenious investigation of the same subject by Mr English, which we give in his own words.

"However operose and difficult (says he) the calculations necessary to determine the stability of nautical vessels may, in some cases, be, yet they all depend, says this author, upon the four following simple and obvious theorems, accompanied with other well known stereometrical and statical principles.

"Theorem 1. Every floating body displaces a quantity of the fluid in which it floats, equal to its own weight; and consequently the specific gravity of the fluid will be to that of the floating body, as the magnitude of the whole is to that of the part immersed.

"Theorem 2. Every floating body is impelled downward by its own essential power, acting in the direction of a vertical line passing through the centre of gravity of the whole; and is impelled upward by the reaction of the fluid which supports it, acting in the direction of a vertical line passing through the centre of gravity of the part immersed; therefore, unless these two lines are coincident, the floating body thus impelled must revolve round an axis, either in motion or at rest, until the equilibrium is restored.

"Theorem 3. If by any power whatever a vessel be deflected
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section ABCD above the bottom. In like manner, the altitude of R, the centre of gravity of the section MCCD, will be found to be equal \( \frac{23953 \times 86966016}{49567808} \) inches; and consequently their difference, or the value of GR = 12072 inches, will be found.

Suppose the vessel to heel 15°, and we shall have the following proportion: namely, As radius: tangent of 15° :: MX = 54 inches : 14’469 inches = ME or MF; and consequently the area of either triangle MXE or MXF = 390 603 square inches. Therefore, by theorem 4th, as 49567808: 390 603 :: 72 = 28 = \( \frac{1}{2} AB : 5’6975’5’6575’3’1245’2’573 \) inches = 8W, the stability required.

Moreover, as the sine of 15°: radius :: 5’6975’5’6575’3’1245’2’573 :: RT = 22’013 = BS, to which if we add 24’934, the altitude of the point R, we shall have 46’947 for the height of the metacentre, which taken from 72, the whole altitude, there remains 25’053, from which, and the half width = 54 inches, the distance BS is found = 50’529 inches very nearly, and the angle 8BV = 86°06’42’’; whence 8SV = 58’645 inches.

Again: Let us suppose the mean length of the vessel to be 45 feet, or 480 inches, and we shall have the weight of the whole vessel equal to the area of the section MCCD = 49567808 multiplied by 480 = 2395354784 cubic inches of water, which weighs exactly 6,708 pounds avoirdupois, allowing the cubic foot to weigh 62.5 pounds.

And, finally, as 8V: 8W (i.e.) as 88’645’1’573 :: 88’508’5’6575’3’1245’2’573, the weight on the gunwale which will sustain the vessel at the given inclination. Therefore a vessel of the above dimensions, and weighing 38 tons 5 cwt, 281b. will require a weight of one too 13 cwt, 64 lb., to make her incline 15°.

In this example the deflecting power has been supposed to act perpendicularly on the gunwale at B; but if the vessel is navigated by sails, the centre of line must be found; with which and the angle of deflection, the projected distance thereof on the line SV may be obtained; and then the power calculated as above, necessary to be applied at the projected point, will be that part of the wind’s force which causes the vessel to heel. And conversely, if the weight and dimensions of the vessel, the area and altitude of the sails, the direction and velocity of the wind be given, the angle of deflection may be found.

Florentia Bridge. See Bridge.

Flock Paper. See Paper.

FLOOD, a deluge or inundation of waters. See DELUGE.

FLOOD: is also used in speaking of the tide. When the water is at lowest, it is called ebb; when rising, young flood; when at highest, high flood; when beginning to fall, ebb water.

Floor-mark, the mark which the sea makes on the shore at flowing water and the highest tide, it is also called high-water mark.

LOOK of an anchor. See Anchor.

LOOKING, among miners, a term used to express a peculiarity in the load of a mine. The load or quantity of ore is frequently intercepted in its course by the crossing of a vein of earth or stone, or some different metallic substance; in which case the load is moved to one side, and this transient part of the load is called a flocking.

FLOOR, in building, the underside of a room, or that part we walk on.

Floors are of several sorts: some of earth, some of brick, others of stone, others of boards, &c.

For brick and stone Floors, see Pavement.

For boarded Floors, it is observable that the carpenters never floor their rooms with boards till the carcass is set up, and also enclosed with walls, lest the weather should injure the flooring. Yet they generally rough-plane their boards for the flooring before they begin any thing else about the building, that they may set them by to dry and season, which is done in the most careful manner. The best wood for flooring is the fine yellow deal well seasoned, which when well laid, will keep its colour for a long while; whereas the white sort becomes black by often washing, and looks very bad. The joints of the boards are commonly made plain, so as to touch each other only; but, when the stuff is not quite dry, and the boards shrink, the water runs through them whenever the floor is washed, and injures the ceiling underneath. For this reason they are made with feather edges, so as to cover each other about half an inch, and sometimes they are made with grooves and tenons; and sometimes the joints are made with slope tails; in which case the lower edge is nailed down, and the next drove into it, so that the nails are concealed. The manner of measuring floors is by squares of 10 feet each side, that is, taking the length and breadth, and multiplying them together and cutting off two decimals, the content of a floor in square will be given. Thus 18 by 16 gives 288 or 2

Earthen Floors, are commonly made of loam, and sometimes, especially to make malt on, of lime and brook sand, and gun dust or anvil dust from the forge.

Ox and fine clay, tempered together, Sir Hugh Plat says, make the finest floor in the world.

The manner of making earthen floors for plain-country habitations is as follows: Take two-thirds of lime and one of coal ashes well sifted, with a small quantity of loam clay; mix the whole together, and temper it well with water, making it up into a heap: let it lie a week or ten days, and then temper it over again. After this heap it up for three or four days, and repeat the tempering very high, till it becomes smooth, yielding, tough, and gluey. The ground being then levelled, lay the floor therewith about 25 or 3 inches thick, making it smooth with a trowel: the hotter the season is the better; and when it is thoroughly dried, it will make the best floor for houses, especially malt houses.

If any one would have their floors look better, let them take lime made of rag stones, well tempered with whites of eggs, covering the floor about half an inch thick with it, before the under-flooring is too dry. If this be well done, and thoroughly dried, it will look when rubbed with a little oil as transparent as metal or glass. In elegant houses, floors of this nature are made of stucco, or of plaster of Paris beaten and sifted, and mixed with other ingredients.
Florealis

Floor of a Ship, strictly taken, is only so much of her bottom as she rests on when aground.

Such ships as have long, and withal broad floors, lie on the ground with most security, and are not apt to heel, or tilt on one side; whereas others, which are narrow in the floor, or in the sea phrase, cramped by the ground, cannot be grounded without danger of being overturned.

Floor Timbers, in a ship, are those parts of a ship's timbers which are placed immediately across the keel, and upon which the bottom of the ship is framed; to these the upper parts of the timbers are united, being only a continuation of floor timbers upwards.

Florea, the reputed goddess of flowers, was, according to Lactantius, only a lady of pleasure, who having gained large sums of money by prostituting herself, made the Roman people her heir, on condition that certain games called Florales might be annually celebrated on her birth-day. Some time afterwards, however, such a foundation appeared unworthy the majesty of the Roman people, the senate, to enable the ceremony, converted Florea into a goddess, whom they supposed to preside over flowers; and so made it a part of religion to render her propitious, that it might be well with their gardens, vineyards, &c. But Vossius (de Idol. lib. i. c. 12.) can by no means allow the goddess Florea to have been the corzeant above mentioned: he will rather have her a Sabine deity, and thinks her worship might have commenced under Romulus. His reason is, that Varro, in his fourth book of the Latin tongue, ranks Florea among the deities to whom Titus king of the Sabines offered up vows before he joined battle with the Romans. Add, that from another passage in Varro it appears, that there were priests of Florae, with sacrifices, &c. as early as the times of Romulus and Numae.

The goddess Florea was, according to the poets, the wife of Zephyrus. Her image in the temple of Castor and Pollux was dressed in a close habit, and she held in her hand the flowers of peas and beans: but the modern poets and painters have been more lavish in investing her charms, considering that no part of nature offers such innocent and exquisite entertainment to the sight and smell, as the beautiful variety which adorns, and the odour which embalms, the floral creation.

Floreales Ludii, or Floral Games, in antiquity, were games held in honour of Florea, the goddess of flowers. They were celebrated with shameful debaucheries. The most licentious discourses were not enough, but the courtesans were called together by the sound of a trumpet, made their appearance naked, and entertained the people with indecent shows and postures: the comedians appeared after the same manner on the stage. Val. Maximus relates, that Catullus being once present in the theatre on this occasion, the people were ashamed to ask for such immodest representations in his presence; till Catullus, appeared of the reservedness and respect with which he inspired them, withdrew, that the people might not be disappointed of their accustomed diversion. There were several other sorts of shows exhibited on this occasion; and, if we may believe Sextus in Callio, c. 6. and

Vapianus in Caesaris, these princes presented elephants dancing on ropes on these occasions.

The ludi florales, according to Pliny, lib. xiv. c. 19., were instituted by order of an oracle of the Sibyls, on the 28th of April; not in the year of Rom. 161, as we commonly read it in the ancient editions of that author; nor in 164, as F. Harduin has corrected it, but, as Vossius reads it, in 163: though they were not regularly held every year till after 500. They were chiefly held in the night time, in the Patrician street: some will have it there was a circus for the purpose on the hill called Hortulorum.

Floralia, in antiquity, a general name for the feasts, games, and other ceremonies, held in honour of the goddess Florea. See Florea and Floreales Ludii.

Florence, the capital of the duchy of Tuscany, and one of the finest cities in Italy. It is surrounded on all sides but one with high hills, which rise insensibly, and at last join with the lofty mountains called the Apennines. Towards Pisa, there is a vast plain of 40 miles in length; which is so filled with villages and pleasure houses, that they seem to be a continuation of the suburbs of the city. Independent of the churches and palaces of Florence, most of which are very magnificent, the architecture of the houses in general is in a good taste; and the streets are remarkably clean, and paved with large broad stones chiseled so as to prevent the horses from sliding. The city is divided into two unequal parts by the river Arno, over which there are no less than five bridges in sight of each other. That called the Ponte della Trinità, which is uncommonly elegant, is built entirely of white marble, and ornamented with four beautiful statues representing the Seasons. The quays, the buildings on each side, and the bridges, render that part of Florence through which the river runs by far the finest. Every corner of this beautiful city is full of wonders in the arts of painting, statuary, and architecture. The streets, squares, and fronts of the palaces, are adorned with a great number of statues; some of them by the best modern masters, Michael Angelo, Bandinelli, Donatello, Giovanni di Bologna, Benvenuto Cellini, and others. Some of the Florentine merchants formerly were men of vast wealth, and lived in a most magnificent manner. One of them, about the middle of the fifteenth century, built that noble fabric, which, from the name of its founder, is still called the Palazzo Pitti.

The man was ruined by the prodigous expense of this building, which was immediately purchased by the Medici family, and has continued ever since to be the residence of the sovereigns. The gardens belonging to this palace are on the declivity of an eminence. On the summit there is a kind of fort, called Bobbacc. From this, and from some of the higher walks, you have a complete view of the city of Florence, and the beautiful vale of Arno, in the middle of which it stands. This palace has been enlarged since it was purchased from the ruined family of Pitti. The furnitures is rich and curious, particularly some tables of Florentine work, which are much admired. The most precious ornaments, however, are the paintings. The walls of what is called the Imperial Chamber, are painted in fresco, by various painters; the subjects are allegorical, and in honour of Lorenzo de Medici, distinguished.
Florence, an ancient piece of English gold coin. Every pound weight of standard gold was to be coined into 50 Florences, to be current at six shillings each; all which made in tail 15 pounds; or into a proportionate number of half Florences, or quarter pieces, by indenture of the mint: 16 Edw. III.

Florentia, in Ancient Geography, a town of Etruria, on the Arno; of great note in Sulla’s wars. Now called Firenze or Firenze by the Italians; Florence in English. E. Long. 11. Lat. 43. 30.

Florentine marble. See Citadinesca.

Florescentia (from floresco, “to flourish or bloom”); the act of flowering, which Linnaeus and the sexualists compare to the act of generation in animals; as the ripening of the fruit in their opinion resembles the birth. See Flower.

The Florentine style is one too much enriched with figures and flowers of rhetoric.

Florida, a province of North America, bounded on the south by the gulf of Mexico, on the north by Georgia and Alabama, on the east by the sea, and on the west by Alabama. It was first discovered, in 1497, by Sebastian Cabot, a Venetian, then in the English service; whereas a right to the country was granted by the kings of England; and this province, as well as Georgia, was included in the charter granted by Charles II. to Carolina.
Florida. In 1513, however, Florida was more fully discovered by Ponce de Leon, an able Spanish navigator, but who undertook his voyage from the most absurd motives that can be well imagined.—The Indians of the Caribbean islands had among them a tradition, that somewhere on the continent there was a fountain whose waters had the property of restoring youth to all old men who tasted them. Ponce de Leon, who set out with this extravagant view as well as others, rediscovered Florida; but returned to the place from whence he came, visibly more advanced in years than when he set out. For some time this country was neglected by the Spaniards, and some Frenchmen settled in it: But by orders of Philip II. of Spain, a force was fitted out; the French intrusions were forced, and most of the people killed. The prisoners were hanged on trees; with this inscription, "Not as Frenchmen, but as Heretics."

This cruelty was soon after revenged by Dominico de Gourgues, a skilful and intrepid seaman of Gascony, an enemy to the Spaniards, and passionately fond of hazardous expeditions and of glory. He had his vessel built with this body of adventurers like himself embarked for Florida. He drove the Spaniards from all their posts with incredible valour and activity; defeated them in every encounter: and by way of retaliation, hung the prisoners on trees; with this inscription, "Not as Spaniards, but as Assassins." This expedition was attended with no other consequences; Gourgues blew up the forts he had taken, and returned home, where no notice was taken of him. It was conquered in 1539 by the Spaniards under Ferdinand de Soto, not without a great deal of bloodshed; as the natives were very warlike and made a vigorous resistance. The settlement, however, was not fully established till the year 1565; when the town of St Augustine, the capital of the colony while it remained in the hands of the Spaniards, was founded. In 1586, this place was taken and pillaged by Sir Francis Drake. It met with the same fate in 1605, being burnt and plundered by Captain Davis and a body of buccaneers. In 1702, an attempt was made upon it by Colonel More, governor of Carolina. He set out with 500 English and 700 Indians: and having reached St Augustine, he besieged it for three months; at the expiration of which, the Spaniards having sent some ships to the relief of the place, he was obliged to retire. In 1740 another attempt was made by General Ogilthorpe; but he being outwitted by the Spanish governor, was forced to raise the siege with loss; and Florida continued in the hands of the Spaniards till the year 1765, when it was ceded by treaty to Great Britain.—During the American war, which terminated in 1783, it was again reoccupied by his Catholic majesty, and it remained subject to Spain till 1818, when General Jackson alleging that support had been given by the Spaniards to some hostile Indian tribes, seized Pensacola and St Marks, the only fortified posts in the country except St Augustine. The province was since ceded by treaty to the United States, and the treaty after much delay has at length been ratified (1821.)

Florida is about 400 miles in length, from north to south, and occupies an area of about 50,000 square miles. The country is in general flat, and without hills. The soil is good, but overrun with pines and brushwood. The climate is considered better than that of the neighbouring state of Georgia. The whole white inhabitants and slaves probably do not exceed 25,000 or 25,000. See Florida, Supplement.

FLORILEGIUM, Florilegium, a name the Latins have given to what the Greeks call συλλογὴ, συλλογία; viz. a collection of choice pieces, containing the finest and brightest things in their kind.

FLORILEGIUM, is also particularly used for a kind of breviary, in the Eastern church, compiled by Arcadius, for the convenience of the Greek priests and monks, who cannot carry with them, in their travels and pilgrimages, all the volumes wherein their office is dispersed. The florilegion contains the general rubrics, psaltries, canticles, the horologium, and the office of the feria, &c.

FLORIN, is sometimes used for a coin, and sometimes for a money of account.

FLORIN, as a coin, is of different values, according to the different metals and different countries where it is struck. The gold florins are most of them of a very coarse alloy, some of them not exceeding thirteen or fourteen carats, and none of them seventeen and a half. See Money Table.

FLORIN, as a money of account, is used by the Italian, Dutch, and German merchants and bankers, but admits of divisions in different places. Ibid.

FLORINIANI, or Floriani, a sect of heretics, of the second century, denominated from its author Florius, or Florianus, a priest of the Roman church, deposed along with Blasius for his errors. Florius had been a disciple of St Polycarp, along with Irenæus. He made God the author of evil; or rather asserted, that the things forbidden by God are not evil, but of his own appointing, in which he followed the errors of Valentine, and joined himself with the Carpocratians. They had also other names given them. Porphyrus says, they were the same with the Carpocratians. He adds that they were also called Sabellians, gens de militaribus fuerunt. St Irenæus calls them Geminiotes; St Epiphanius Philobismes; and Theodoret, Barbarotes, on account of the impurities of their lives. Others call them Zaccheans; others Codians, &c. though for what particular reasons, it is not easy to say, nor perhaps would be worth while to inquire.

FLORIS, Francis, an eminent historical painter, was born at Antwerp in 1528. He followed the profession of a statuary till he was twenty years of age; when preferring painting, he entered the school of Lambert Lombard, whose manner he imitated very perfectly. He afterwards went to Italy, and completed his studies from the most eminent masters. The great progress he made in historical painting, at his return procured him much employment; and his countrymen complimented him with the flattering appellation of the Flemish Raphael. He got much money, and might have rendered his acquaintance more worthy of the attention of the great, had he not debased himself by frequent drunkenness. He died in 1590, aged 50.

FLORIST, a person curious or skilled in flowers: their kinds, names, characters, culture, &c. It is also applied to an author who writes what is called the Floris
flora of any particular place, that is, a catalogue of the plants and trees which are found spontaneously growing there.

FLORUS, LUCIUS ANNAEUS, a Latin historian, of the same family with Seneca and Lucan. He flourished in the reigns of Trajan and Adrian; and wrote an abridgment of the Roman history, of which there have been many editions. It is composed in a florid and poetical style; and is rather a panegyric on many of the great actions of the Romans, than a faithful and correct recital of their history. He also wrote poetry, and entered the lists against the emperor Adrian, who satirically reproached him with frequenting taverns and places of dissipation.

FLORY, FLOWERY, or Florey, in Heraldry, a cross that has flowers at the end circumflex and turning down; different from the potentia, in as much as the latter stretches out more like that which is called patera.

FLOS, FLOWER. See Flower, Botany Index.

Flaminus Flos, a flower which is furnished with the pointal or female organs of generation, but wants the stamens or male organ. Female flowers may be produced apart from the male, either on the same root or on distinct plants. Birch and mulberry are examples of the first case, willow and poplar of the second.

Maculatus Flos, a male flower. By this name Linnaeus and the sexualists distinguish a flower which contains the stamens, reckoned by the sexualists the male organ of generation; but not the stigma or female organ. All the plants of the class dioecia of Linnaeus have male and female flowers upon different roots; those of the class monoeccia bear flowers of different sexes on the same root. The plants, therefore, of the former are only male and female: those of the latter are androgynous; that is, contain a mixture of both male and female flowers.

Flos, in Chemistry, the most subtle part of bodies, separated from the more gross parts by sublimation in a dry form.

FLOTA, or Flotta, fleet; a name the Spaniards give particularly to the ships which they send annually from Cadiz to the port of Vera Cruz, to fetch thence the merchandizes gathered in Mexico for Spain. It consists of the native, admiral, and patach, or fiction, which go on the king's account; and about 15 ships, from 400 to 1000 tons, belonging to particular persons. They set out from Cadiz about the month of August, and are 18 or 20 months before they return. Those sent to fetch the commodities prepared in Peru are called galleons.

The name flottilla is given to a number of ships which get before the rest in their return, and give information of the departure and cargo of the flota and galleons.

FLOTSON, or Flotsson, goods that by ship-wreck are lost, and floating upon the sea; which, with jetson and lagon, are generally given to the lord admiral; but this is the case only where the owners of such goods are not known. And here it is to be observed that jetson signifies any thing that is cast out of a ship when in danger, and afterwards is cast on the shore by the water, notwithstanding which the ship perishes. Lagon is where heavy goods are thrown overboard, before the wreck of the ship, and sink to the bottom of the sea.

FLOUNDER, FLUKE, or BUT. See Pleuronectes, Ichthyology Index.

Flounders may be fished for all day long, either in a swift stream, or in the still deep water; but best in the stream, in the mouths of April, May, June, and July; the most proper baits are all sorts of worms, wrasps, and gentles.

FLOUR, the meal of wheat-corn, finely ground and sifted. See Meal.

The grain itself is not only subject to be eaten by insects in that state; but, when ground into flour, it gives birth to another race of destroyers, who eat it unmercifully, and increase so fast in it, that it is not long before they wholly destroy the substance. The finest flour is most liable to breed these, especially when stale or ill prepared. In this case, if it be examined in a good light, it will be observed to be in continual motion, and on a nicer inspection there will be found in it a great number of little animals of the colour of the flour, and very nimble. If a little of this flour is laid on the plate of the double microscope, the insects are very distinctly seen in great numbers, very brisk and lively, continually crawling over one another's backs, and playing a thousand little tricks together; whether in diversion or in search of food, it is not easy to determine. These animals are of an oblong and slender form; their heads are furnished with a kind of trunk or hollow tube, by means of which they take in their food, and their body is composed of several rings. They do vast mischief among magazines of flour laid up for armies and other public uses. When they have once taken possession of a parcel of this valuable commodity, it is impossible to drive them out; and they increase so fast, that the only method of preventing the total loss of the parcel is to make it up into bread as soon as can be done. The way to prevent their breeding in the flour is to preserve it from damp: nothing gets more injury by being put up damp than flour; and yet nothing is more frequently put up so. It should be always carefully and thoroughly dried before it is put up, and the barrels also dried into which it is to be put; then, if they are placed in a room tolerably warm and dry, they will keep it well. Too dry a place never does flour any hurt, though one too moist almost always spoils it.

Flour, when carefully analyzed, is found to be composed of three very different substances. The first and most abundant is pure starch, or white fæcule, insoluble in cold, but soluble in hot water, and of the nature of mucous substances; which, when dissolved, form water glues. The second is the gluten, most of whose properties have been described under the article Bread. The third is of a mild nature, perfectly soluble in cold water, of the nature of saccharina, extractive mucous matters. It is susceptible of the spirituous fermentation, and is found but in small quantity in the flour of wheat. See Bread, Gluten, STARCH, and Sugar, Chemistry Index.

FLOWER, FLOS, among botanists and gardeners, the most beautiful part of trees and plants, containing the organs or parts of fructification. See Botany Index.
Flowers. Designed for medical use, should be plucked when they are moderately blown, and on a clear day before noon; for as roses, must be taken in the bud.

Flowers, in antiquity. We find flowers in great request at the entertainments of the ancients, being provided by the master of the feast, and brought in before the second course; or, as some are of opinion, at the beginning of the entertainment. They not only adorned their heads, necks, and breasts, with flowers, but often bestroved the beds whereon they lay, and all parts of the room with them. But the head was chiefly regarded. See Garland.

Flowers were likewise used in the bedecking of tombs. See Burial.

 Eternal Flower. See Xeranthemum.
 Everlasting Flower. See Gaphalium.
 Flower-Pin. See Poiciana.
 Sun-Flower. See Helianthus.
 Trumpet-Flower. See Edora.
 White Flower. See Anemone.

Flower-de-lis, or Flower-de-luce, in Heraldry, a bearing representing the lily called the queen of flowers, and the true hieroglyphic of royal majesty; but of late it is become more common, being borne in some coats one, in others three, in others five, and in some more spread all over the escutcheon in great numbers. The arms of France are, three flowers-de-lis or, in a field azure. See Iris.

Flower-de-luce. See Iris, Botany Index.

Flowers, in Heraldry. They are much used in coats of arms; and in general signify hope, or denote human frailty and momentary prosperity.

Flowers, in Chemistry. By this name are generally understood bodies reduced into very fine parts, either spontaneously, or by some operation of art; but the term is chiefly applied to volatile solid substances, reduced into very fine parts, or into a kind of meal by sublimation. Some flowers are nothing else than the bodies themselves, which are sublimed entire, without suffering any alteration or decomposition; and other flowers are some of the constituent parts of the body subjected to sublimation.

Colours of Flowers. See the article Colour (of Plants.)


Preserving of Flowers. The method of preserving flowers in their natural beauty through the whole year has been much sought after by many people. Some have attempted it by gathering them when dry and not too much opened, and burying them in dry sand; but this, though it preserves their figure well, takes off from the liveliness of their colour. Montignius prefers the following method to all others. Gather roses, or other flowers, when they are not yet thoroughly open, in the middle of a dry day; fill the vessel up to the top with them; and when full sprinkle them over some good French wine, with a little salt in it; then set them by in a cellar, tying down the mouth of the pot. After this they may be taken out at pleasure; and, setting them in the sun, or within reach of the fire, they will open as if growing natural-ly; and not only the colour, but the smell also will be preserved.

The flowers of plants are by much the most difficult parts of them to preserve in any tolerable degree of perfection; of which we have instances in all the collections of dried plants, or Horti sicci. In these the leaves, stalks, roots, and seeds of the plants, appear very well preserved; the strong texture of these parts making them always retain their natural form, and the colours in many species naturally remaining. But where these fade, the plant is little the worse for use as to the knowing the species by it. But it is very much otherwise in regard to flowers; these are naturally by much the most beautiful parts of the plants to which they belong; but they are so much injured in the common way of drying, that they not only lose, but change their colours one into another, by which means they give a handle to many errors; and they usually also wither up, so as to lose their very form and natural shape. The primrose and cowslip kinds are very eminent instances of the change of colour in the flowers of dried spec-

ies; for those of this class of plants easily dry in their natural shape; but they lose their yellow, and, instead of it, acquire a fine green colour, much superior to that of the leaves in their most perfect state. The flowers of all the violet kind lose their beautiful blue, and become of a dead white; so that in dried specimens there is no difference between the blue-flowered violet and the white-flowered kinds.

Sir Robert Southwell has communicated to the world a method of drying plants, by which this defect is proposed to be in a great measure remedied, and all flowers preserved in their natural shape, and many in their natural colours.—For this purpose two plates of iron are to be prepared of the size of a large half sheet of paper, or larger, for particular occasions; these plates must be made so thick as not to be apt to bend; and there must be a hole made near every corner for receiving a screw to fasten them close together. When these plates are prepared, take some goodness several sheets of paper, and then gather the plants with their flowers when they are quite perfect. Let this be always done in the middle of a dry day; and then lay the plant and its flower on one of the sheets of paper doubled in half, spreading out all the leaves and petals as nicely as possible. If the stalk is thick, it must be pared or cut in half, so that it may lie flat; and if it is woody, it may be peeled, and only the bark left. When the plant is thus expanded, lay round about it some loose leaves and petals of the flower, which may serve to complete any part that is deficient. When all is thus prepared, lay several sheets of paper over the plant, and as many under it; then put the whole between the iron plates, laying the papers smoothly one on one, and laying the other evenly over them; screw them close, and put them into an oven after the heat is drawn, and let them lie there two hours. After that, make a mixture of equal parts of aquafortis and common brandy; shake these well together, and when the flowers are taken out of the pressure of the plates, rub them lightly over with a camel's hair pencil dipped in this liquor; then lay them upon fresh brown paper, and covering them with some other sheets, press them between this and other papers with a handkerchief till...
the wat of these liquors is dried wholly away. When
the plant is thus far prepared, take the bulk of a nut-
meg of gum dragon; put this into a pint of fair water
cold, and let it stand 24 hours; it will in this time be
wholly dissolved: then dip a fine hair pencil in this
liquor, and with it daub over the back sides of the
leaves, and lay them carefully down on half a sheet of
white paper fairly expanded, and press them down with
some more papers over these. When the gum-
water is fixed, let the presser and papers be removed,
and the whole work is finished. The leaves retain their
verdure in this case, and the flowers usually keep
their natural colours. Some care, however, must be
taken, that the heat of the oven be not too great.
When the flowers are thick and bulky, some art may
be used to pare off their backs, and dispose the petals
in a due order; and after this, if any of them are
wanting, their places may be supplied with some of
the supernumerary ones dried on purpose; and if any
of them are only faded, it will be prudent to take
them away, and lay down others in their stead: the
leaves may be also disposed and medled in the same
manner.

Another method of preserving both flowers and fruit
found throughout the whole year is also given by the
same author. Take saltpetre, one pound; Armenian
buck, two pounds; clean common sand, three pounds;
mix all well together. Then gather fruit of any kind
that is not fully ripe, with the stalk to each; put these
in, one by one, into a wide-mouthed glass, laying
them in good order. Tie over the top with an oil-
cloth, and carry them into a dry cellar, and set the
whole upon a bed of the prepared matter of four inches
thick in a box. Fill up the remainder of the box with
the same preparation; and let it be four inches thick,
all over the top of the glass, and all round its sides.
Flowers are to be preserved in the same sort of glasses,
and in the same manner: and they may be taken up
after a whole year as plump and fair as when they were
buried.

Artificial Flowers of the Chinese. See Tong-
trao.

FLOWERS, in the animal economy, denote women's
monthly purgations or menes. Niceri derives the
word in this sense, from flum, q. d. flum. Others
will have the same occasion hence, that women do
not conceive till they have bad their flowers; so that
these are a sort of forerunners of their fruit.

FLOWERS, in Rhetoric, are figures or ornaments of
discourse, by the Latins called floeculi.

FLOWERING of Bulbous Plants. These plants
will grow and flower in water alone, without any earth,
and make a very elegant appearance. We daily see
this practised in single roots; but there is a method
of doing it with several roots in the same vessel. Take
a common small garden pot; stop the hole at the bot-
tom with a cork, and lute in the cork with putty
so water can get through; then fit a board to the top
of the pot, and bore six or seven holes in it at equal
distances, to place the bulbs in; and as many smaller
ones nearer them to receive sticks, which will serve to
tie up the flowers. Then fill up the pot with water to
the board; and place tulips, jackdaws, narcissuses, and
the like plants in the root upon the holes, so that the
bottom of the roots may touch the water; thus will
they all flower early in the season, and be much more
beautiful than any pot of gathered flowers, and will
last many weeks in their full perfection. After the
season of flowering is over, the roots will gradu-
ally shrink through the holes of the board, and get loose
into the water: but, instead of being spoiled there, they
will soon increase in size; so that they cannot return
through the holes, and will produce several offsets.
It is natural to try from this the consequence of keeping
the roots under water during the whole time of their
blowing: and in this way they have been found to
succeed very well, and flower even stronger and more
beautifully than when in the ground. They may thus,
also, with proper care in the degree of heat in the
room, be kept flowering from before Christmas till
March or April. It is not easy, in this last manner,
to manage the keeping the boards under water, for
which reason it is better to procure some sheet-lead of
about four pounds to the foot, and cut this to the size
of the mouth of the pot. In this there should be bored
holes for the bulbs, and other holes for the sticks:
and, in order to keep the sticks quite firm, it is pro-
per to have another plate of lead shaped to the bottom
of the pot, with holes in it, answering to those of the
upper plate made for the sticks. The sticks will in
this means be always kept perfectly steady, and the
roots, being kept under water by the upper plate of
lead, will flower in the most vigorous and beautiful
manner imaginable. Some have thought of adding to
the virtues of the water by putting in nitre in small
quantities, and others have added earth and sand at
the bottom; but it has always been found to succeed
better without any addition.

It may be more agreeable to some to use glass jars
in this last method with the leads, instead of earthen
pots. The bulbs succeed full as well in these; and
there is this advantage, that the progress of the roots
is seen all the while, and they are managed better as to
the supply of water.

By repeated experiments in this way on dried bulbs,
and on those taken fresh out of the ground, the former
have been found to succeed the best. For those taken
fresh out of the ground being full of moisture, will not
so soon, upon changing their element, be nourished
fully by a new one; and the fibres which they had
struck in the ground, always rot when put into the wa-
ter, and new ones must be formed in their places; so
that it requires more time for them to come to flow-
ering. The bulbs themselves will not rot in this man-
nner; but they will never be so strong as those which
were put into the water dry, which gradually fill
themselves with moisture from it, and regularly plump
up. The best method of managing the whole proc-
есс is this: Place the bulbs at first only on the surface
of the water; for thus they will strike out their
fibres most strongly. When they have stood six
weeks, pour in the water so high as to cover them
totally, and keep them thus till they have done
flowering.

Sometimes the roots will become mouldy in several
parts while they stand above the water, and the clean-
ing them of it is to no purpose; for it will eat and
spread the further, and frequently eat through two or
three of their coats. In this case they must be imme-
diately covered with water; when the mould will be
stopped,
Flowering, stopped, and the roots become sound, and flower as well as those which never had any such distemper. If the roots are suffered to remain in water all the year, they will not decay; but will flower again at their proper season, and that as vigorously as those which have been taken out and dried. The old fibres of those roots never rot till they are ready to push forth new ones. It is found by experience, that the hyacinth, and many other plants, grow to a greater degree of perfection when thus in water than when in the ground. There is a peculiar species of hyacinth called Keay's Jewel; this never, or very rarely, produces seed-vessels in the common way of flowering in the ground; but it will often produce some pods when blown in water.

Mr. Miller has intimated, in the Philosophical Transactions, that bulbs set in glasses grow weaker, and should be renewed every other year: but it is found, that, when managed in this manner, and kept under water, at the time of taking them up, they are as large, and some of them larger, than when planted; and if these be dried at a proper season, they will flower, year after year, as well as fresh ones.

Ranunculus and anemone roots have been found to shoot up their stalks very well in this way; but the flowers are usually blasted, which seems to arise from want of free air. Pink will flower very well in this manner; auriculas also may, with care, be brought to flower, but not strongly. Roses, jessamines, and honeysuckles, may also be made to flower this way, and will thrive and send out suckers; the best pieces to plant, are suckers cut off from the plant. Some pansies are rooted from cuttings of a similar kind. Some bulbs have been grown in this manner, without any fibres. The succulent plants may also be raised this way; for instance, the opuntia or Indian fig. If a fragment of a leaf of this plant be cut, and laid by to dry for a month till it is an absolute skin, as soon as it is put in this manner into water, it begins to plump up, and soon sends out fibrous roots, and produces new leaves as quickly as it would do in the ground.

This is the more singular in these sorts of plants, because in their natural state in the ground, they cannot bear much water. This method of growing in water is not peculiar to the bulbous-rooted ones, but others may even be raised from seed by it. A bean or pea, set in this manner, will grow up to its proper standard, and will flower and produce pods which will ripen their seed. The smaller seeds may be also raised in this manner, by the help of wool to support them.

No vegetable transplanted out of the earth into water will thrive kindly; but any plant, whether raised from the root or seed in water, may be transplanted to the earth, and will succeed very well. It may be possible, therefore, from this method of raising plants in water, to come at a better way than is usually practised of raising some roots in the earth which are to be kept to rot thereof, such as anemones, ranunculuses, and hyacinths. A bulb dropped by chance upon the ground, will strike out both stronger and more numerous fibres than those which are planted in the usual way in the ground. On this principle, it may be proper to take out the earth of the bed where the bulbs are to stand at the time of planting them, to such a depth as they are to be placed under it when set for flowering. The bulbs are then to be set in their flowering places, on the surface of this low ground; and to stand there till they have shot out their fibres and their head: then the earth is to be added over them by degrees, till they are covered as high above the head as they are in the usual manner of planting them; thus they would be preserved from the danger of rotting; and their fibres would be much stronger, and consequently they would draw more nourishment, and flower better than in the common way. The common method of planting these roots renders them liable to be destroyed by either extremes of a wet or a dry season. In the first case, the bulbs are discharged from moisture they receive; and, in the second, they become dry as a stick and moulder, so that they are insensibly rotted by the first rain that falls afterwards.

The directions necessary to the success of the bulbs planted in water are these. When the leads false bottoms are fixed down tight within two or three inches of the bottom of the vessel (which is only designed to hold the sticks steady which are to support the leaves and stalks), then lay on the lead upon which the bulbs are to rest, placing the notched part opposite to that in the false bottom, as near as the sticks, when placed, will suffer it; then place the bulbs one in each hole, and fill up with water to the upper lead. The bottom of the bulb will then touch the water; and as the water diminishes in quantity, keep it supplied with more up to the same height for a month or six weeks; in which time the bulbs will have shot strong fibres. Then fill up the water about half an inch above the surface of the lead; and by degrees, as the fibres strengthen, and the plumes shoots from the head, keep the water higher and higher, till at length the whole bulb is covered. The water is to be kept at this standard till the season for drawing them returns.

At the time of planting the bulbs, they must be carefully cleaned from any fouling at the bottom by scraping them with the point of a knife till the sound part of the bulb appears; clear them likewise from any loose skins, and even take off their brown skin till they appear white; otherwise this brown skin will tinge the water, and the growth will not succeed so well.

The notches in the side of each lead are intended to give easy passage to the water, that, if there should be any fouling or sediment in it, on shaking it a little it may all run through, and fresh water be put in its place. But this shifting the water need not be done more than once or twice in a winter, as there may be occasion from the fouling; and when this is done, the sides of the vessel should be cleaned with a painter's brush, and rinsed out again, and the bulbs themselves washed, by pouring water on them at a little distance.

At any time when the outer skins of the bulbs dry, they are to be peeled off, that they may not occasion fouling in the water; and if any dust or foul matter be at any time observed swimming on the surface, the method is to fill up the pot or vessel to the rim, and let it run over: this will carry off that light fouling, and the water may afterwards be poured away to the proper standard.

Bulbs of equal bigness should be planted together in the
FLUENT, or FLOWING QUANTITY, in the doctrine of fluxions, is the variable quantity which is considered as increasing and decreasing; or the fluent of a given fluxion, is that quantity whose fluxion being taken, according to the rules of that doctrine, shall be the same with the given fluxion. See FLUXIONS. See also FLUENTS, SUPPLEMENT.

FLUID, an appellation given to all bodies whose particles easily yield to the least partial pressure, or force impressed. For the Laws and Properties of FLUIDS, see HYDRODYNAMICS in this work; and FLUIDS, ELEVATION OF, in the SUPPLEMENT.

There are various kinds of animalcles to be discerned in different fluids by the microscope. Of many remarkable kinds of these, a description is given under the article ANIMALCULE. All of these little animals are easily destroyed by separating them from their natural element. Naturalists have even fallen upon shorter methods. A needle point, dipped in spirit of vitriol, and then immersed into a drop of pepper water, readily kills all the animalcles: which, though before frisking about with great liveliness and activity, no sooner come within the influence of the acid particles, than they spread themselves, and tumble down to all appearance dead. The like may be done by a solution of salt; only with this difference, that, by the latter application, they seem to grow vertiginous, turning round and round till they fall down. Tincture of salt of tartar, used in the same manner, kills them still more readily; yet not so, but there will be apparent marks of their first being sick and convulsed. Inks destroy them as fast as spirit of vitriol, and human blood produces the same effect. Urine, sack, and sugar all destroy them, though not so fast; besides, that there is some diversity in their figures and appearances, as they receive their deaths from this poison or that. The point of a pin dipped in spittle, presently killed all the kinds of animalcles in puddle water, as Mr Harris supposes it will other animalcles of this kind.

All who are acquainted with microscopic observations, know very well, that in water, in which the best glasses can discover no particle of animated matter, after a few grains of pepper, or a fragment of a plant of almost any kind, has been some time in it, animals full of life and motion are produced; and those in such numbers, as to equal the fluid itself in quantity. When we see a numerous brood of young fishes in a pond, we make no doubt of their having owed their origin to the spawn, that is, to the eggs of the parents of the same species. What are we then to think of these? If we will consider the progress of nature in the insect tribes in general, and especially in such of them as are most analogous to these, we shall find it less difficult to give an account of their origin than might have been imagined.

A small quantity of water taken from any ditch in the summer months, is found to be full of little worms, seeming in nothing so much as in size to differ from the microscopic animalcles. Nay, water, without these, exposed in open vessels to the heat of the weather, will be always found to abound with multitudes of them, visible to the naked eye, and full of life and motion. These we know, by their future changes, are the fly worms of the different species of grutes, and multitudes of other fly species; and we can easily determine, that they have owed their origin only to the eggs of the parent fly there deposited: Nay, a closer observation will at any time give ocular proof of this; as the flies may be seen laying their eggs there, and the eggs may be followed through all their changes to the fly again. Why then are we to doubt but that the air abounds with other flies and animalcles as minute as the worms in those fluids; and that these last are only the fly worms of the former, which, after a proper time spent in that state, will suffer changes like those of the larger kinds, and become flies like those to whose eggs they owed their origin? Vid. Reaumur, Hist. Insect. vol. iv. p. 431.

The differently medicated liquors made by infusions of different plants, afford a proper matter for the worms of different species of these small ones: and there is no reason to doubt, but that among these some are viviparous, others oviparous; and to this may be, in a great measure, owing the different time taken up for the production of these insects in different fluids. Those which are a proper matter for the worms of the viviparous fly, may be soonest found full of them; as, probably the liquor is no sooner in a state to afford them,
FLU. These cannot be the effects of imagination, or of faults in our eyes, because they appear the same to all. For and if we consider what would be the case to an eye formed in such a manner as to see nothing smaller than an ox, on viewing the air on a marsh fully peopled with gnats, we must be sensible that the clouds of these insects, though to us distinctly enough visible, would appear to such an eye merely as the moving parcels of air in the former instance do to us: and surely it is thence no rash conclusion to infer, that the case may be the same, and that myriads of flying insects, too small to be singly the objects of our view, yet are to us what the cloud of gnats would be in the former case.

Nervous Fluid. See Anatomy Index.
Elastic Fluids. See Chemistry Index.

FLUIDITY, is by Sir Isaac Newton defined to be, that property of bodies by which they yield to any force impressed, and which have their parts very easily moved among one another.

To this definition some have added, that the parts of a fluid are in a continual motion. This opinion is supported by the solution of salts, and the formation of tinctures. If a small bit of saffron is thrown into a phial full of water, a yellow tincture will soon be communicated to the water to a considerable height; though the phial is allowed to remain at rest; which indicates a motion in those parts of the fluids which touch the saffron, by which its colouring matter is carried up.

With regard to water, this can scarce be denied; the constant exhalations from its surface show, that there must be a perpetual motion in its parts from the ascent of the steam through it. In mercury, where insensible evaporation does not take place, it might be doubted; and accordingly the Newtonian philosophers in general have been of opinion, that there are some substances essentially fluid, from the spherical figure of their impressed part, and the congelation of mercury, however, by an extreme degree of cold, demonstrates that fluidity is not essentially inherent in mercury more than in other bodies.

That fluids have vacancies in their substance is evident, because they may be made to dissolve certain bodies without sensibly increasing their bulk. For example, water will dissolve a certain quantity of salt, after which it will receive a little sugar, and after that a little alum, without increasing its first dimensions. Here we can scarce suppose any thing else than that the saline particles were interposed between those of the fluid; and as, by the mixture of salt and water, a considerable degree of cold is produced, we may hence easily see why the fluid receives these substances without any increase of bulk. All substances are expanded by heat, and reduced into less dimensions by cold; therefore, if any substance is added to a fluid, which tends to make it cold, the expansion by the bulk of the substance added will not be so much perceived as if this effect had not happened; and if the quantity added be small, the fluid will contract as much, perhaps more, from the cold produced by the mixture, than it will be expanded from the bulk of the salt. This also may let us know with what these interstices between the particles of the fluid were filled up; namely, the element of fire or heat. The saline particles, up

2
FLU

on their solution in the fluid, have occupied these spaces; and now the liquor being deprived of a quantity of this element equal in bulk to the salt added, feels sensibly colder.

As, therefore, there is scarce any body to be found, but what may become solid by a sufficient degree of cold, and none but what a certain degree of heat will render fluid; the opinion naturally arises, that fire is the cause of fluidity in all bodies, and that this element is the only essentially fluid substance in nature. Hence we may conclude, that those substances which we call fluids are not essentially so, but only assume that appearance in consequence of an intimate union with the element of fire; just as gums assume a fluid appearance on being dissolved in spirit of wine, or salts in water.

Upon these principles Dr Black mentions fluidity as an effect of heat. The different degrees of heat which are required to bring different bodies into a state of fluidity, he supposes to depend on some particulars in the mixture and composition of the bodies themselves: which becomes extremely probable, from considering that we change the natural state of bodies in this manner: when two metals are compounded, the mixture is usually more fusible than either of them separately. See Chemistry Index.

It is certain, however, that water becomes warmer by being converted into ice; which may seem contradictory to this opinion. To this, however, the doctor replies, that fluidity does not consist in the degree of sensible heat contained in bodies, which will affect the hand or a thermometer; but in a certain quantity which remains in a latent state. This opinion he supports from the great length of time required to melt ice; and to ascertain the degree of heat requisite to keep water in a fluid state, he put five ounces of water into a Florence flask, and converted it into ice by means of a freezing mixture put round the flask. Into another flask of the same kind he put an equal quantity of water cooled down nearly to the freezing point, by mixing it with snow, and then pouring it off. In this he placed a very accurate thermometer; and found that it acquired heat from the air of the room in which it was placed; seven degrees of heat were gained in the first half hour. The ice being exposed to the same degree of heat, namely, the air of a large room without fire, it cannot be doubted that it received heat from the air as fast as the water which was not frozen; but, to prevent all possibility of deception, he put his hand under the flask containing the ice, and found a stream of cold air very sensibly descending from it, even at a considerable distance from the flask; which undeniably proved, that the ice was all that time absorbing heat from the air. Nevertheless, it was not till 11 hours that the ice was half melted, though in that time it had absorbed so much heat as ought to have raised the thermometer to 140°; and even after it was melted, the temperature of the water was found scarce above the freezing point: so that as the heat which entered could not be found in the melted ice, he concluded that it remained concealed in the water, as an essential ingredient of its composition.

FLUKE, or FLOUNDER. See Pleuronectes.

FLUKE Worm. See Fasciola. Helminthology Index.

FLUKE of an Anchor, that part of it which fastens in the ground. See Anchor.

FLUMMERY, a wholesome sort of jelly made of oatmeal.

The manner of preparing it is as follows. Put three large handfuls of finely ground oatmeal to steep, for 24 hours, in two quarts of fair water: then pour off the clear water, and put two quarts of fresh water to it; strain it through a fine hair sieve, putting in two spoonfuls of orange flower water, and a spoonful of sugar: boil it till it is as thick as a hasty pudding, stirring it continually while it is boiling, that it may be very smooth.

FLUOR, in Physics, a fluid; or, more properly, the state of a body that was before hard or solid, but is now reduced by fusion or fire into a state of fluidity.

FLUOR Acid. See Fluoric Acid. Chemistry Index.

FLUOR Albica, a flux incident to women, commonly known by the name of whites. See Medicine Index.

FLUOR Spar or Blue John, called also fluxing spar, vitriol or glass spar, are minerals composed of calcareous earth united with fluoric acid. See Mineralogy Index.

FLUSHING, a handsome, strong, and considerable town of the United Provinces, in Zealand, and in the island of Walcheren, with a very good harbour, and a great foreign trade. It was put into the hands of Queen Elizabeth, for a pledge of their fidelity, and as a security for the money she advanced. It was taken by the British in the memorable ill conducted expedition of 1809, and kept some months. E. Long. 3. 32. N. Lat. 51. 26.

FLUTE, an instrument of music, the simplest of all those of the wind kind. It is played on by blowing it with the mouth; and the tones or notes are changed by stopping and opening the holes disposed for that purpose along its side.

This is a very ancient instrument. It was at first called the flute à bec, from bec, the old Gaulish word signifying the beak of a bird or fowl, but more especially of a cock; the term flute à bec must therefore signify the beaked flute; which appears very proper, on comparing it with the traverse or German flute. The word flute is derived from flauto, the Latin for a lamprey or small eel taken in the Sicilian seas, having seven holes immediately below the gills on each side, the precise number of those in the front of the flute.

By Mersennus this instrument is called the fistula ductis seu Anglico; the lowest note, according to him, for the treble flute, is C flat, and the compass of the instrument 15 notes. There is however, a flute known by the name of the concert flute, the lowest note of which is F. Indeed, ever since the introduction of the flute into concerts, the lowest note of the instrument, of what size soever it is, has been called F; when in truth its pitch is determinable only by its correspondence in respect of acuteness or gravity with one or other of the chords in the scala maxima or great system.

Besides the true concert flute, others of a less size were soon introduced into concerts of violins; in which case the method was to write the flute part in a key correspondent
correspondent to its pitch. This practice was introduced in 1710 by one Woodcock, a celebrated performer on this instrument, and William Babell organist of the church of All-Hallows, Bread Street, London. They failed, however, in procuring for the flute a reception into concerts of various instruments; for which reason one Thomas Stanesby, a very curious maker of flutes and other instruments of the like kind, about the year 1732, adverted to the scale of Mersennius, in which the lowest note was C, invented what he called the new system; in which, by making the flute of such a size as to be a fifth above concert pitch, the lowest note became C solet a ut. By this contrivance the necessity of transposing the flute part was taken away; for a flute of this size, adjusted to the system above mentioned, became an octave to the violin. To further this invention of Stanesby’s, one Lewis Merci, an excellent performer on the flute, published about the year 1735, six solos for this instrument, three of which are said to be accommodated to Mr Stanesby’s new system; but the German flute was now become a favourite instrument, and Stanesby’s ingenuity failed of its effect.—One great objection indeed lies against this instrument, which, however, equally affects all perforated pipes; namely, that they are never perfectly in tune, or cannot be made to play all their notes with equal exactness. The utmost that the makers of them can do is to tune them to some one key; as the hautboy to C, the German flute to D, and the English flute to F; and to effect this truly, is a matter of no small difficulty. The English flutes made by the younger Stanesby came the nearest of any to perfection; but those of Bressan, though excellent in their tone, are all too flat in the upper octave. For these reasons some are induced to think, that the utmost degree of proficiency on any of those instruments is not worth the labour of attaining it.

German flute, is an instrument entirely different from the common flute. It is not, like that, put into the mouth to be played; but the end is stopp’d with a tampon or plug, and the lower lip is applied to a hole about two inches and a half or three inches distant from the end. This instrument is usually about a foot and a half long; rather bigger at the upper end than the lower; and perforated with holes, besides that for the mouth, the lowest of which is stopped and opened by the little finger’s pressing on a brass or sometimes a silver key, like those in hautboys, bassoons, &c. Its sound is exceeding sweet and agreeable; and serves as a treble in a concert.

Flute, or Fluyt, is a kind of long vessel, with flat ribs or floor timbers, round behind, and swelled in the middle; serving chiefly for the carrying of provisions in fleets or squadrons of ships; though it is often used in merchandise. The word flute, taken for a sort of boat or vessel, is derived, according to Borel, from the ancient flute, a little boat. In the verbal process of the miracles of St Catherine of Sweden, in the 12th century, we read unus equum suum una cum mercibus magni ponderis introditur super instrumentum de lignis fabricatum, vulgariter dictum flutum. Upon which the Bollandists observe, that in some copies it is read flatta, an instrument called by the Latins ratio; and that the word flatta or flotta arose from fluttered or vlotten, “to float.”

Flutes, or Flutings, in Architecture, are peculiar channels or cavities cut along the shaft of a column or pilaster. They are supposed to have been first introduced in imitation of the plasts of women’s robes; and are therefore called by the Latins strigii and ruge. The French call them cannetiers, as being excavations; and we, flutes or flutings, as bearing some resemblance to the musical instrument so called. They are chiefly affected in the Ionic order, in which they had their first rise; though they are also used in all the richer orders, as the Corinthian and Composite; but rarely in the Doric, and scarce ever in the Tuscan.

FLUX, in Medicine, an extraordinary issue or evacuation of some humour. Fluxes are various, and variously denominated, according to their seats or the humours thus voided; as a flux of the belly, uterine flux, hepatic flux, salivary flux, &c. The flux of the belly is of four kinds, which have each their respective denominations, viz. the interstine or fluxus intersticialis; the caduceus, or fluxus chylousus; the diarhoea; and the dysentery, or bloody flux. See Medicine Index.

FLUX, in Hydrography, a regular periodical motion of the sea, happening twice in 24 hours; wherein the water is raised and driven violently against the shores. The flux or flow is one of the motions of the tide; the other, whereby the water sinks and retires, is called the reflux or ebb. There is also a kind of rest or cessation of about half an hour between the flux and reflux; during which time the water is at its greatest height, called high water. The flux is made by the motion of the water of the sea from the equator towards the poles; which, in its progress, strikes against the coasts in its way, and meeting with opposition from them, swells, and where it can find passage, as in flat rivers, &c. rises up and runs into the land. This motion follows, in some measure, the course of the moon; as it rises or comes later every day by about three quarters of an hour, or more precisely by 48 minutes; and by so much is the motion of the moon slower than that of the sun. It is always highest and greatest in full moons, particularly those of the equinoxes. In some parts, as at Mount St Michael, it rises 80 or 90 feet, though in the open sea it never rises above a foot or two; and in some places, as about the Moreas, there is no flux at all. Its runs up some rivers above 120 miles. Up the river Thames it only goes 80, viz. near to Kingston in Surrey. Above London bridge the water flows four hours and ebbs eight; and below the bridge, flows five hours and ebbs seven.

FLUX, in Metallurgy, is sometimes used synonymously with fusion. For instance, an ore, or other matter, is said to be a liquid flux, when it is completely fused.

But the word flux is generally used to signify certain saline matters, which facilitate the fusion of ores and other matters, which are difficulty fusible in essays and reductions of ores; such as alkalies, nitre, burnt tartar, and common salt. But the word flux is more particularly applied to mixtures of different proportions of only nitre and tartar; and these fluxes are called by particular names, according to the proportions of these ingredients, as in the following articles.

White Flux, is made with equal parts of nitre and of tartar detonated together, by which they are alkali-
The residue of this detonation is an alkali composed of the alkalies of the nitre and of the tartar, both which are absolutely of the same nature. As the proportion of nitre in this mixture is more than is sufficient to consume entirely all the inflammable matter of the tartar, the alkali remaining after the detonation is perfectly white, and is therefore called white flux; and as this alkali is made very quickly, it is also called extemporaneous alkali. When a small quantity only of white flux is made, as a few ounces for instance, some nitre always remains undecomposed, and a little of the inflammable principle of the tartar, which gives a red or even a black colour to some part of the flux; but this does not happen when a large quantity of white flux is made; because then the heat is much greater. This small quantity of undecomposed nitre and tartar which remains in white flux is not hurtful in most of the metallic fusions in which this flux is employed: but if the flux be required perfectly pure, it might easily be disengaged from those extraneous matters by a long and strong calcination, without fusion.

Crude flux. By crude flux is meant the mixture of nitre and tartar in any proportions, without detonation. Thus the mixture of equal parts of the two salts used in the preparation of the white flux, or the mixture of one part of nitre and two parts of tartar for the preparation of the black flux, are each of them a crude flux before detonation. It has also been called white flux, from its colour; but this might occasion it to be confounded with the white flux above described. The name, therefore, of crude flux is more convenient.

Crude flux is detonated and alkaliized during the reductions and fusions in which it is employed; and it is then changed into white or black flux, according to the proportions of which it is composed. This detonation produces good effects in these fusions and reductions, if the swelling and extravasation of the detonating matters be guarded against. Accordingly, crude flux may be employed successfully in many operations; as, for instance, in the ordinary operation for procuring the regulus of antimony.

Black flux. Black flux is produced from the mixture of two parts of tartar and one part of nitre detonated together. As the quantity of nitre which enters into the composition of this flux is not sufficient to consume all the inflammable matter of the tartar, the alkali which remains after the detonation contains much black matter, of the nature of coal, and is therefore called black flux.

FLUXIONS.

INTRODUCTION.

The branch of mathematical analysis which is called in this country the Method of Fluxions, but on the continent the Differential and Integral Calculus, was invented near the end of the 17th century; and Sir Isaac Newton, and Mr Leibnitz, two of the greatest philosophers of that age, have both claimed the distinction.

It will appear very possible that two such men should both fall upon this method of calculation nearly about the same time, if it be considered, that from the beginning of the 17th century its principles were gradually coming into view, in consequence of the united labours and discoveries of a number of mathematicians, such as Napier, Cavallerius, Roberval, Fermat, Barrow, Wallis, and others. And considering the number of men of the first abilities engaged at that time in the study of mathematics, we may reasonably suppose, that the fluxional or differential calculus, would very soon have been found according to the ordinary progress of human knowledge, even although a Newton, or a Leibnitz, had not by the force of superior genius anticipated perhaps by a few years that event. The first intimation that was given of the discovery of the calculus was in the year 1669, when through the intervention of Dr Barrow, a correspondence was begun between Sir Isaac Newton (then Mr Newton), and Mr Collins, one of the secretaries to the Royal Society. Dr Barrow communicated to the latter a paper by Newton, which had for its title, De analysi per aequationes numero terminorum infinitas. In this paper, besides shewing how to resolve equations by approximation, Newton teaches how to square curves, not only when the expression for the ordinate in terms of the abscissa is a rational quantity, but also when it involves radical quantities, by first resolving these into an infinite series of rational terms by means of the binomial theorem, a thing which had never before been done. Newton in this paper gives some rather obscure indications of the nature of his calculus, which however serve to shew, beyond all doubt, that he was then in possession of it; and indeed there is good reason to believe that he knew it as early as the year 1665, or even sooner.

These analytical discoveries of Newton were immediately circulated among mathematicians both in this country and abroad, by Dr Barrow, and by Collins and Oldenburg, the two secretaries to the Royal Society.

About the end of the year 1672, Newton communicated to Collins, by letter, a method of drawing tangents to curve lines, illustrated by an example, from which it again plainly appears, that he now possessed his method of fluxions.

In the course of the following year, Leibnitz came to London, and communicated to several members of the Royal Society, some researches relating to the theory of differences. It was however shewn to him, that this subject had been previously treated by Mouton an astronomer of Lyons; upon this Leibnitz directed his attention to the doctrine of series, which was now considerably advanced, in consequence of the discoveries of the English mathematicians.

The first direct communication that passed between Newton and Leibnitz, was by a letter, which the former addressed to Oldenburg, about the middle of the year 1676. In the beginning of this letter, which was intended to be shewn to Leibnitz, Newton speaks of him with much respect. The letter itself chiefly refers to
FLUXIONS.

the theory of infinite series. In a second letter, written also with a view to its being communicated to Leibnitz, Newton, after bestowing deserved commendation on him, proceeds to explain the steps by which he was led to the discovery of the binomial theorem. He afterwards, among other things, delivers several theorems which have the method of fluxions for their basis; but he does not give their demonstrations, and only observes, that they depend on the solution of a general problem, the enunciation of which he conceals under anagram of transposed letters, but the meaning of it is this: An equation being given containing any number of flowing quantities, to find their fluxions; and the contrary.

This was another proof that Newton was now in full possession of his calculus.

In the end of June 1677, Leibnitz sent to Oldenburg, for the purpose of being communicated to Newton, a letter containing the first essays of his Differential Calculus. The death of Oldenburg, which happened soon after, put an end to the correspondence, and, in the year 1684, Leibnitz published his method in the Leipzic Acts for the month of October 1684. The title of the memoir which contained it was, Nova methodus pro maximis et minimis, itemque tangentiis, que nec fractas, nec irrationales quantitates moratur, et singulare pro illis calculi genus. Thus, in whatever way Leibnitz came by his calculus, whether he discovered it solely by the force of his own genius, or founded it on the method of fluxions, previously invented by Newton, both of which hypotheses are possible, his method was certainly published before Newton's, which, except what transpired in consequence of the circulation of his letters and manuscripts, became only known to the world for the first time, by the publication of the Principia in the end of the year 1686.

It seems at first to have been allowed, that Leibnitz had invented his calculus, without having any previous knowledge of what had been done by Newton; for in the first edition of the Principia, Newton says, "In the course of a correspondence which ten years ago I carried on with the very learned geometrician Mr Leibnitz, having intimated to him that I possessed a method of determining maxima and minima, of drawing tangents, and resolving such problems, not only when the equations were rational, but also when they were irrational; and having concealed this method, by transposing the letters of the following sentence—An equation being given, containing any number of flowing quantities, to find their fluxions; and the contrary; this celebrated man answered that he had found a similar method, which he communicated to me, and which differs from mine, only in the enunciation, and in the notation." To this, in the edition of 1714 is added, and in the manner of conceiving the quantities to be generated.

Principia
lib. III. lem. 3 subcl.

There is reason to suppose that Leibnitz might have continued to enjoy undisturbed the honour of being considered as one of the inventors of the fluxional or differential calculus, if he had not manifested a disposition to attribute the invention too exclusively to himself. This called forth some remarks respecting the priority of Newton's claim to the discovery. In particular M. Fatio asserted, in a treatise on the Line of swiftest descent, published in 1699, "that he was obliged to own Newton as the first inventor of the differential calculus, and the first by many years; and that he left the world to judge whether Leibnitz, the second inventor, had taken any thing from him."

On the other hand, when Newton's treatise on the quadrature of curves, and on the enumeration of lines of the third order, was published, which was in 1704, the Leipzic journalists insinuated, in a very liberal account which they gave of the work, that Leibnitz was the first inventor, and that Newton had taken his method from Leibnitz's, substituting fluxions for differences.

In consequence of this attack on Newton, Dr John Keill asserted, in the Philosophical Transactions for 1708, that Newton was beyond a doubt the first inventor of the arithmetic of fluxions, and that the same arithmetical notation that Newton changed, was afterwards published by Mr Leibnitz in the Leipzic Acts. In answer to this, Leibnitz replied, in a letter to Hans Sloane, secretary to the Royal Society, that, if one knew better than Newton himself, that the charge against him implied in Keill's assertion was false; and he required Keill to retract what he had said. To this request, however, Keill would by no means accede; but on the contrary, he wrote a long letter to the secretary of the Royal Society, in which he endeavoured to prove, not only that Newton had preceded Leibnitz in the invention, but that he had given to the latter such indications of the nature of his calculus, as made it easy for him to fall upon the same. This letter was sent to Leibnitz, who replied, that Keill, although learned, was too young a man to be fit to judge of what had passed between him and Newton, and he requested the Royal Society to put a stop to Keill's clamours.

The Royal Society being thus appealed to as a judge, appointed a committee to examine all the old letters, papers, and documents which had passed among several mathematicians, relating to the question. The judgment of the committee was to the following effect: "That Mr Leibnitz was in London in 1673, and went thence to Paris, where he kept a correspondence with Mr Collins by means of Mr Oldenburg, till about September 1676, and then returned by London and Amsterdam to Hanover; and that Mr Collins was very free in communicating to able mathematicians what he had received from Newton. That it did not appear, that Mr Leibnitz knew any thing of the differential calculus before his letter of the 21st of June 1677, which was a year after a copy of Newton's letter of the 10th of December 1672 had been sent to Paris, to be communicated to him, and above four years after Mr Collins began to communicate that letter to his correspondents; in which letter the method of fluxions was sufficiently described to any intelligent person. That Newton was in possession of his calculus before the year 1669, and that those who had reputed Leibnitz the first inventor, knew little or nothing of his correspondence with Mr Collins, and Mr Oldenburg, and other persons, nor of Newton's having that method above 15 years before Mr Leibnitz began to publish it in the Leipzic Acts. That for these reasons, they reckoned Newton the first inventor, and were of opinion, that Mr Keill in asserting the same had been in no ways injurious to Mr Leibnitz."

It is deserving of remark, that the committee delivered no opinion upon the advantage which Leibnitz was accused of having taken of the hint furnished to him.
FLUXIONS.

in the course of his correspondence with Newton; they left the decision of this point to the world in general; and to enable every one to judge for himself, the Royal Society ordered the opinion of the committee to be printed, together with all the documents upon which it was founded. These appeared in 1712 under the title of, Commercium Epistolicum de Analysis promota. This work was carefully circulated over Europe, to vindicate the title of the English nation to the discovery. Leibnitz expressed great dissatisfaction, and threatened to reply in such a manner as to confound his adversaries. There seems no reason however to suppose, that any thing he could have said, would have affected Newton's claim to the honour of being the first inventor; for on this point there cannot be any doubt. With respect, however, to the other question, whether Leibnitz took his calculus from Newton, or found it himself, it is impossible to decide with such certainty. Mr Montucla, in his History of Mathematics *, says, "There are only three places of the Commercium Epistolicum, which treat of the principles of fluxions in so clear a way, as to prove that Newton had found it before Leibnitz, but too obscurely, it seems, to take from the latter the merit of the discovery. One of these is in a letter from Newton to Oldenburg, who had signified to him, that Stüiitz and Gregory had each found a very simple method of drawing tangents. Newton replied, that he conjectured what the nature of that method was; and he gave an example of it, which shews it to be in effect the same thing as those geometricalians had found. He adds, that it is only a particular case, or rather a corollary to a method much more general, which, without a laborious calculation, applies to the finding of tangents to all sorts of curves, geometrical or mechanical, and that without being obliged to free the equation from radicals. He repeats the same thing without explaining himself farther, in another letter, and he conceals the principle of the method under transposed letters. The only place where Newton has allowed any thing of his method to transpire, is in his Analysis per equationes numero terminas infinitas. He here discloses, in a very concise and obscure manner, his principle of fluxions, but there is no certainty of Leibnitz's having seen this essay. His opponents have never asserted that it was communicated to him by letter, and they have gone no farther than to suspect, that he had obtained a knowledge of it in the interview which he had with Collins, upon his second journey to London. Indeed, this suspicion is not entirely destitute of probability, for Leibnitz admitted, that in this interview, he saw a part of the Epistolar Correspondence of Collins. However I think it would be rash to pronounce upon this circumstance. If Leibnitz had confined himself to a few essays of his new calculus, there might have been some foundation for that suspicion; but the numerous pieces he inserted in the Leipsic Acts, prove the calculus to have received such improvements from him, that probably he owed the invention of it to his genius, and to the efforts he made to discover a method, which put Newton in possession of so many beautiful truths. This is so much the more likely, as, from the method of tangents discovered by Dr Barrow, the transition to the differential calculus was easy, nor was the step too great for such a genius as that with which Leibnitz appears to have been endowed." Such is the opinion of Montucla, who being a foreigner, cannot be supposed to have been too partial towards Newton, an Englishman. The British mathematicians have hitherto, with few exceptions, entertained an opinion still more decidedly in favour of the claims of their celebrated countryman.

It has been said that Newton took no share in the controversy; this however seems not to have been expected the case, for besides suppressing in the third edition of his Principia (printed in 1729) the passages which have already quoted, which seems to admit that Leibnitz invented his calculus for himself, he is known to have written the notes which accompany the edition of the Commercium Epistolicum, printed in 1722. Leibnitz had also begun to prepare a Commercium Epistolicum, but he died before it was completed.

Besides the disputes that have happened respecting the inventor of the method of fluxions, the accuracy of the method itself has been the subject of controversy, both in Britain and on the continent. The differential calculus was attacked abroad by Newcomen, a writer of little or no reputation as a mathematician, and by Rolle, who was an expert algebraist, and an indefatigable calculator, but rash, and too confident of the justness of his own opinions, and jealous of the inventions of others. To the first of these writers Leibnitz himself replied, and afterwards Bernoulli and Herden; the attack from Rolle was successfully repelled by Puyvavon, who was as zealous and intelligent, as his adversary was warm and impatient.

The very concise manner in which the great inventor of the method of fluxions thought proper to explain its principles, gave occasion to the celebrated Dr Berkeley bishop of Cloyne to call in question, not only the logical accuracy of the reasoning employed to establish the theory of fluxions, but also the faith of mathematicians in general, in regard to the truths of religion. The bishop commenced the controversy first in a small work entitled The Minute Philosopher; but his principal attack made its appearance in 1734, under the title of "The Analyst, or A Discourse addressed to an Uninformed Mathematician," (understood to be Dr Halley,) "wherein it is examined whether the object, principles, and inferences of the modern Analysts are more distinctly conceived than religions mysteries and points of faith." One of the best answers which was made to this work came from the pen of Benjamin Robins, and is entitled, "A discourse concerning the nature and certainty of Sir Isaac Newton's methods of fluxions, and of prime and ultimate ratios." Other mathematicians likewise attempted to defend Newton, and the method of fluxions, against the very cogent and well-directed arguments of the bishop: but the most satisfactory way of removing all objections to the method, was to abandon those obscure and inaccurate modes of expression, of which Berkeley had, not without some reason, complained, and to substitute in their place, others more intelligible, and more consonant to the common methods of mathematical reasoning. This was accordingly done by the celebrated Maclaurin, who, in the year 1742, published his Treatise of Fluxions, a work which, although in some respects rather diffuse, placed the principles of the method beyond controversy, by establishing them on the firm basis of geometrical demonstration.

It would extend this introduction to too great a length...
length were we to enter into a detailed account of the various improvements which the calculus has received from its first invention to the present time. We shall just briefly observe, that among those who contributed the first and the most effectually to its improvement, we may reckon Newton and Leibnitz themselves, the two illustrious rivals for the honour of its discovery; these were followed by the two brothers James and John Bernoulli, by the Marquis de L'Hospital, and many other foreign mathematicians; and in this country we may reckon Craig, Cheyne, Cotes, Taylor, and De Moivre, as among the earliest of its improvers. It is to Cotes in particular that we are indebted for the discovery of the method of finding the fluents of certain rational fractions, a discovery which was extended by De Moivre, so as to form one of the most beautiful and complete branches of the theory of fluxions.

Besides innumerable memoirs on particular branches of the fluxional calculus, which are found to be in academical collections, many distinct treatises have been written on the subject. Some of the most valuable of these are as follow. The Method of Fluxions and Infinite Series, by Sir Isaac Newton. This work was written in Latin, but was not published till the year 1736, when it was translated into English, and given to the world, along with a comment, by Mr. Colson. Harmoniae Mensuraria, by Cotes, a most valuable and original work, published in 1716. A Treatise on Fluxions, in two books, by MacLaurin, published in 1742. Many parts of the writings of the celebrated Euler have a reference to the theory of fluxions, or the differential and integral calculi. He, however, three works in particular that relate to that subject; the first is his Introductio in Analysis Infinitarum, the second his Institutiones Calculi Differentialis, and the third his Institutiones Calculi Integralis.

There is a work on this subject which deserves to be particularly mentioned, both on account of its excellence, and the singular circumstance of its being composed by a lady. Its title is, Analytica Institutiones, in four books, originally written in Italian, by Donna Maria Gaetana Agnesi. This lady was Professor of Mathematics and Philosophy in the University of Bologna; her work was first published in 1749, and has been styled by her countryman Frisi, Opus nitidissimum, ingeniosissimum, et certo maximum quod adhuc ex feminine alicujus calo- smo prodierit. A part of this work has been published in the French language by Bos. An English translation was prepared for the press many years ago by the late Professor Colson; it remained, however, unpublished, and might still have continued so, but for the liberality of Baron Masere, who, after satisfying some pecuniary claims upon the manuscript, caused it, in 1801, to be published (we believe at his own expense), in two volumes quarto. The Doctrine and Application of Fluxions, by Thomas Simpson, is a work deservedly in high estimation. The Doctrine of Fluxions, by Emerson, is also very generally read by the British mathematicians. We are sorry, however, to observe, that there is no work in the English language that exhibits a complete view of the theory of fluxions, with all the improvements that have been made upon it to the present time. We cannot at present acquire any tolerable acquaintance with the subject, without consulting the writings of the foreign mathematicians. There are several excellent works in the French language; we may mention in particular a Traité de Calcul Différentiel et de Calcul Integral, by Cousin, in 2 vols. 400; another by Bos. in 2 vols. 8vo; and another by La Croix, in 3 vols. 400. This last deserves particular notice, as the author intended it to comprehend the substance of the various valuable treatises by Euler, as well as of the most important academical memoirs that relate to this subject. The author has also published an abridgment of his work, in one volume octavo. Principiorum Calculi Differentialis et Integralis, by L'Huillier, published in 1795, contains a very clear exposition of the principles of the calculus. The writings of our countrymen Landen and Waring, and of these foreign mathematicians La Grange, Le Gendre, La Place, and many others, abound with improvements in the calculus. Having given this sketch of the history of this very important branch of mathematical science, we proceed to explain its principles.

PART I. THE DIRECT METHOD OF FLUXIONS.

Sect. I. Principles and Definitions.

1. IN the application of algebra to the theory of curve lines, we find that some of the quantities which are the subject of consideration, may be conceived as having always the same magnitude, as the parameter of a parabola, and the axes of an ellipse or hyperbola; while others again are indefinite in respect of magnitude, and may have any number of particular values, such as are the co-ordinates at any point in a curve line. This difference in the nature of the quantities which are compared together, has equally place in various other theories, both in pure and mixed mathematics, and it naturally suggests the divisions of all quantities whatever into two kinds, namely, such as are constant, and such as are variable.

2. A constant quantity is that which retains always the same magnitude, however other quantities with which it is connected may be supposed to change; and a variable quantity is that which is indefinite in respect of magnitude, or which may be supposed to change its value. Thus, in the arithmetic of sines, the radius is a constant quantity, while the cosine, sine, tangent, &c. of an arch, also the arc itself, are variable quantities; and in the conic sections the axes and the parameters of the axes are constant quantities, and any abscissa and its corresponding ordinate are variable quantities.

Constant quantities are usually denoted by the first letters of the alphabet a, b, c, &c. and variable quantities by the last letters x, y, z, &c.

3. Any expression of calculation, containing a variable quantity, along with other constant quantities, is called a Function of that variable quantity. Thus, supposing x to be variable, and the other quantities constant, any
any one of these expressions $a x^n$, $a x^n b x^n$, $a x^n c x^n$, $a x^n d x^n$, $a x^n e x^n$, and so on.

$\cos x$, $\sin x$, $\&c.$ is a function of $x$; and in any such equation as $y = a x^n + b x^n + c x^n + \&c.$, the quantity $y$ is called a function of $x$. Even although the variable quantities $x$ and $y$, should not be separated as in the last example, but should be related to each other as in the following,

$$a x^n y + b x^n y + c x^n y = 0,$$

as, setting aside the consideration of the constant quantities, the value of $y$ depends on that of $x$, and on the contrary the value of $x$ depends on that of $y$, the quantity $y$ is said to be a function of $x$, and on the other hand $x$ is said to be a function of $y$.

4. If a variable quantity be supposed to change its value, then a corresponding change will take place in the value of any function of that quantity. Let us examine the nature of this change in the magnitude of a function.

First, let us suppose that $x$ denoting any variable quantity, the function to be considered is any integer power of that quantity, as $x^n$, or $x^a$, or $x^n$, &c.; then, $x$ being supposed to be increased by an indefinite quantity $\Delta x$, and thus to become $x + \Delta x$, the function will change its value; if it be $x^n$ it will become $(x + \Delta x)^n$, or

$$x^n + 2 x^n \Delta x + x^n \Delta x^2,$$

and if it be $x^3$ it will become $(x + \Delta x)^3$ or

$$x^3 + 3 x^2 \Delta x + 3 x^1 \Delta x^2 + x^0 \Delta x^3,$$

and if it be $x^4$ it will become $(x + \Delta x)^4$, or

$$x^4 + 4 x^3 \Delta x + 6 x^2 \Delta x^2 + 4 x^1 \Delta x^3 + x^0 \Delta x^4,$$

and so on, for other integer powers.

If we compare the new value of the function in each of these cases with its former value, it will immediately appear, that the new value may be resolved into two parts, one of which is the original value of the function, and, therefore, the other is the increment which the function has received, in consequence of the change in the value of the variable quantity $x$. Thus, the function being $x^n$, we have found its new value to be $x^n + 2 x^n \Delta x + x^n \Delta x^2$, of which expression, the first term $x^n$ is the original value of the function; therefore the other part of the expression viz. $2 x^n \Delta x + x^n \Delta x^2$ is its increment. In like manner the expression $x^n = 2 x^n + 3 x^n + 4 x^n + 5 x^n + 6 x^n + 7 x^n + \&c.$, which is the new value of the function $x^n$, may be resolved into $x^n$, the original value of the function, and $3 x^n + 3 x^n + 4 x^n + 5 x^n + 6 x^n + 7 x^n + \&c.$ its increment; and $x^n + 4 x^n + 5 x^n + 6 x^n + 7 x^n + 8 x^n + \&c.$, the new value of the function $x^n$, may be resolved into $x^n$, the function itself, and $4 x^n + 5 x^n + 6 x^n + 7 x^n + 8 x^n + 9 x^n + \&c.$ its increment.

5. Having seen that, by conceiving the variable quantity $x$ to receive the indefinite increment $\Delta x$, the functions $x^n$, $x^n$, $x^n$, receive the increments

$$2 x^n \Delta x,$$

$$3 x^n \Delta x,$$

$$4 x^n \Delta x,$$

respectively, we next observe that each increment is expressed by a series, the first term of which is the first power of the indefinite quantity $\Delta x$ multiplied by some function of the variable quantity $x$ as a co-efficient.

The second term of the series consists of the second power of $\Delta x$, multiplied also by a function of $x$ as a co-efficient; and, in like manner, the third and following terms are composed of the third and higher powers of $\Delta x$ (the exponents forming the arithmetical series 1, 2, 3, 4, &c.) each multiplied by a function of $x$ as a co-efficient; and it appears, that the particular form of the function which constitutes the co-efficient of any assigned term of the series depends entirely upon the particular form of the original function. Thus, when the original function is $x^n$, the function which is the co-efficient of the first term is $\frac{n}{1}$; when the original function is $x^n$, the co-efficient of the first term is $\frac{n(n-1)}{1 \cdot 2}$; when the original function is $x^n$, the co-efficient of the first term is $\frac{n(n-1)(n-2)}{1 \cdot 2 \cdot 3}$, and so on. It also appears that the functions of $x$, which are the co-efficients of the powers of $\Delta x$ are composed only of the variable quantity $x$ and given quantities, so that they are entirely independent of the indefinite increment $\Delta x$.

6. These observations may be extended to a function that is any power whatever of a variable quantity, by the application of the binomial theorem. Let $x$ be supposed to become $x + \Delta x$, then $x^n$ will become $(x + \Delta x)^n$; but by the binomial theorem, (see Algebra, Sect. xvii.) $(x + \Delta x)^n$ when expanded into a series, is

$$x^n + \frac{n}{1} x^{n-1} \Delta x + \frac{n(n-1)}{1 \cdot 2} x^{n-2} \Delta x^2 + \frac{n(n-1)(n-2)}{1 \cdot 2 \cdot 3} x^{n-3} \Delta x^3 + \&c.$$

where it appears, that the first term of the series is the original value of the function, and the following terms are the first, second, and following powers of the increment $\Delta x$, each multiplied by a new function of $x$, that is independent of the increment. Let us denote the functions $n x^{n-1}$, $\frac{n(n-1)}{1} x^{n-2}$, and $\frac{n(n-1)(n-2)}{1 \cdot 2 \cdot 3} x^{n-3}$, &c. by $p_1$, $q_1$, &c. respectively; and it is to be observed that, in the present case, as well as in the case of any other function of $x$ we may hereafter consider, by the letters $p_1$, $q_1$, &c. or the same letters with accents over them, or partly the capital letters $P$, $Q$, $R$, &c. we do not mean to denote functions of $x$ of any particular form, but functions of $x$ in general, that consist only of $x$ and given quantities. This being kept in view, it appears that the variable quantity $x$ being supposed to change its value, and to become $x + \Delta x$, the function $x^n$ changes its value, so as to become

$$x^n + p \Delta x^n + q \Delta x^n + r \Delta x^n + \Delta x^n + \&c.$$

a series, the terms of which have the properties already explained in the two preceding sections.

7. Every rational and integer function of a variable quantity $x$ is necessarily of this form,

$$A x^n + B x^{n-1} + C x^{n-2} + \&c.$$
to \( n + h \); and to avoid complicated expressions, let us suppose the function to consist of these two terms \( Ax^n + Bx^p \). We have already found in last section that \( x \) being supposed to become \( n + h \), \( x^n \) will become

\[ x^n + p + q + r + s + &c. \]

where \( p, q, r, &c. \) denote functions of \( x \) independent of \( h \), as explained in the last section, and consequently \( Ax^n \) will become

\[ Ax^n + Ap + Aq + Ar + As + &c. \]

In like manner \( Bx^p \) will become

\[ Bx^p + Bp + Bq + Br + Bs + &c. \]

\( p', q', r', &c. \) denoting also functions of \( x \) independent of \( h \); therefore taking the sum of the two series, it appears that, supposing \( x \) to change its value, and to become \( n + h \), the function \( Ax^n + Bx^p \) becomes

\[ Ax^n + Bx^p + (A + Bp) + (Ap + Bq) + (Aq + Br) + (Ar + Bs) + &c. \]

now \( p \) and \( p' \) being functions of \( x \), \( Ap + Bp' \) will also be a function of \( x \), and may be denoted more simply by \( p \), and for the same reason \( Aq + Br \), \( Ar + Bs \), \&c. which are functions of \( x \), may be denoted by \( q, r, &c. \) thus the expression for the new value of \( Ax^n + Bx^p \) is

\[ Ax^n + Bx^p + P + Q + R + &c. \]

a series, the form and properties of which are in all respects analogous to those of the series that expresses the new value of the function \( x^n \); and although we have supposed the function to consist of but two terms, still the form of the series and its properties will be the same, that is, it will consist of two parts, one of which is independent of \( h \), and is the original value of the function, and the other is a series, the terms of which are the successive powers of the increment \( h \), each multiplied by a function of the variable quantity \( x \) as a coefficient. This conclusion may be expressed in symbols concisely thus,

\[ \frac{\Delta x^n + Bx^p + Cx^q + &c.}{Bx^p} \]

and \( \Delta x^n \) for the new value which \( x \) acquires by \( x \) changing its value to \( x + h \),

\[ \Delta x^n = Ap + Bp' + Cq' + &c. \]

a series of the same nature as before.

9. Let us now consider a fractional function of \( x \), and let us suppose it to be

\[ (Ax^n + Bx^p + Cx^q + &c.) \]

that is, suppose it to be the \( m \)th power of a polynomial, consisting of any number of terms whatever. Let the expression between the parenthesis be denoted by \( v \), then we are to consider the function \( v^m \). Now when \( x \) becomes \( x + h \), we have already found that \( v \) becomes

\[ v = \frac{v + p + q + r + s + &c.}{v + p + q + r + s + &c.} \]

where \( p, q, r, &c. \) denote constant quantities. Let \( v \) denote the numerator of the fraction, and \( w \) its denominator, then the function is

\[ w \]

and

\[ w \]

now when \( x \) becomes \( x + h \), v becomes

\[ v + \frac{p + q + r + s + &c.}{v + p + q + r + s + &c.} \]

and \( w \) becomes

\[ w + \frac{p + q + r + s + &c.}{w + p + q + r + s + &c.} \]

and consequently \( v \) becomes

\[ (v + p + q + r + s + &c.) \]

and
and the product of these two factors, by actual multiplication is

\[ uv' + uv' + uv' + wv' \]

Now, here as before, it appears that the coefficients of the powers of \( h \) are functions of \( x \), therefore, denoting these functions by \( P, Q, R, \&c. \), and observing that \( v \) is the new value of \( \frac{v}{w} \) we have the new value of \( \frac{v}{w} \) expressed by the series

\[ \frac{v}{w} + PA + QA + RA + &c. \]

or, substituting the single letter \( s \) for \( \frac{v}{w} \), that is, for

\[ \frac{A'}{x} + \frac{B'}{x} + \frac{C'}{x} + &c. \]

and putting \( s' \) for the value of \( s \) acquires when \( x \) becomes \( x + h \),

\[ s' = s + P h + Q h^2 + R h^3 + &c. \]

a series in all respects analogous to those already found for the other functions of \( x \).

10. In the functions which we have hitherto considered, the exponents of the powers of \( x \) were constant quantities. Let us now consider a function in which the exponent is the variable quantity \( x \) itself.

Suppose then the function to be \( a^x \), where \( a \) denotes a given number; then, by supposing \( x \) to become \( x + h \), the function will become

\[ a^{x+h} = a^x \cdot a^h. \]

Now it has been shown in the article Algebra, § 295, that if \( A \) be put to denote the quotient arising from the division of a logarithm of \( a \) by the logarithm of \( 2 \cdot \pi \cdot 182 \cdot 8 \cdot 8 \), the exponential quantity \( a^x \) is expressed by the series

\[ 1 + \frac{A}{1} h + \frac{A}{1^2} \cdot h^2 + \frac{A}{1^2 2} \cdot h^3 + &c. \]

therefore, \( a^{x+h} \), the new value of the function, is

\[ a^x \cdot \left( 1 + \frac{A}{1} h + \frac{A}{1^2} \cdot h^2 + \frac{A}{1^2 2} \cdot h^3 + &c. \right) \]

this series, by multiplying all its terms by \( a^x \), and putting \( p, q, r, \&c. \) for that part of each term which is independent of \( h \), becomes

\[ a^x \cdot p h + q h^2 + r h^3 + &c. \]

so that denoting the function \( a^x \) by \( w \), and its new value by \( w' \),

\[ w' = w + p h + q h^2 + r h^3 + &c. \]

a series of the same form as the others.

11. From a due consideration of what has been shown relating to the changes that take place in the magnitude of a variable function, corresponding to the change that takes place in the magnitude of the variable quantity from which the function is formed, we may conclude the truth of the following general proposition to be sufficiently established.

Let \( x \) denote a variable quantity, and \( u \) any function whatever of that quantity, let \( x \) be supposed to receive any increment \( h \), and thus to become \( x + h \), and let \( u' \) be the new value which the function acquires by the change in the value of \( x \); then, the new value of \( u \) may in every case be expressed thus:

\[ u' = u + p h + q h^2 + r h^3 + &c. \]

where \( p, q, r, \&c. \) denote quantities that are quite independent of \( h \), and consequently can only involve the variable quantity \( x \), and given quantities.

12. Having examined what is the general form that any function of a variable quantity acquires by a change in the value of that quantity, and found it to be a series, the first term of which is always the function itself, it is evident that the remaining terms will express the increment that the function receives, in consequence of the change in the magnitude of the variable quantity from which the function is formed. Let us now compare the simultaneous increments of a variable quantity and its function with each other, and that we may at first avoid general reasoning, and fix the mind more completely, let us suppose the functions to have a determinate form, as \( x^2, x^3, x^4, \&c. \).

Putting \( u \) and \( u' \) as before to denote the two succeeding values of the function, first let it be supposed that \( u = x^2 \), then \( x \) being supposed to receive the indefinite increment \( h \), and thus to become \( x + h \), and \( u \) to change its value to \( u' = (x + h)^2 \), we have

\[ u' = x^2 + 2 x h + h^2, \]

or, \( u' = u + 2 x h + h^2 \),

and consequently

\[ u' - u = 2 x h + h^2. \]

Thus it appears, that the simultaneous increments of \( x \) and \( x^2 \) (or \( u \)) are \( 2 x \cdot h + h^2 \), respectively. Let us now compare these increments, not in respect of their absolute magnitudes, but in respect of their ratio to each other, thus we shall have the increment of \( u \) to the increment of \( x \), as \( 2 x h + h^2 \) to \( h \), that is, (dividing the two last terms of the proportion by \( h \) as \( 2 x h + h \) to 1. Or, instead of employing an analogy, let us, for the sake of brevity, and in conformity to the algebraic notation, rather express each of these ratios by the quotient arising from the division of the antecedents of the ratio by its consequents, and put the results equal to each other. Then, observing that the symbol \( u' - u \), which expresses the difference between the succeeding values of the function, may be employed to denote its increment, we have

\[ \frac{u' - u}{h} = \frac{2 x h + h^2}{h} = 2 x + h. \]

Hence it appears that the expression for the ratio of the increment of the function \( u \) to the increment of the variable quantity \( x \) is made up of two parts, one of these, viz. \( 2 x \cdot x \), is quite independent of \( h \), the increment of \( x \), and the other is in the present case that increment itself. In consequence of this peculiarity in the form
FLUXIONS.

Part I. Direct Method.

form of the expression for the ratio, it is evident that
if the increment \( h \) be conceived to be continually dimin-
ished, the part of the expression which consists of \( h \)
will continually diminish, so that the whole expression,
viz. \( 2x + h \), may become more nearly equal to its first
term \( 2x \) than by any assignable difference; therefore,
\[ 2x \text{ may be considered as the limit of the ratio } \frac{u}{h} \]
that is, a quantity to which the ratio may approach
nearer than by any assignable-difference, but to which
it cannot be considered as becoming absolutely equal.

Let us next suppose that \( w = x^3 \), then \( x \) being supposed
to become \( x + h \), we have \( w = (x + h)^3 = x^3 + 3x^2h +
3xh^2 + h^3 \), or
\[ w = u + 3x^2h + 3xh^2 + h^3 \]
and consequently
\[ \frac{w - u}{h} = 3x^2h + 3xh^2 + h^3 \]
and \( \frac{w - u}{h} = 3x^2h + 3xh^2 + h^3 \).

Here it is evident, as in the former case, that the expres-
sion for the ratio \( \frac{w - u}{h} \) is composed of two parts,
one of these, viz. the first term \( 3x^2h \), is a function of \( h \)
that is independent of the increment \( h \); but the other,
viz. \( 3xh^2 + h^3 \), or \( h(3x + h) \), is the product of two
factors, one of which is the increment itself. From the
particular form of this latter part of the expression for
the ratio, it is plain, that \( h \) being supposed to be con-
tinually diminished, that part will also diminish, and
may become less than any assignable quantity. There-
fore in this case, as well as in the former, the ratio
\( \frac{w - u}{h} \) has a limit, and that limit is the first term of
the general expression for the ratio, namely the quantity
\( 3x^2h \).

Suppose, next, that \( w = x^4 \), and consequently
\[ w = (x + h)^4 = x^4 + 4x^3h + 6x^2h^2 + 4xh^3 + h^4 \]
or,
\[ w = u + 4x^3h + 6x^2h^2 + 4xh^3 + h^4 \]
and \( \frac{w - u}{h} = 4x^3h + 6x^2h^2 + 4xh^3 + h^4 \).

Here, as in the two former cases, we have only to in-
spect the general expression for the ratio \( \frac{w - u}{h} \) to dis-
cover, that by supposing \( h \) to be continually dimin-
ished, the latter part of the expression, viz. \( h(4x^3 + 6x^2h + h^2) \),
and which comprises all the terms except the first, will
become smaller than any assignable quantity; and con-
sequently, that the first term \( 4x^3h \) is the limit of the
ratio.

13. It is easy to see that the property which we have
found to belong to the ratio of the simultaneous incre-
ments of a variable quantity, and its function in these
three particular cases, is an immediate consequence
of the form of the expression for the increment of the
function, so that it is not peculiar to the functions \( x^3 \),
\( x^4 \), and \( x^4 \), but belongs equally to all functions what-
soever.

For we have found, § 11, that \( u \) being supposed to
denote any function of a variable quantity, as for ex-
ample, \( ax^3 \), or \( ax^3 + bx^2 + cx \) &c., or
\[ ax^3 + bx^2 + cx + d \]
and \( \frac{u}{h} \) being put for the new value which the function
acquires when \( x \) becomes \( x + h \),
\[ w = u + p + q + r + s + t + &c. \]
where \( p, q, r, s \) &c. denote functions of \( x \) that are in-
dept of \( h \), therefore,
\[ w = u + p + q + r + s + t + &c. \]
and
\[ \frac{w - u}{h} = p + q + r + s + t + &c. \]
or,
\[ \frac{w - u}{h} = p + q + r + s + t + &c. \]

Thus it appears, that whatever be the form of the
function, the ratio \( \frac{w - u}{h} \) is always expressed by a quan-
ty which may be resolved into two parts; one of these,
viz. \( p \), is independent of the increment \( h \); but the other,
viz. \( q + r + s + t + &c. \) is the product of \( h \) by a series,
the first term of which is a function of \( h \), and the re-
maining terms also functions of \( x \) multiplied by the first,
second, third, and higher powers of \( h \). Now from the
particular form of this last part of the general expression
for the ratio, it is manifest, that \( h \) being conceived to
be continually diminished, the quantity \( q + r + s + t + &c. \)
will also be continually diminished, and may be-
come less than any assignable quantity; therefore, the
limit of the ratio \( \frac{w - u}{h} \) is simply \( p \), that is, the function
of \( x \), which is the coefficient of the first or simple power
of \( h \) in the general expression for the increment.

14. From what has been just shewn, we may infer
the truth of the following general proposition relative
to the simultaneous changes that take place in a vari-
able quantity and its function.

Let \( x \) denote a variable quantity and \( u \) any function
of that quantity, let \( x \) be conceived to change its value
and become \( x + h \), where \( h \) denotes an arbitrary incre-
ment, and let \( w \) denote the new value which the function
acquires, in consequence of the change in the magnitude
of \( x \). Then, observing that \( h \) and \( u \) are the simul-
taneous increments of the variable quantity and its func-
tion, if \( h \) be conceived to be continually diminished,
\( \frac{w - u}{h} \) will continually approach to a certain
limit, which will be different for different functions, but
always the same for the same function, and in every case
quite independent of the magnitude of the increments.
The ratio which is the limit of the ratio of the incre-
ments, when these increments are conceived to be con-
tinually diminished, may be called the limiting ratio
of the increments.

15. The analytical fact contained in the preceding
proposition, affords the foundation for a mathemati-
cal theory of great extent, and which may be divided
into
I. Fluxions.

Having given the relation of any number of variable quantities to each other, to determine the limiting ratios of their increments; and the measures of the velocities with which the variable quantities increase have been called their **fluxions**.

19. To simplify the hypothesis, we may suppose that the point which generates the line $AP$, or $x$, moves uniformly; thus the measure of its velocity, or the fluxion of $x$, will be a given quantity, with which the measure of the velocity of the point $Q$, or the fluxion of $w$, may be continually compared. To determine then the fluxions, or rather the ratio of the fluxions of $x$ a variable quantity, and $w$, any function of that quantity, is in effect to resolve the following problem.

Having given an equation expressing the relation at every instant between the spaces passed over by two points, one of which moves with a uniform velocity; it is required to find an expression for the ratio that the measures of the velocities have at every instant to each other.

20. Now it is a fundamental principle in the theory of motion, resulting indeed from the very nature of a variable velocity, that when two velocities are compared together, whether they be both variable, or one of them uniform, and the other variable, the measures of their velocities are any quantities having to each other the ratio that is the limit of the ratio of the spaces described in the same time, when those spaces are conceived to be continually diminished. And hence it follows that the ratio of the fluxions of two variable quantities is no other than the limiting ratio of their simultaneous increments.

That the theory of motion may be applied to the generation of variable algebraic quantities, we have supposed them to be represented by lines; this, however, is not necessary, if the variable quantities are themselves geometrical magnitudes; for like as a line is conceived to be generated by the motion of a point, so a surface may be considered as generated by the motion of a line, a solid by the motion of a surface, and an angle by the rotation of one of the lines which contain it: and the fluxions of those quantities at any instant, or position, will be the measures of the velocities, or degrees of swiftness, according to which they increase at that instant or position.

But in every case the ratio of the rates of increase, or fluxions of two homogeneous magnitudes, will be the limiting ratio of their simultaneous increments.

21. Having thus found that by conceiving variable quantities as generated by motion, and taking their velocities, or rates of increase, as an object for the mind to contemplate and reason on, we are in the end led to the consideration of the limiting ratios of their increments, a subject which is purely mathematical, and independent of the ideas of time or velocity, we shall exchange the definition of a fluxion given in § 18, which involves those ideas, for another that rests entirely upon the existence of limiting ratios.

By the fluxions then of two variable quantities having any assigned relation to each other, we are in the following treatise always to be understood to mean any indefinite

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(A) Such as Lagrange, Cousin, La Croix, &c. abroad, and Landen in this country.

Vol. VIII. Part II.
FLUXIONS.

Indefinite quantities which have to each other the limiting ratio of their simultaneous increments.

In conformity to this definition of fluxions, it is evident that we are to consider them, not as absolute, but as relative quantities, which derive their origin from the comparison of variable quantities with each other in respect of their simultaneous variations of magnitude.

22. Sir Isaac Newton employed different symbols at different times to denote the fluxions of variable quantities. It is now, however, common in Britain to denote them by the same letters employed to express the quantities themselves, and each having a dot over it. Thus $u$ denotes the fluxion of the variable quantity expressed by $x$, and in the like manner $v$, $w$, $z$, denote the fluxions of the variable quantities $x$, $y$, $z$, respectively.

23. Suppose now that $x$ is any function of a variable quantity $x$, and that the limiting ratio of the simultaneous increments of $x$ and $x$ is the ratio of $p$ to $x$, where $p$ denotes some other function of $x$; then, from the definition just given of fluxions, we have

$$u = px,$$

and

$$v = px.$$

Hence it follows as a consequence of the preceding definition, that the fluxion of $u$, any function of a variable quantity $x$, is the product arising from the multiplication of that function of $x$ which is the expression for the limiting ratio of the increments by the fluxion of the variable quantity $x$ itself.


24. The method of fluxions naturally resolves itself into two parts, as we have already observed, § 15. We proceed to explain the first of these, which is called the Direct Method, and which treats of finding the ratio of the fluxions of variable quantities, having given the relations of those quantities to each other.

25. We shall begin with investigating the ratio of the fluxions of two variable quantities in that particular case, when one of them is any power of the other.

Let us suppose then, that $u$ is such a function of a variable quantity $x$, that $u = px^n$, where $n$ denotes any number whatever, it is required to determine the ratio of the fluxions of $u$ and $x$.

If we recur to the definition which has been given of the fluxions of variable quantities in § 21, it will appear that we have in effect resolved the problem just proposed in three particular cases, when treating of the limiting ratio of the increments of variable quantities. For it has been shown in § 12, that when $u = x^n$, and $x$ is supposed to change its value, so as to become $x + h$, where $h$ denotes an indefinite increment, and in consequence of this change in the magnitude of $x$, $u$ also changes in value, and becomes $x$, then, observing that $u = px^n$ and $x$ are the simultaneous increments of $x$ and $x$, the limiting ratio of $\frac{u}{x} = h$ is $2x$. Let this expression for the limiting ratio be put equal to the ratio of the fluxions of $u$ and $x$, that is to $\frac{u}{x}$, thus we have $\frac{u}{x} = 2x$, and $u = 2x$.

Hence it appears, that whatever be the magnitude of the quantity that expresses the fluxion of $x$, the fluxion of $u$ will be expressed by the fluxion of $x$ multiplied by $2x$.

Again, when $u = x^3$, and $u$, $u'$, $u''$, and $h$ denote the same as before, it has been shown, § 12, that the limiting ratio of $\frac{u'}{h} = 3x^2$, therefore, $\frac{u''}{h} = 3x^2$, and $\frac{u}{x} = 3x^2$; that is, the fluxion of $x$ is expressed by the fluxion of $x$ multiplied by $3x^2$.

And when $u = x^4$, it has been shown, § 12, that the limiting ratio of $\frac{u}{x} = 4x^3$. Therefore, $\frac{u}{x} = 4x^3$ and $u = 4x^3$.

To resolve the problem generally, or when $u = x^n$, let us suppose $x$ to become $x + h$, and $u$ to become $u'$, then $u' = (x + h)^n$. But this last quantity, when expanded into a series by the binomial theorem (ALGEBRA, Sect. XVII.) is

$$u' = (x + h)^n + nx^{n-1}h + \text{etc.},$$

or $u' = p + h^n + nx^{n-1}h + \text{etc.}$

where $p$, $q$, $r$, etc. denote functions of $x$, independent of $h$. Therefore,

$$\frac{u'}{h} = p + h^n + nx^{n-1}h + \text{etc.},$$

and

$$\frac{u}{x} = p + h^n + nx^{n-1}h + \text{etc.}.$$

Therefore, supposing $h$ to be continually diminished, the limit of $\frac{u'}{h}$ is $p$; but, whatever be the nature of the exponent $n$, the limit of $\frac{u}{x}$ is $nx^{n-1}$, (ALGEBRA, § 257); therefore, the limit of $\frac{u}{x}$ is $nx^{n-1}$, and consequently

$$\frac{u}{x} = nx^{n-1},$$

and

$$\frac{u}{x} = nx^{n-1}.$$
Let both sides of this equation be raised to the power  

\[ (1+v)^n = (1 + Mu)^n. \]

Now as we have just found that \( m \) and \( n \) being integers,  

\[ (1+v)^n = 1 + mv + \&c. \]

and  

\[ (1 + Mu)^n = 1 + nMu + \&c. \]

Here we stop at the second term, that being the only one whose coefficient is required. Substitute now for \( Mu \) its value \( Av + \&c. \) then, stopping again at the second term, we get  

\[ (1 + Mu)^n = 1 + nAv + \&c. \]

therefore,  

\[ 1 + Mu + \&c. = 1 + nAv + \&c. \]

and making the coefficients of \( v \) in each series equal to each other,  

\[ nA = m, \quad \text{and} \quad \frac{\lambda}{n}. \]

31. In the last place, let us suppose that the exponent is a negative quantity either whole or fractional, so that  

\[ (1 + \lambda)^{-\frac{n}{2}} = 1 + A'v + B'v^2 + \&c. \]

or  

\[ (1 + \lambda)^{-\frac{1}{2}} = 1 + A'v + B'v^2 + \&c. \]

Then, multiplying both sides by \((1+v)^{-\frac{n}{2}}\) we get  

\[ 1 = (1 + v)^{-\frac{n}{2}} (1 + A'v + B'v^2 + \&c.) \]

or, substituting \( x + Av + Bv^2 + \&c. \) for \((1 + v)^{-\frac{n}{2}}\) and actually multiplying the two series,  

\[ 1 = x + A' \left\{ v + B' \right\} + A' \left\{ v + A' \right\} \left\{ B' + B \right\} + \&c. \]

Now that this equation may subsist, whatever be the value of \( v \), it is necessary that  

\[ A + A' = 0, \]

\[ B + AA' + B' = 0, \]

and by these equations we may determine \( A', B', C', \&c. \) It is, however, only required at present to find the first of these, viz. \( A' \), now we have \( \lambda = -A \); but \( A \) being the coefficient of the second term of the series expressing \((1 + v)^{-\frac{n}{2}}\), the exponent of which is positive, we have already found it to be \(-\frac{m}{n}\) therefore, \( A' = -\frac{m}{n} \)

32. As we have found that the coefficients of the second term of the developments of \((1 + v)^n\), \((1 + v)^{-\frac{n}{2}}\), and \((1 + v)^{-\frac{1}{2}}\) are \( m_n \) and \(-\frac{m}{n} \), respectively, it appears that whatever be the number denoted by \( n \), the two first terms of the series expressing \((1 + v)^n\) are \( 1 + mv \) and therefore, substituting for \( v \) its value \( \lambda \), and multiplying by \( m \), the two first terms of the series expressing \((x + \lambda)^n\) are \( nA + nA' = \lambda \), agreeing with what we have

\[ U_{2 4} \]
33. The mode of reasoning employed to determine the ratio of the fluxions of \( u \) and \( w \), when the former is a function of the latter of the form \( u^r \), will apply equally when the function has any other assigned form. But instead of investigating in this manner the fluxion of every particular function, it is better to consider a complex function as the sum, or difference, or product or quotient, &c. of other simple functions, and to investigate rules for each of these cases, supposing that the fluxions of the simple functions are previously known.

34. Let us first suppose that \( u \), a function of a variable quantity \( x \), is equal to the sum of \( u \) and \( w \), two other functions of \( x \). It is required to find the fluxion of \( u \), having given the fluxions of \( u \) and \( w \).

Let \( x \) be conceived to change its value, and to become \( x+h \); then, as \( u \) and \( w \) will also change their values, § 11, the one to

\[
\frac{u}{h} = \frac{\Delta u}{\Delta h} = \frac{u + \Delta u}{h} = \frac{v + p h + q h^2 + r h^3 + &c.}{h} = \frac{v + h(p + \Delta p) + h^2(q + \Delta q)(p + \Delta p) + &c.}{h} = \frac{v + p + \Delta p + q + \Delta q}{h} = \frac{v + p + \Delta p + q + \Delta q}{h} = \frac{v + p + \Delta p + q + \Delta q}{h}.
\]

If we now conceive \( h \) to be continually diminished, we shall have the limit of \( \frac{u}{h} \) expressed by \( v + p^1 \). But \( p \) is the limit of \( \frac{\Delta u}{h} \), § 14, and in like manner \( p^1 \) is the limit of \( \frac{\Delta u}{h} \), therefore,

\[
\frac{\Delta u}{h} = \lim \frac{\Delta u}{h} + \lim \frac{\Delta u}{h}.
\]

Substitute now the ratio of the fluxions instead of the limited ratios, and we have

\[
\frac{u}{h} = \frac{v + p^1 + \Delta p^1}{h} = \lim \frac{u}{h} + \lim \frac{u}{h} = \lim \frac{u}{h} + \lim \frac{u}{h}.
\]

therefore, \( u = v + p^1 \).

35. If we suppose \( s \) to be a function of \( u \), and \( u \), \( v \), \( w \), &c. other functions of \( u \), such that

\[
\frac{u}{h} = \frac{v^1 + p v + q v^2 + r v^3 + &c.}{h}.
\]

\( a, b, c, d, e, \) denote any given numbers, positive or negative, then, by reasoning as above, it is evident that

\[
i = a u + b v + c w + &c.
\]

Therefore, to find the fluxion of the sum of any number of functions, each multiplied by a constant quantity. Multiply the fluxion of each function by its constant coefficient, and the sum of the products is the fluxion required.

36. If \( e \) denote a constant quantity, and \( u, v, w \), is functions of \( x \), such that \( u = x + v \); then \( x \) being supposed to become \( x+h \), and consequently \( u \) to become \( u+h \), or \( u + p h + q h^2 + &c. \) and \( c + v \) to become \( c + v + p h + q h^2 + &c. \), we have

\[
u = x + v = x + v + \Delta v = x + v + p h + q h^2 + &c.
\]

and hence \( \frac{\Delta v}{h} = \frac{\Delta w}{h} = \frac{c + v}{h} \),

therefore, \( \frac{u}{h} = \frac{v}{h} \),

and these ratios being always equal, their limits must also be equal; therefore, substituting for the limiting ratios those of the fluxions, we have \( \frac{u}{h} = \lim \frac{\Delta u}{h} \).

That is to say, the fluxion of \( e \cdot v \) is \( v \), from which it appears, That the fluxion of any variable function is the very same as the fluxion of the same function increased \( e \) diminished by any constant quantity. This is a remark of great importance in the theory of fluxions, as will appear hereafter.

37. Let us now suppose that \( u, v, w \), are functions of \( x \), such that \( u = v + w \), it is required to find the fluxion of \( u \), supposing the fluxions of \( v \) and \( w \) to be given.

By supposing that \( u, v, w \), and \( w \), change their values as usual, we have

\[
u = v + w \quad \frac{\Delta v}{h} = \lim \frac{\Delta v}{h} + \lim \frac{\Delta w}{h}.
\]

and this last expression by multiplication becomes

\[
u = v + w + p h + q h^2 + &c.
\]

therefore

\[
u = (v + \Delta v + p h + q h^2 + &c.) - (v + \Delta v + p h + q h^2 + &c.) = \lim \frac{\Delta v}{h} \]

dividing now by \( h \), and taking the limit of \( \frac{\Delta v}{h} \), we have that limit expressed by \( v + \Delta v + p h + q h^2 + &c. \); but \( p \) is the limit of \( \frac{\Delta v}{h} \), § 14, and in like manner \( p \) is the limit of \( \frac{\Delta v}{h} \), therefore

\[
\frac{\Delta v}{h} = \frac{\Delta v}{h} + \frac{\Delta w}{h}.
\]
that it is required to find the fluxion of \( w \), having given
the fluxions of \( v \) and \( w \).

From the given equation we have \( w = v \times w \), and there-
fore (§ 37.) \( \frac{v}{w} = w \times \frac{v}{w} \), let \( \frac{v}{w} \) be substituted for \( w \)
in this equation, and it becomes \( v = w \times \frac{v}{w} + \frac{v}{w} \), from
which we easily obtain

\[
\frac{v}{w} = \frac{w}{w^2} \frac{dw}{dx}.
\]

Hence we have the following rule for finding the
fluxion of a fraction.

Multiply the fluxion of the numerator by the denomi-

nator, and from the product subtract the fluxion of the
denominator multiplied by the numerator, and divide the
remainder by the square of the denominator; the result
is the fluxion required.

40. It will now be proper to shew the application of
these general rules for determining the fluxions of vari-
able functions to some particular examples.

Example 1. Suppose \( u = a + b \sqrt{x} - \frac{c}{x} \). Required
the fluxion of \( u \).

Here \( a \) being a constant quantity, the fluxion of
\( a + b \sqrt{x} - \frac{c}{x} \) is the same as the fluxion of \( b \sqrt{x} - \frac{c}{x} \).

§ 36, or \( b \times \frac{d}{dx} - \frac{c}{x^2} \). Now, by § 26, the fluxion of
\( x^{\frac{1}{2}} \) is \( \frac{1}{2} x^{-\frac{1}{2}} \), which expression is equivalent to
\( \frac{x^{-\frac{1}{2}}}{2} \), or to \( \frac{x}{2 \sqrt{x}} \) and in like manner the fluxion
of \( x^{-1} \) is \( -x^{-1-1} \), or \( -x^{-2} \), or \( \frac{c}{x^2} \) therefore,
multiplying the fluxion of \( x^{\frac{1}{2}} \) by \( b \), and the fluxion of
\( x^{-1} \) by \( c \), and taking the sum of the products, agree-
ably to the rule in § 35, we have

\[
\frac{u}{w} = \frac{b}{2\sqrt{x}} + \frac{c}{x^2}.
\]

Ex. 2. Suppose \( u = a + b \frac{1}{\sqrt{x}} - \frac{c}{x^2} - \frac{d}{x^n} \).

By writing the function thus

\[
u = a + b \frac{1}{\sqrt{x}} - c x^{-2} - d x^{-n-2} \]

the application of the same rules employed in the last
example gives us

\[
u = -b x^{-\frac{3}{2}} + \frac{c}{2 x^3} + \frac{d}{3 x^{n+1}}.
\]

or, exchanging the fractional indices for the radical
sign, and otherwise reducing,

\[
u = -2 b \frac{x}{2x^2} + \frac{4 c x}{3 x^2} - \frac{2 d x}{x^n}.
\]
Ex. 3. Suppose \( u = (a + b \cdot x^n)\).

In order to find the fluxion of this function by the rules already laid down, it will be necessary to consider it first as a function of a variable quantity that is itself a function of \( x \). Let us then put \( a + b \cdot x^n = \nu \), and thus the proposed equation becomes \( u = \nu^2 \); then, \( u \) being considered as a function of \( \nu \), we have by § 26.

\[ u = m \cdot \nu \cdot x^{-n} \cdot \nu^n \]

Again, \( \nu \) being considered as a function of \( \kappa \), from the equation \( v = a + b \cdot x^n \), we find by § 36. and § 26.

\[ \dot{v} = m \cdot h \cdot e^{-n} \cdot \kappa^n \]

Let this value of \( \nu \) be substituted in the expression for \( u \), and it becomes

\[ \dot{u} = m \cdot n \cdot b \cdot x^{-n} \cdot \kappa^n \cdot \kappa \]

which, by substituting for \( \nu \) its value \( a + b \cdot x^n \), is also

\[ \dot{u} = m \cdot n \cdot b \cdot x^{-n} \cdot (a + b \cdot x^n) \cdot x^-n \cdot \kappa \]

Ex. 4. Suppose \( u = \sqrt{a - x^2} \).

Here we are to proceed as in the last example, and first put \( a = x^2 = \nu^2 \), then \( u = \sqrt{v} = \nu \); and therefore

\[ \frac{\dot{u}}{2} = \frac{\dot{\nu}}{2 \cdot \nu} \cdot \frac{\nu}{\nu} = \frac{\dot{\nu}}{2 \cdot \nu} \]

Again, since \( \nu = x^2 \), by § 26. we find \( \dot{\nu} = 2 \cdot x \cdot \dot{x} \). Substitute this value of \( \nu \) in the expression for \( u \), and we have

\[ \dot{u} = \frac{2 \cdot x \cdot \dot{x}}{2 \cdot \nu} \]

which, by restoring \( \sqrt{a - x^2} \) for \( \nu \), and leaving out the number common to the numerator and denominator, becomes

\[ \dot{u} = \frac{x \cdot \dot{x}}{\sqrt{a - x^2}} \]

Ex. 5. Suppose \( u = \sqrt{a + b \cdot x + c \cdot x^2} \).

By proceeding in the same manner as in last example, we find

\[ \dot{u} = \frac{b + 2 \cdot x \cdot \dot{x} \cdot u}{\sqrt{a + b \cdot x + c \cdot x^2}} \]

Ex. Suppose \( u = (a + b \cdot x^2) \sqrt{(a - x^2)} \).

Here the proposed function is the product of these three functions, viz. \( u, a + b \cdot x^2, \) and \( \sqrt{(a - x^2)} \). Therefore, its fluxion will be found by proceeding according to the rule in § 38.

Now the fluxion of \( u \) is \( \dot{u} \), and the fluxion of \( a + b \cdot x^2 \) is \( 2 \cdot x \cdot \dot{x} \), and the fluxion of \( \sqrt{(a - x^2)} \) has been found in last example to be \( \frac{2 \cdot x \cdot \dot{x}}{\sqrt{(a - x^2)}} \). Therefore, multiplying the fluxion of each function by the product of the other two functions, and taking the sum of all these products, we find

\[ \dot{u} = \left\{ \frac{(a + b \cdot x^2) \sqrt{(a - x^2)} \cdot \dot{x}}{2 \cdot x \cdot \dot{x} \cdot \sqrt{(a - x^2)}} + \frac{x \cdot \sqrt{(a - x^2)} \cdot \dot{x}}{2 \cdot x \cdot \dot{x} \cdot \sqrt{(a - x^2)}} \right\} \]

Ex. 7. Suppose \( u = \frac{a + \kappa}{a + \kappa^2} \).

Here we employ the rule given in § 39. for finding the fluxion of a fractional function; thus we find

\[ \dot{u} = \frac{(a + \kappa^2) \cdot \dot{x} - 2 \cdot \kappa \cdot (a + \kappa) \cdot \dot{x}}{(a + \kappa^2)^2} \]

which when reduced, is

\[ \dot{u} = \frac{a - \kappa}{(a + \kappa)^2} \]

Ex. 8. Suppose

\[ u = \sqrt{a - b \cdot x - \sqrt{(a - x^2)^2}} \]

To simplify this expression, we put \( b \sqrt{(a - x^2)^2} = z \), and find

\[ \dot{u} = \frac{b}{\sqrt{(a - x^2)^2}} \]

But, since \( z = \frac{b}{\sqrt{(a - x^2)^2}} \), we have, § 26

\[ \dot{u} = \frac{b}{\sqrt{(a - x^2)^2}} \]

and since \( \sqrt{(a - x^2)^2} = (a - x^2) \), \( \sqrt{(a - x^2)^2} = (a - x^2) \), \( \sqrt{(a - x^2)^2} = (a - x^2) \), by considering \( a - x^2 \) as a single variable quantity, and observing that its fluxion is \( -2 \cdot x \cdot \dot{x} \), we find by § 26. that

\[ \dot{u} = \frac{b}{\sqrt{(a - x^2)^2}} \cdot x \cdot -2 \cdot x \cdot \dot{x} = \frac{4 \cdot x \cdot \dot{x}}{2 \cdot x \cdot \sqrt{(a - x^2)^2}} \]

Instead of \( y, x, y, x \), substitute now their values in the expression for the fluxion of \( u \), thus it becomes

\[ \dot{u} = \frac{b}{\sqrt{(a - x^2)^2}} \cdot x \cdot -2 \cdot x \cdot \dot{x} = \frac{4 \cdot x \cdot \dot{x}}{2 \cdot x \cdot \sqrt{(a - x^2)^2}} \]

Ex. 9. Suppose \( u = a \cdot x^n \cdot y^n \), where \( v \) and \( y \) denote any functions of a variable quantity.

Then, § 37.

\[ \dot{u} = \frac{a \cdot v \cdot \dot{x} \cdot \text{fluxion of } y^n + a \cdot v \cdot \text{fluxion of } y \cdot \dot{x} \cdot \text{fluxion of } y^n}{a \cdot v \cdot \text{fluxion of } y^n} \]
But fluxion of \( v = mx^{-1} \), § 26,
and fluxion of \( y = ny^{-1} \); therefore,

\[
\begin{align*}
\frac{dv}{dx} &= a(y^{-2})(y' + v) \\
&= a(y^{-2})(y' + (y^{-1}v)).
\end{align*}
\]

Ex. 10. Suppose \( a = \frac{v + z}{y} \), where \( v, z \) and \( y \) denote any function of a variable quantity. Then, because fluxion \( (v + z)\frac{d}{dx} = \frac{v + z}{y} \), § 34, and fluxion \( y^2 = 3y \), § 26, we have, § 35,

\[
\frac{dv}{dx} = \frac{y^2(v + z) - 3v + x}{y^2}.
\]

41. As when \( u \) denotes that particular function of \( x \) which is \( x^n \), we have (§ 25),

\[
\frac{u}{x} = nx^{n-1};
\]

so, in general, whatever be the form of the function denoted by \( u \), we have always

\[
\frac{u}{x} = px^{n-1},
\]

where \( p \) denotes a new function of \( x \), resulting from the analytical process employed to find the fluxion of the function \( u \), and depending for its form upon the particular form of that function: just as in involution, or any of the other operations of algebra, a result is obtained depending upon the particular nature of the operation, and the quantities operated upon.

Let us put \( p \) to denote the particular function \( nx^{n-1} \), or the expression for \( \frac{u}{x} \) the ratio of the fluxion of \( u \) to the fluxion of \( x \) when \( u = x^n \), then, supposing that \( n - 1 \)
is not equal to 0, (for in that case \( nx^{n-1} \) would be simply \( n, n \) given number,) we may reason concerning the ratio of the fluxions of the variable quantities \( p \) and \( n \), in all respects as concerning the ratio of the fluxions of \( a \) and \( x \); and accordingly, from the equation

\[
p = nx^{n-1},
\]

we get, by taking the fluxions,

\[
\frac{p}{x} = (n-1)x^{n-2},
\]

or, considering \( p \) as denoting generally the function of \( x \) that results from the operation of finding the fluxion of the original function \( u \), whatever be the form of that function, we have

\[
\frac{p}{x} = q,
\]

where \( q \) denotes a new function of \( x \), derived from \( p \), the former function, by the same kind of operation as that by which \( p \) was deduced from \( u \).

Suppose now \( q \) to denote the particular function \( p = n(n-1)x^{n-2} \), then,

\[
\frac{q}{x} = n(n-1)(n-2)x^{n-3},
\]

or \( \frac{q}{x} = r \), where \( r \) denotes a function of \( x \) derived from \( q \), as \( q \) was derived from \( p \), or \( p \) from the original function \( u \).

And it is evident that we may proceed in this manner as far as we please, unless it happen that in finding the series of functions \( p, q, r \), &c., we at last arrive at a result that is a constant quantity, and then the series of operations will terminate. Thus if the function was \( ax^n \), we should have

\[
\frac{u}{x} = ax^n,
\]

\[
\frac{u}{x} = 4ax^n = p,
\]

\[
\frac{v}{x} = 4-3ax^n = q,
\]

\[
\frac{v}{x} = 4-3.2ax^n = r,
\]

\[
\frac{v}{x} = 4-3.2.1ax^n = 2.4ax^n.
\]

Here the expression for \( \frac{v}{x} \) is a constant quantity, which has no fluxion.

Hence it appears, that relatively to any function of a variable quantity, there exists a series of limiting ratios, deducible from that function, and from each other, by a repetition of the operation of finding the fluxion of a variable function.

42. In treating of the fluxion of a function, we have hitherto regarded the fluxion of the variable quantity \( x \), from which the function is formed, merely as one of the terms of a ratio, without considering whether it was a constant or a variable quantity.

Now as we may assume any hypothesis respecting the nature of the fluxion of \( x \), that is not inconsistent with what has been already delivered, we shall suppose it to be constant. This assumption, if we consider the fluxions of variable quantities as the measures of their respective velocities, or rates of increase, is in effect the same thing as to suppose that the variable quantity \( x \) increases uniformly. Then, as in the expressions

\[
\frac{v}{x} = p, \quad \frac{p}{x} = q, \quad \frac{q}{x} = r, &c.
\]

or these others, which follow from them,

\[
\frac{v}{x} = px, \quad p = qx, \quad q = rx, &c.
\]

the symbol \( v \) is to be understood as denoting a constant quantity, it follows that if \( p \) be variable, then \( px \), or \( v \) will be variable; and if \( q \) be variable, then \( qx \), or \( p \), will
43. Let us now recur to the relation in which the succeeding functions $p$, $q$, $r$, &c. stand to the original function $u$.

By performing that particular analytical operation upon the function $u$, which consists in finding its fluxion, we obtain $p$, $q$, $r$, &c. as the expression for its fluxion, that is, we get $\frac{u}{x} = px$; and by repeating the operation on the function $p$, we get $\frac{p}{x} = qx$; and therefore $p = q^x$; but, $x$ being regarded as a constant quantity, $p = q$ is deduced from $p$, $x$, considered as a function of $x$, just in the same manner as $p$ is derived from the original function $u$, therefore the expression $q^x$ is deduced from the function $u$ by performing the operation of taking the fluxion twice; that is, first upon the function $u$ itself, and then upon $p$ or $q$, the expression for its fluxion; and in this second operation $x$ (or the fluxion of the quantity from which the function is formed) is considered as a constant quantity.

The expression $q^x$, obtained in this manner from the function $u$, is called the second fluxion of the function $u$; and to express its relation to the function $u$, it is denoted by $\frac{u}{x}$, that is, by the letter denoting the function itself with two dots over it. Thus, like as $u = px$, we have

\[ \frac{u}{x} = q^x \text{ and } \frac{u}{x} = q. \]

Again, since $q = \frac{u}{x}$, it follows that $\frac{q}{x} = q^x$; but, as $x$ is constant, $q^x$ is derived from $q$, by the operation of finding its fluxion, considering it as a function of $x$, just in the same manner as $q$ is derived from $p$, or $u$, and in the same manner as $x$ is derived from $p$ or $u$, or $u$, and in the same manner as $x$ is derived from $p$, or $u$, or $u$, and in the same manner as $x$ is derived from $p$, or $u$, or $u$, or $u$. The function $u$, is therefore, like as $p$ or $q$ or $x$ is the first fluxion of the function, and $q^x$ or $x$ is its second fluxion, so $r^x$ is called its third fluxion, and is denoted by $r$, that is, by the letter expressing the function itself, having three dots placed over it, so that

\[ \frac{u}{x} = r^x \text{ and } \frac{u}{x} = r. \]

The fourth fluxion of a variable function $u$ is denoted by $\frac{u}{x}$, that is, by the letter $u$ with four dots over it, and is derived from the third fluxion, in the same manner as the third is derived from the second, or the second from the first, or the first fluxion from the variable function itself; observing, that, in repeating the operation of taking the fluxions, the symbol $\frac{u}{x}$ (or the fluxion of the variable quantity from which the function is formed) is considered as a constant quantity. And the same mode of notation and deduction is to be understood as applying to a fluxion of any order whatever of a variable function.

44. To illustrate what has been said respecting the second and higher orders of fluxions of a function, let us suppose $w$ to denote the particular function $x^n$; then, proceeding agreeably to what has been laid down in last section, we obtain, by the rule for finding the fluxion of any power of a variable quantity (§ 26.)

\[ \frac{w}{x} = w = n(n-1)x^{n-2} \]
\[ \frac{w}{x} = w = n(n-1)(n-2)x^{n-3} \]
\[ \frac{w}{x} = w = n(n-1)(n-2)(n-3)x^{n-4} \text{ &c.}. \]

Here we have exhibited the first, second, third, and fourth fluxions of the function $x^n$; the law of continuation is obvious, and it appears that when $n$ is any positive integer, the function $x^n$ will have as many orders of fluxions, as there are units in $n$, and no more; for if $n$ were supposed $\equiv 3$, then, as the fourth fluxion, and all the subsequent ones, are multiplied by $x$, or in that case by $3$, it consequently would vanish, and a similar observation may be made when $n$ is any other whole positive number.

45. That we might be able to apply the rules of § 26, § 34, &c. to the determination of the fluxion of a complex function of a variable quantity, we have found it convenient in some cases to consider such a function as composed of other more simple functions of the same quantity, and we have expressed its fluxion by means of the fluxions of those other functions. In finding the fluxion of any higher order than the first of such a complex function by those rules, we must keep in mind, that it is only the fluxion of $x$, the variable quantity from which the functions are all formed, that is to be considered as constant, and that the fluxions of the functions themselves are in general variable quantities; so that each of them may have a second, third, &c. fluxion, as well as the function which is composed of them.

Let us suppose, for example, that

\[ w = \sqrt{a^x + b^x} \]

then, considering $a^x + b^x$ as a function of $x$, and putting $v$ to denote it, we have $w = \sqrt{v}$, and $w = \frac{1}{\sqrt{v}}$; but since $w = a^x + b^x$, it follows that $v = ax^x$; therefore, substituting for $v$ and $w$ their respective values, we have

\[ w = \frac{ax^x}{\sqrt{ax} + \sqrt{bx}}. \]

Now, to find the second fluxion of $w$, we may either take the fluxion of this last expression, viz. $\frac{w}{x}$, and consider the symbol $\frac{w}{x}$, which is found in it, as denoting a constant quantity; or we may recur to the equation $\frac{w}{x} = \frac{1}{\sqrt{v}}$, and take the fluxion of this other expression for $\frac{w}{x}$; and in this case, we must consider that both $v$ and $w$ denote variable functions of $x$, and therefore that the fluxion of $\frac{w}{x}$ may be found by the rule for
for finding the fluxion of a fraction; observing that $\frac{\dot{v}}{\dot{w}}$ is to be substituted as the fluxion of $\frac{v}{w}$. Accordingly, proceeding by this last method, and considering that the fluxion of $\sqrt{v}$, the denominator of the fraction, is $\frac{\sqrt{v}}{\sqrt{v}}$, we find

$$\dot{w} = \frac{\frac{\dot{v}}{\sqrt{v}} \cdot \frac{\dot{v}}{\sqrt{v}}}{\sqrt{v}} = \frac{2\dot{v}}{4v}.$$

Now from the equation $w = ax^2 + bx$, we have $\dot{w} = 2ax$, and (observing that $z$ is constant) $\dot{w} = 2ax$. Let these values of $\dot{v}$, $\dot{w}$, and $\dot{w}$ be now substituted in the expression for $\ddot{w}$, and it becomes

$$\ddot{w} = \frac{4(ax^2 + bx)^2}{(a^2 + b^2)(a^2 + b^2)}.$$

The very same expression for $\ddot{w}$ would have been found if we had employed the other method.

By proceeding as in this last example, the rules already delivered for finding the first fluxion of any function of a variable quantity will apply to the finding of the fluxion of any higher order.

Thus if we had $w = u + t$, where $u$ and $t$ denote each a function of another variable quantity $x$, and it were required to find the different orders of fluxions of $w$, considered also as a function of $x$; then, by the rule of § 37, we have

$$\dot{w} = \dot{u} + \dot{t},$$

and $\ddot{w} = \ddot{u} + \ddot{t}$.

but $\dot{u}$ and $\ddot{u}$ being variable functions of $x$, we may consider $\dot{u}$ and $\ddot{u}$ as denoting also variable functions of $x$, the fluxions of which are to be denoted by $\dot{u}$ and $\ddot{u}$ respectively; now by the rule in § 37, we have

fluxion of $\dot{u} = \dot{u} + \ddot{u}$, and fluxion of $\ddot{u} = \ddot{u} + \dddot{u}$,

therefore, $\dddot{u} = 2\dot{u} + \dddot{u}$.

By considering $\dot{u}$, $\ddot{u}$, also $\dddot{u}$, as denoting each a distinct function of $x$, we may find the third fluxion of $w$ from the second, in the same manner as the second has been found from the first, and so on for the other orders of fluxions of $w$. If it be now required to express the successive orders of fluxions of $w$ in terms of $x$ and its fluxion, we must find the values of $\dot{u}$, $\dddot{u}$, &c. also of $\dddot{u}$ &c. in terms of $x$ and its fluxion, and these values, also the particular functions of $x$ denoted by $\dot{u}$ and $\dddot{u}$ being substituted in the expressions found for $w$, $\dot{u}$, &c. will give to these expressions the form required.

If for example we suppose that

Vol. VIII. Part II.

46. If the fluxion of a variable quantity be considered as the measure of its rate of increase, if that rate be uniform, then its measure will be a constant quantity; but if it be variable, then its measure will be a variable quantity, which will also have a certain rate of increase or decrease; and the measure of this rate will be its fluxion, or will be the fluxion of the fluxion of the original variable quantity; that is, it will be the second fluxion of the original variable quantity. And if this second fluxion is not a constant quantity, then the measure of its rate of variation will be its fluxion, or will be the third fluxion of the original variable quantity, and so on. Thus a quantity will have a successive order of fluxions till some one fluxion become constant, and then it will have no more.

47. We have hitherto supposed the equation expressing the relation between a variable quantity, and a function of that quantity, to be of such a form, that the function was found alone, and of the first degree on one side of the equation, and some power, or combination of powers, of the variable quantity on the other; as in these examples,

$$w = ax^2, \quad u = a + bx + c + dx.$$ 

In such cases as these, $w$ is said to be an explicit function of $x$. We are now to consider how the ratio of the fluxions is to be found when the relation between the variable quantity and its function is expressed by an equation, the terms of which involve different powers, both of the function, and the variable quantity; as in the following example,

$$y^2 = ax + by + c = 0,$$

where we are to consider $y$ as a function of $x$; but from the particular manner in which its relation to $x$ is expressed, it is said to be an implicit function of that quantity.

Now in this example, by the resolution of a quadratic equation, we find

$$y = \frac{ax + \sqrt{a^2 - 4bc} x + \frac{4c}{2}},$$

and as $y$ is here an explicit function of $x$, its fluxion and the ratio of its fluxion to that of $x$, might be determined by the rules already laid down. But it is to be observed that it is only in the particular case of the proposed equation being of the second degree that we can effect the solution generally in this manner. If it

$$4x$$
FLUXIONS.

48. We may however in all cases resolve the problem, without a previous resolution of the equation, by reasoning as follows.

Whatever be the degree of the equation, by giving particular values to $x$, we can, by the theory of equations, obtain corresponding particular values of $y$; therefore, we may be assured that in every case $y$ is expressible by means of $x$ in some way or other, if not in finite terms, at least in the form of a series, the terms of which shall involve powers of $x$. Hence we may infer, as in the case of explicit functions, that when $x$ changes its value, and becomes $x + k$, $y$ will also chance its value, and becomes

$$y + p + q + k q + \&c.$$

where $p$, $q$, &c. denote functions of $x$, that are independent of the arbitrary quantity $h$. Let us denote $p h + q + k q + \&c.$ the increment of $y$, by the single letter $k$; then $y + k$ is the new value of $y$, corresponding to $x + k$, the new value of $x$. Let these new values be substituted instead of $x$ and $y$ in the proposed equation

$$y'' - a \cdot x \cdot y + b \cdot x^2 = c = 0,$$

and as the result must still be $= 0$, we have

$$(y + k)'' - a (x + k) \cdot (y + k) + b (x + k)^2 = c = 0;$$

which equation, by actually involving its terms, substituting for $k$ its value $p h + q + k q + \&c.$, and arranging the result in the form of a series proceeding by the powers of $h$, becomes

$$y'' - a \cdot x \cdot y + b \cdot x^2 = c = 0,$$

$$+ (2 p y - a (p x + y) + b 2 x) h = 0;$$

$$+ Q h^2 + R h + \&c.$$

Here $Q$, $R$, &c. denote quantities independent of $h$, and involving $x$, $y$, $p$, $q$, &c. to that of $x$, and functions of $x$, and therefore $Q$, $R$, &c. are also functions of $x$. Now as this equation must subsist whatever $h$ may be, which is a quantity quite arbitrary and independent of the coefficients by which its powers are multiplied, it follows (as has been observed when treating of the method of indeterminate coefficients, ALGEBRA, § 261.) that the coefficients of the different powers of $h$ must be each equal to 0.

Therefore,

$$y'' - a \cdot x \cdot y + b \cdot x^2 = c = 0.$$

$$2 p y - a (p x + y) + 2 b x = 0;$$

&c.

From the first of these equations we can infer nothing, as it is no other than the proposed equation itself; but from the second we find

$$p = \frac{a y - 2 b x}{2 y - a n}.$$

Now $h$, and $k = p h + q + \&c.$ being the simultaneous increments of $x$ and $y$, we have $\frac{k}{h} - p + q h + \&c.$, therefore, supposing $h$ to be continually diminished, and putting $\frac{y}{x}$ equal to the limit of $\frac{k}{h}$, we have $\frac{y}{x}$, therefore

$$y = \frac{a y - 2 b x}{2 y - a n}$$

thus we have obtained an expression for the ratio of the fluxions of $y$ and $x$, from which we find

$$2 y^2 - a (x y + y x) + 2 b x = c = 0;$$

and this is precisely the expression we should have obtained, had we taken the fluxion of each term of

$$y'' - a \cdot x \cdot y + b \cdot x^2 = c = 0,$$

the proposed equation, and put the result equal to 0.

49. But to see that this will always be the case, whatever be the degree of the equation, we have only to observe, that, by the very same process employed to deduce from the original equation

$$y'' - a \cdot x \cdot y + b \cdot x^2 = c = 0,$$

these two others

$$2 y - a (x y + y x) + 2 b x = c = 0;$$

if we suppose the equation to be generally expressed thus,

$$y'' + a y^m + \cdots + x^r = c = 0,$$

where the exponents $i$, $m$, $n$, and $r$ denote constant quantities, we shall obtain

$$l y'' + a (m y^{n - 1} x y + n y^{m - 1} r) \cdots + r x^r = c = 0,$$

and hence, by substituting for $p$ its value $\frac{y}{x}$, and bringing $x$ from the denominator,

$$l y'' + a (m y^{n - 1} x y + n y^{m - 1} r) \cdots + r x^r = c = 0.$$

From which it appears that, when the relation between $x$, a variable quantity, and $y$, a function of that quantity, is expressed by an equation, the terms of which are brought all to one side, so as to produce an expression $= 0$; the relation of the fluxions will be found, by taking the fluxion of each term of the equation (considering $y$ as a function of $x$), and putting the sum of these fluxions equal to 0.

50. Having from the equation

$$y'' - a \cdot x \cdot y + b \cdot x^2 = c = 0,$$

found that

$$\frac{y}{x} = \frac{a y - 2 b x}{2 y - a n},$$

if it be required to find the second fluxion of $y$, we have only to take the fluxion of the latter side of this equation,
FLUXIONS:

Consider the equation, considering \( t \) as constant, and \( y \) as a function of \( n \); thus we have

\[
\frac{\frac{dy}{dt}}{(ay-bx)^n} = \frac{\frac{dy}{dx}}{(2y-an)^n}
\]

an equation which abbreviates to

\[
y = \frac{(4b-an)(cy-yx)^n}{(2y-an)^n}
\]

and from which we may extermate \( y \) by means of the equation

\[
y = \frac{(ay-bx)^n}{2y-an}
\]

By the same mode of proceeding we may determine the third or any higher fluxion of the function \( y \).

51. As far as we have yet gone in explaining the principles of fluxions, we have had continually occasion to employ the rule for finding the fluxion of the particular function \( ax^n \), where \( a \) denotes a variable quantity, and \( n \) any constant number; and we may therefore in respect of other functions, consider \( ax^n \) as a simple function. Besides the function \( ax^n \), writers on Analysis have considered each of the following as also constituting a simple analytic function of a variable quantity; viz.

\[ a^x, \text{ where } a \text{ is constant, and } x \text{ is variable.} \]

Log. \( x \), that is the logarithm of \( x \), a variable number.

Sin. \( x \), that is the sine of \( x \), a variable arch of a circle, radius being unity.

Cos. \( x \), that is the cosine of \( x \), a variable arch of a circle, radius being as before unity.

52. We have already found the fluxion of \( ax^n \), and we proceed to find the fluxions of the other simple functions of \( x \); and, as in the investigation of these we shall have occasion to employ the binomial theorem, it will be proper to show how that theorem may be deduced from the principles already explained. We are then to find the series that expresses \( (a+x)^n \), when \( n \) is any number whatever. Or, since \( (a+x)^n \) is equal to \( a^n(1+x)^n \), where \( v \) denotes the fraction \( \frac{n}{a} \), we may leave the quantity \( a^n \) out of consideration, as has been formerly observed, § 28, and seek the series that expresses \( (1+x)^n \).

As we have already pointed out (§ 28.) the process of induction by which we may find the general form of the series, we shall not here repeat it, but assume

\[(1+x)^n = 1 + Ax + Bx^2 + Cx^3 + Dx^4 + \&c.\]

where \( A, B, C, D, \&c. \) are numbers that are independent of \( x \).

Now, as the fluxion of a variable function must be the same, whether that function be expressed by one term, or developed into a series of terms, by performing the operation of taking the fluxion on each side of the above equation, the results must be equal, that is, § 26.

\[n(1+x)^n = Ax + 2Bx^2 + 3Cx^3 + 4Dx^4 + \&c.\]

or leaving out the quantity \( a \), common to each term,

\[n(1+x)^n = Ax + 2Bx^2 + 3Cx^3 + 4Dx^4 + \&c.\]

Let both sides of this equation be multiplied by \( 1 + x \), and divided by \( n \), thus we shall have

\[(1+x)^n = \frac{1}{n} \left\{ Ax + 2Bx^2 + 3Cx^3 + 4Dx^4 + \&c. \right\}
\]

Thus, by performing on the quantities the analytical process of taking their fluxions, we have obtained a new expression for \( (1+x)^n \). Let the quantities that are independent of \( x \) in each expression be put equal to each other, and also the coefficients of like powers of \( x \); thus we obtain

\[\begin{align*}
1 &= \frac{A}{n}, \text{ and hence } A = n \\
A &= \frac{A + 2B}{n}, \quad B = \frac{n-1}{2} \\
B &= \frac{3B + 3C}{n}, \quad C = \frac{n-2}{3} \\
C &= \frac{3C + 4D}{n}, \quad D = \frac{n-3}{4} \\
& \text{&c.}
\end{align*}\]

Or, substituting successively the expression for each coefficient in that which follows it,

\[\begin{align*}
A &= n, \\
B &= \frac{n(n-1)}{2}, \\
C &= \frac{n(n-1)(n-2)}{2}, \\
D &= \frac{n(n-1)(n-2)(n-3)}{2}, \\
& \text{&c.}
\end{align*}\]

Hence it appears that

\[(1+x)^n = 1 + \frac{n(n-1)}{2} x + \frac{n(n-1)(n-2)}{2 \cdot 3} x^2 + \ldots \]

and therefore, substituting \( \frac{n}{a} \) for \( x \), and multiplying by \( a^n \),

\[(a+x)^n = a^n + \frac{n(n-1)}{2} a^{n-1} x + \frac{n(n-1)(n-2)}{2 \cdot 3} a^{n-2} x^2 + \&c.\]

where the law of continuation is evident.

53. We now proceed to investigate the fluxions of the function \( ax^n \), \( a \) being supposed constant, and \( x \) the variable quantity, to which the function is referred.
Let \( x \) be supposed, as formerly, to change its value, and to become \( x + h \), and put \( x' \) for the new value that the function acquires by this change in the magnitude of \( x \), then we have

\[
 x' = x + h = x + \alpha^2 \times \alpha^2,
\]

and, taking the difference between the two succeeding values,

\[
 x' - x = \alpha^2 \times \alpha^2 = \alpha^2 (\alpha' - 1).
\]

We must now develop the expression \( \alpha^2 - 1 \) into a series, the terms of which are arranged according to the successive powers of the increment \( h \). To effect this, let us put \( \alpha = \alpha - 1 \), so that \( \alpha = 1 + h \), and \( \alpha^2 = (1 + h)^2 \); but by the binomial theorem, this last expression may be expanded into the following series:

\[
 x' = 1 + h b + \frac{h(h-1)}{2} b^2 + \frac{h(h-1)(h-2)}{3} b^3 + \cdots.
\]

Therefore,

\[
 x' = 1 + h b + \frac{h(h-1)}{2} b^2 + \frac{h(h-1)(h-2)}{3} b^3 + \cdots.
\]

As the terms of this series are not arranged according to the powers of \( h \), but according to the powers of \( \alpha \), it is necessary that we transform it into another having the required form; now this may be effected by actually multiplying together all the factors that constitute each term, and arranging the series anew in such a manner, that each of its terms may be a power of \( \alpha \), multiplied by a coefficient composed only of the powers of \( h \), and given numbers.

Accordingly we have:

\[
 1 + h b + \frac{h(h-1)}{2} b^2 + \frac{h(h-1)(h-2)}{3} b^3 + \cdots,
\]

or, otherwise expressed thus,

\[
 x' = 1 + \frac{\alpha^3 - 1}{\alpha - 1} + \frac{\alpha^4 - 1}{\alpha^2 - 1} + \frac{\alpha^5 - 1}{\alpha^3 - 1} + \cdots,
\]

where \( \alpha \) is equal to the infinite series \( \frac{b^2}{2} + \frac{b^3}{3} + \cdots \),

\[
 1 + \frac{b^4}{4} + \cdots.
\]

That is, to

\[
 \frac{a - 1}{x} = (a - 1)^3 + \frac{(a - 1)^4}{3} \cdot \frac{(a - 1)^5}{4} + \cdots.
\]

and \( B, C, &c. \) are also quantities composed of the powers of \( b \), and consequently are independent of \( h \); but as these are all to disappear in the course of the investigation, it is not necessary to express them otherwise than by a general symbol. Therefore, we have now got

\[
 a^\alpha = 1 + A b + B b^2 + C b^3 + \cdots,
\]

and consequently,

\[
 x' - x = a^\alpha (\alpha' - 1) = a^\alpha (A b + B b^2 + C b^3 + \cdots),
\]

\[
 \frac{x'}{x} = A \alpha + B \alpha^2 + C \alpha^3 + \cdots.
\]

Hence, when \( h \) is conceived to be continually diminished, we have the limit of \( \frac{x'}{x} \) expressed by \( A \alpha \); and therefore, \( \frac{\alpha' - 1}{\alpha - 1} = A \alpha \).

\[
 \alpha = A \alpha, \quad \text{and} \quad \alpha = A \alpha^2.
\]

54. In the preceding investigation, we have had occasion to develop the exponential expression \( a^\alpha \) into a series of this form,

\[
 1 + A b + B b^2 + C b^3 + \cdots,
\]

that is, a series the terms of which are the successive powers of the exponent, each multiplied by a coefficient, which is independent of the exponent.

We have however only determined the coefficients of the first two terms of the series, these being the only ones we had occasion to employ.

The result of the investigation however may be applied to determine all the coefficients by the very same kind of process as that which we have employed in \( \alpha \), to determine the coefficients of the terms of the series which constitutes the other expression of \( a^\alpha \).

Instead of denoting the exponent by \( A \), let us consider it as a variable quantity, and express it by \( n \); then, from what has been shown, it appears that

\[
 \alpha^n = 1 + A n + B n + C n^2 + D n^3 + \cdots,
\]

where \( A, B, C, &c. \) express constant quantities. Let the operation of taking the fluxions be now performed on both sides of this equation, (observing that the fluxion of \( \alpha^n \) is \( A \alpha^n \)) and let all the terms be divided by \( \alpha \), which is common to each, thus we obtain

\[
 \alpha^n = A + 2 B n + \frac{3 C n^2 + 4 D n^3 + \cdots}{A}.
\]

and, dividing by \( A \),

\[
 \alpha^n = 1 + 2 B n + \frac{3 C n^2 + 4 D n^3 + \cdots}{A^2}.
\]

Let the coefficients of the same powers of \( n \) in each of the two series expressing \( \alpha^n \) be put equal to each other, then,

\[
 \frac{2 B}{A} = A, \quad \text{hence}, \quad B = \frac{A}{2},
\]

\[
 \frac{3 C}{A} = B, \quad \cdots \quad C = \frac{A}{3},
\]

\[
 \frac{4 D}{A} = C, \quad \cdots \quad D = \frac{A}{4},
\]

\&c.

Therefore,
Therefore, substituting these values of $B, C, D, &c.$ in the original series, we have

$$a^2 = 1 + Ax + \frac{A^2 x^2}{2} + \frac{A^3 x^3}{2^2 3} + \frac{A^4 x^4}{2^3 3^2} + &c.$$ 

the same result as has been found in the article Algebra, § 393, by proceeding in a different manner.

55. If we suppose $x = 1$, then the preceding equation becomes

$$a = 1 + A + \frac{A^2}{2} + \frac{A^3}{2^2 3} + \frac{A^4}{2^3 3^2} + &c.$$ 

and if we suppose $x = \frac{1}{A}$, it becomes

$$a^A = 1 + \frac{1}{2} + \frac{1}{2^2 3} + \frac{1}{2^3 3^2} + &c.$$ 

thus the quantity $a^A$ is equal to a constant number, which is the value of $a$ when $A = 1$, and which, by taking the sum of the first ten terms of the series, is found to be $2.7182818$, or by taking the sum of a greater number of terms, more accurately $2.71828182845904$. 

We shall, in the remainder of this treatise, denote this number always by $e$, then $a^A = e$, and $a = e^A$, and taking the logarithms, $\log a = A \times \log e$, hence,

$$A = \frac{\log a}{\log e}.$$ 

56. If we now substitute this value of $A$ in the expression for the fluxion of $a^x$, found in § 53, it becomes

$$u = \frac{1}{a} \log a \cdot a^x.$$ 

Hence it appears, that the fluxion of the function $a^x$ is equal to the fluxion of $x$ multiplied by the function itself, and by the quotient arising from the division of the logarithm of $a$ by the logarithm of $e$, where $e$ denotes, $\frac{1}{\log e}$. The sum is $2.7182818$ nearly.

57. Let us now consider the third simple function of $x$, namely $u = \log x$. Let $a$ be the radical number of the particular system, in which $u$ is a logarithm, and $x$ the corresponding number; then from the nature of logarithms (see Algebra, § 277) we have $x^a = x$. Now, whether we consider $u$ as a function of $x$, or $x$ as a function of $u$, the limiting ratio of their simultaneous increments, and consequently the ratio of their fluxions, will be the same. But by considering $x$ as a function of $u$, we have immediately, from what has been shewn in § 53, and § 55,

$$\frac{1}{u} = A \left( a^u = A^x \right).$$ 

and therefore, $u = \frac{1}{\log a} \log e \cdot \frac{1}{a}$, but as $a$ is the radical number of the system, $\log a = 1$, therefore

$$u = \frac{1}{\log a} \log e \cdot \frac{1}{e}.$$ 

The number which we have denoted by $e$ occurs very often in analytical investigations; it is the radical number of the system of logarithms first invented by Baron Napier, and called by some writers Hyperbolic logarithms, but by others, with more propriety, Napieran logarithms. The expression $\log e$ is called the modulus of the system of logarithms whose radical number is $e$. In the Napieran system $\log e = \log e = 1$, that is, the modulus is unity; but in the common system, or that in which $e = 10$, the modulus $\log e = \log a = 2.302585093$. The rule for finding the fluxion of the logarithm of a variable quantity may now be expressed thus:

**Multiply the fluxion of the variable quantity by the modulus of the system, and divide the product by the variable quantity itself, the result is the fluxion required.**

58. By the application of the rule for finding the fluxion of the logarithm of a variable quantity, we may readily find the fluxions of exponential functions in general. Thus, for example, if $u = x^y$, $x$ and $y$ being both functions of any variable quantity $x$, then $\log u = y \times \log x$; and taking the fluxions (considering $y \times \log x$ as the product of two functions $y$ and $\log x$), and proceeding by the rules of § 57 and last),

$$\frac{1}{u} = y \log x + \frac{y^2}{x},$$

and hence

$$u = \frac{1}{y \log x + \frac{y^2}{x}}.$$ 

and

$$\frac{1}{u} = y \log x + \frac{y^2}{x}.$$ 

59. We are next to consider the functions $u = \sin x$, and $u = \cos x$.

Suppose $x$ to change its value, and to become $x + \delta$, and $u$ to become $u'$, then, since

$$u = \sin x$$

and $u' = \sin (x + \delta)$,

$$u' = u \cos \delta + \sin x \delta.$$ 

but by the arithmetic of sines (see Algebra, § 353),

$$\sin (x + \delta) = \sin x \cos \delta + \cos x \sin \delta,$$

therefore,

$$u' = u \cos \delta + \cos x \sin \delta,$$

and

$$\sin x \delta = \cos x \sin \delta.$$ 

In this case, as when treating formerly of other functions, we might consider the above expression for $u'$ as resolvable into a series $p \delta + q \delta^2 + &c.$ proceeding by the powers of the increment, and hence we might...
might find the limit of \( \frac{u'-u}{h} \) as before. But we may
discover the limit otherwise, by proceeding as follows:
Because

\[
\sin^2 \alpha = 1 - \cos^2 \alpha = (1 - \cos \alpha) (1 + \cos \alpha)
\]

therefore, \( 1 - \cos \alpha = \frac{\sin \alpha}{1 + \cos \alpha} \).

Let this value of \( 1 - \cos \alpha \) be substituted in the expression
for \( u'-u \), and it becomes

\[
u'-u = \cos \alpha \sin \alpha \frac{\sin \alpha \sin \alpha}{1 + \cos \alpha}.
\]

And hence, dividing by \( \sin \alpha \), and arranging the terms
so as to exhibit the ratio \( \frac{\sin \alpha}{1 + \cos \alpha} \), we get

\[
\frac{u'-u}{h} = \frac{\sin \alpha}{h} \left( \frac{\cos \alpha - \sin \alpha \sin \alpha}{1 + \cos \alpha} \right).
\]

Conceive now \( h \) to be continually diminished, and we
shall have the limit of \( \frac{u'-u}{h} \) equal to the limit of \( \frac{\sin \alpha}{1 + \cos \alpha} \)
multiplied by the limit of the following expression

\[
\frac{\sin \alpha \sin \alpha}{1 + \cos \alpha}.
\]

Now, the sine of an arch being less than the arch itself, we have \( \frac{\sin \alpha}{h} < x \). Again, the arch being less
than its tangent, \( \frac{\sin \alpha}{h} < \tan \alpha \); but \( \tan \alpha = \frac{\sin \alpha}{\cos \alpha} \)
and therefore \( \frac{\sin \alpha}{\tan \alpha} = \cot \alpha \). Consequently \( \frac{\sin \alpha}{h} \)
cos \alpha. Hence it appears, that the expression for the
ratio \( \frac{\sin \alpha}{h} \) is less than \( x \), or radius, but greater than
\( \cos \alpha \). But \( \alpha \) being conceived to be continually dimi-
nished, \( \alpha \) continually approaches \( x \), and may come nearer to it than by any assignable difference;
therefore, the limit of \( \frac{\sin \alpha}{h} \) is \( x \). As to the other
expression, \( \cos \alpha = \frac{\sin \alpha \sin \alpha}{1 + \cos \alpha} \) when \( h \) is supposed to be
continually diminished, its second term, to wit, \( \frac{\sin \alpha \sin \alpha}{1 + \cos \alpha} \)
may become less than any assignable quantity; therefore the limit of the expression is simply \( \cos \alpha \); thus,
upon the whole we have found that the limit of \( \frac{u'-u}{h} \)
is \( \cos \alpha \), and therefore

\[
u' = \cos \alpha, \text{ and } u = \cos \alpha, \text{ and } \cos \alpha.
\]

The fluxion of the other function, \( \alpha = \sin \alpha \), is easily deduced from that which we have just found, by
proceeding thus:

Put \( e \) to denote a quadrant, then \( \alpha = \sin (e - x) \),
and therefore

\[
u = \sin (e - x).
\]

Now, it has been just shown that

\[
\text{flux. of } \sin (e - x) = \cos (e - x) \times \text{flux. of } (e - x)
\]

but \( \cos (e - x) = \sin x \), and the fluxion of \( e - x \) is \( -x \); therefore

\[
u = -x \sin x.
\]

Thus it appears, that the fluxion of the sine of a var-
iable arch is equal to the fluxion of the arch multiplied
by its cosine; and that the fluxion of the cosine is equal
to the fluxion of the arch (taken with a negative sign)
multiplied by the sine.

60. We can now very readily find the fluxion of any
other function of an arch of a circle. Thus, suppose
\( w = \tan x \); then, because \( \tan x = \frac{\sin x}{\cos x} \), we have \( w = \frac{\sin x}{\cos x} \). This expression being considered as a fraction-
al function of \( x \), we have, by § 39, and what has been just
now shown

\[
\frac{w'}{h} = \frac{\cos x \cdot x + \sin x}{\cos^2 x}.
\]

or, since \( \cos x + \sin x = 1 \), and \( \frac{1}{\cos x} = \sec x \),

\[
\frac{w'}{h} = \frac{x}{\cos x} = \sec x.
\]

Hence also we have \( w = \frac{x}{\cos x} = \sec x + \tan x \).

In like manner, if we suppose \( w = \sec x \), then, be-
cause \( \sec x \cdot x = \frac{1}{\cos x} \), we have \( w = \frac{x}{\cos x} \), and

\[
\frac{w'}{h} = \frac{\cos x \cdot x + \sin x}{\cos^2 x}.
\]

or, since \( \sin x = \tan x \), and \( \frac{1}{\cos x} = \sec x \),

\[
\frac{w'}{h} = \frac{x}{\cos x} = \sec x \cdot \tan x.
\]

Proceeding in this manner, we find that where \( w = \cot x \), then

\[
\frac{w'}{h} = \frac{-x}{\tan x \cos x} \cdot \frac{x}{\sin x}.
\]

And when \( w = \csc x \), then

\[
\frac{w'}{h} = \frac{-x}{\sin x} \cdot \cot x \cdot \csc x.
\]

61. Let us now consider the fluxions of geometrical
magnitudes: And first let it be required to find the
expression for the fluxion of BDPC the area bounded
by CP, a curve line, and by CB, PD, the ordinates at
its extremities, and BD, the portion of AE, the line of
the abscissas, which lies between those ordinates. Let
the numerical measures of AB and PD, the co-ordi-
nates at the point, be denoted by \( x \) and \( y \), and
the numerical measure of the arc BDPC by \( t \); then
then $y$ and $x$ may both be considered as functions of the abscissa $x$.

Let $x$ or $AD$, be supposed to change its value, and to become $AD'$, and let $DP'$ and $BD'PC$ be the corresponding new values of $y$ and $x$; then $DD'$, and $DD'PP$ will be the geometrical expressions for the simultaneous increments of the abscissa and area. But, as one of these quantities is a line, and the other a space, they cannot be compared in respect of their ratio. Therefore, let us consider $a$ as denoting a line whose numerical value is unity, and then the numerical values of the increments of the abscissa and area may be considered as analogous to the geometrical quantities $DD' \times a$, and the area $DD'PP$ respectively, which quantities being homogenous may now be compared with each other. We are now to investigate the limit of $\frac{a \times DD'}{a \times DD'}$, the general expression for the ratio of the increments of $s$ and $x$. Draw $PM$ and $PN$ parallel to $AE$, meeting the ordinates in $M$ and $N$. The curvilinear area $DD'PP$ is greater than the rectangle $DD'MP$, that is, greater than $PD \times DD'$; but less than the rectangle $DD'PN$, that is, less than $PD' \times DD'$; therefore

$$\frac{PD}{a} \times \frac{DD'}{a} > \frac{PD}{a} \times \frac{DD'}{a} > \frac{PD}{a}.$$ 

But the increments being supposed to be continually diminished, $\frac{PD}{a}$ is the limit of $\frac{PD}{a}$, therefore $PD$ is also the limit of $\frac{area DD'PP}{a \times DD'}$, and hence (§ 21.)

$$\frac{x}{s} = \frac{PD}{a} = \frac{y}{1} = y, \text{ and } \frac{\delta s}{\delta x} = \frac{y}{x}.$$ 

That is, the fluxion of a curvilinear area is equal to the product of the ordinate, and the fluxion of the abscissa.

62. Before we proceed to investigate the expression for the fluxion of an arch of a curve, it is necessary that we should inquire what is the limited ratio of an arch of a curve to its chord.

Let $APB$ be any curve line, all the parts of which are concave towards its chord $AP$. Let $AQ$, $QP$ be tangents at the extremities of the arch, and let $aPQ$ be a triangle similar to $APQ$, but having its base $aP$ of a given magnitude, then

$$AQ + QP : AP :: aQ + QP : aP.$$ 

Suppose now the point $P$ to approach to $A$, then the angles at $A$ and $P$, and consequently the angles at $a$ and $p$, which are equal to them, will decrease, and may become less than any assignable angles; therefore, the limit of the ratio of $aQ + QP$ to $aP$ is evidently a ratio of equality; hence also the limit of the ratio of $AQ + QP$ to $AP$ is the ratio of equality; and since the arch $AP$ is less than $AQ + QP$, but greater than its chord $AP$, the limit of the arch $AP$ to its chord $AP$ must also be the ratio of equality.

63. We proceed now to find the fluxion of an arch of a curve. Let $APP'$ be a curve line of any kind, and $AB$, $BP'$ any two co-ordinates at a point $P$ in the curve. Put $x$ for the abscissa, $y$ for $BP$, the ordinate, and $s$ for the curve line $AP$, then $s$ and $y$ may be considered as each a function of $x$. Draw $PP'$ another ordinate, and draw $PM$ parallel to $AB$, meeting $PP'$ in $M$, and draw the chord $PP'$, then $PM$, $MP'$, and the arch $PP'$, are the simultaneous increments of $x$, $y$, and $s$ respectively. Now we have

$$\frac{arch PP'}{arch PP'} = \frac{chord PP'}{chord PP'} \times \frac{PM}{PM}.$$ 

But chord $PP' = \sqrt{(PM + MP')} = PM \sqrt{1 + MP'^2};$

therefore,

$$\frac{arch PP'}{arch PP'} = \frac{chord PP'}{chord PP'} \times \frac{MP'^2}{PM}.$$

Suppose now the increments to be continually diminished, then, as $x \rightarrow \lim$ of $arch PP'$, and $y \rightarrow \lim$ of $arch PP'$, we have $\frac{MP'^2}{PM} (\text{§ 21.})$, and $\frac{s}{x} = \lim$ of $arch PP'$. Hence, we have

$$\frac{s}{x} = \sqrt{1 + \left(\frac{y}{x}\right)^2}, \text{ and } s = \sqrt{x^2 + y^2}.$$ 

Hence it appears that the square of the fluxion of a curve line of any kind is equal to the sum of the squares of the fluxions of the co-ordinates.

64. The expression for the fluxion of a solid may be found by the same mode of reasoning as that which we have employed, § 61., to find the fluxion of a curvilinear area. Let $APQ$ be a portion of the solid generated by the revolution of $APB$, a curve line, about $AC$, a line taken in the plane of the curve, as an axis. Let $PD$, $PD'$ be the lines in which $BA$, $a$, a plane passing along the axis $AC$, meets $PQ$, $QP$, the planes of two circles formed by sections of the solid perpendicular to its axis. Draw $PM$ and $PN$ parallel to $AD$. Put $AD = x$, $DP = y$, let $z$ denote the solid $AP$, having $y$ for the radius of its circular base, and $x$ for its altitude; put $w$ for the number $3'14159$, viz. the circumference of a circle having its diameter $1$, and let $a$ denote an area, having its numerical measure expressed by unity; then $DD'$, or $a \times DD'$ being considered as the increment of $a$, the portion of the solid comprehended between the parallel planes $PQ$, $PQ'$, will be the corresponding increment of $a$, which we are to consider as a function of $x$; hence (§ 21.) $\frac{a}{x}$ is equal to the limiting ratio of the portion of the solid, comprehended between the planes $PQ$, $PQ'$ to the solid $a \times DD'$. But the former of these solids being evidently greater than a cylinder $Pm$, having the circle $PA$ for its base, and $DD'$ for its altitude, that is greater than $\pi PD \times DD'$, and less than a cylinder $Np$, having the circle $PQ'$ for its base, and $DD'$ for its altitude, that is less than $\pi PD' \times DD'$;
it follows, that as long as DD' has an assignable magnitude,

\[
\frac{xPD^4 \times DD' \times x}{a \times DD'} \rightarrow \frac{xPD^4}{a};
\]

and\[
\frac{xPD^4 \times DD' \times x}{a \times DD'} \rightarrow \frac{xPD^4}{a};
\]

but the increment DD' being continually diminished, \(\frac{xPD^4}{a}\), the greater limit of \(\frac{x}{n}\), approaches continual-
ly to its lesser limit \(\frac{xPD^4}{a} = \frac{x}{a} = (\text{because } a = 1) x\); so as to come nearer to it than by any assignable differ-
ence, therefore \(\frac{x}{a} = ay\), and \(\frac{x}{a} = ay\). Now, if we ob-
serv that \(y^2\) is the area of the circle \(PQ\), it will appear, that the fluxion of a solid generated by the revolu-
tion of a curve about its axis is equal to the fluxion of the axis multiplied by the general expression for the area
of a circle formed by supposing the curve to be cut by a plane perpendicular to its axis.

Fig. 5.

To find the fluxion of the surface of the solid, let us denote that surface by \(s\), and let \(x\) and \(y\) denote as before; then the surface contained between the cir-
cles \(PQ\) and \(P'Q'\) will be the increment of \(s\), cor-
responding to \(DD'\) the increment of \(x\). Draw\ the chord PP', then the curve line PP' being supposed to re-
volve about the axis AC, and thus to generate the increment of the surface of the solid, the chord PP'
will generate at the same time the convex surface of a frustum of a cone; now the limiting ratio of the curve
line PP' to its chord PP' being the ratio of equality, the limiting ratio of the surfaces generated by the revolu-
tion of these lines will also be the ratio of equality;

\[
\frac{\text{surf. gener. by arch PP'}}{x \times DD'}\]

will also be the limit of

\[
\frac{\text{surf. gener. by chord PP'}}{DD'}\]

but the convex surface of a frustum of a cone is equal to the product of its slant side into half the sum of the circumference of its two bases (see Geometry), and in the present case these circumstances are equal to \(2 PD \times x\), and \(2 PD' \times x\), therefore \(\frac{x}{n}\) is equal to the limit of

\[
\frac{\pi(PD+PD') PP'}{DD'} = \pi(PD+PD') PP' \frac{DD}{DD'};
\]

but the point \(D'\) being supposed to approach to \(D\), the

limit of \(PD+PD'\), will manifestly be \(a PD'y\); and since

\[
\frac{PP'}{DD} = \frac{(\sqrt{DD'^2+PM'^2})}{DD} = \sqrt{1 + \frac{PM'^2}{DD}}\]

the limit of this expression (if we consider that \(PM\) and \(DD'^2\) are the simultaneous increments of \(x\) and \(y\)) is evident,
yielding \(\frac{x}{a} = ay\), therefore

\[
\frac{x}{a} = 2xy \sqrt{1 + \frac{x^2}{a}};
\]

and consequently

\[
\frac{x}{a} = 2xy \sqrt{1 + \frac{x^2}{a}}.
\]

If we now observe that \(a = y\) is the circumference of the circle \(PQ\), and \(\sqrt{1 + \frac{x^2}{a}}\) is the fluxion of the curve line \(AP\); it, will appear, that the fluxion of the surface of a solid generated by the revolution of a curve about its axis is equal to the fluxion of the curve line multiplied by the general expression for the circumference of a circle formed by supposing the curve to be cut by a plane perpendicular to its axis.

Sect. III. The Application of the Direct Method of

Fluxions.

Having explained the principles of the direct method of fluxions at as great a length as we think suitable to the work of which this treatise forms a part, we proceed to shew how the calculus may be applied to the resolution of some general problems in Analysis and Geometry.

Investigation of a general formula for expanding a

Function into a Series.

66. In treating of principles of the method of fluxions, we have, from an examination of particular functions, inferred by induction, that \(u\) being any function of a variable quantity \(x\), which was either actually expressed, or capable of being expressed by a combination of the powers of \(x\), then \(x\) being supposed to change its value, and to become \(x + h\), the new value which the function \(u\) will acquire when \(x + h\) is substituted in it instead of \(x\) will always be capable of being expanded into a series of this form,

\[u + p h + q h^2 + r h^3 + \&c.,\]

where \(p, q, \&c.\) denote functions of \(x\) that are quite independent of \(h\).

We have shown that, from the particular form of this development, it happens that the ratio of \(p h + q h^2 + r h^3 + \&c.\) the increment of the function, to \(h\) the increment of the variable quantity \(x\) itself, admits of a limit, which is always expressed by \(p\), the coefficient of its second term; and as we have defined this limit to be the expression for the ratio of the fluxions of \(u\) and \(x\), so that \(\frac{u}{x}\), the new value of the function may also be expressed thus,

\[\frac{u}{x} + p + q h + r h^2 + \&c.,\]

And
And this expression may be considered as indicating not only the general form of the series, but also the particular relation subsisting between \( u \), the original function, and \( p_t \), the coefficient of the second term of the series, the latter being in every case that function of \( x \) which results from the operation of taking the fluxion of the former, and dividing by \( x \).

We are now to investigate the relation that subsists between each of the remaining coefficients and the original function.

67. First let us suppose the function \( w \) to have the particular form \( x^n \), \( n \) being a constant number. Then \( x \) changing its value to \( x + h \), \( x \) changes to \( x' = (x + h)^n \), therefore, by the binomial theorem (§ 52.),

\[
w' = x' + nx'x^{-1}h + \frac{n(n-1)}{2} x^{-2} h^2 + \text{&c.}
\]

But since \( w = x^n \), by taking the successive fluxions of \( u \), and considering \( x \) as constant, we have

\[
w' = nx^{n-1}, \quad w'' = n(n-1)x^{n-2}, \quad w''' = \frac{n(n-1)(n-2)}{2} x^{n-3}, \quad w'''' = \frac{n(n-1)(n-2)(n-3)}{2} x^{n-4}, \quad \text{&c.}
\]

Let \( u, w, w', w'' , \text{&c.} \) be now substituted for \( x^n, nx^{n-1},\)

\[
x(x-1)x^{n-2}, \text{&c. respectively, in the series for } w', \text{ and we have}
\]

\[
w' = u + \frac{w}{x} + \frac{w'}{x^2} + \frac{w''}{x^3} + \frac{w'''}{x^4} + \text{&c.}
\]

68. This manner of expressing the development of \( w' \), or \((x + h)^n\), indicates directly the relation that each of the coefficients of the successive powers of \( h \) has to the original function.

The first term of the series is the original function \( u \), or \( x^n \) itself, or it is what the function \((x + h)^n\) becomes upon the supposition that \( h = 0 \). The second term is \( h \), or \( \frac{h}{x} \), multiplied by the coefficient \( \frac{u}{x} \), which coefficient is a function of \( x \) derived from the original function by the operation of taking its fluxion, and dividing the result by \( x \). The third term is \( \frac{h^2}{x^2} \) multiplied by the coefficient \( \frac{w}{x} \), that is, by a function of \( x \) derived from the preceding coefficient \( \frac{u}{x} \) by the same

operation as that coefficient was derived from the original function, namely by taking the fluxion of \( \frac{u}{x} \), considering \( x \) as constant, and dividing by \( x \). The fourth term is \( \frac{h^3}{x^3} \) multiplied by \( \frac{w'}{x^2} \), that is, by a function of \( x \) deduced from the third coefficient by the very same operation as that by which the third was derived from the second, or the second from the first. And so on with respect to all the other terms of the series, the \( n \)th term being the product of \( \frac{h^n}{x^n} \) and the \((n-1)\) th fluxion of the function \( w \) divided by \( x^{n-1} \).

69. Let us now suppose that \( w \) denotes any other function of \( x \), then, whatever be its nature, it may always be conceived as capable of being expressed by a series, the terms of which are powers of \( x \), in this manner;

\[Ax^n + Bx^{n-1} + Cx^{n-2} + Dx^{n-3} + &c.
\]

where \( A, B, C, \text{&c.} \), \( a, b, c, \text{&c.} \) denote constant numbers. Thus we have

\[w = Ax^n + Bx^{n-1} + Cx^{n-2} + &c.
\]

Then, \( w \) being supposed to become \( x + h \), and (in consequence of the change in the value of \( x \)) \( w \) to become \( w' \); we have

\[w' = A(x + h)^n + B(x + h)^{n-1} + C(x + h)^{n-2} + &c.
\]

Let us now denote \( Ax^n \) by \( P \), \( Bx^{n-1} \) by \( Q \), \( Cx^{n-2} \) by \( R \), \&c. then by last §

\[
\begin{align*}
A(x + h)^n &= P + \frac{\dot{P}}{x} + \frac{\ddot{P}}{x^2} + \frac{\dddot{P}}{x^3} + &c., \\
B(x + h)^n &= Q + \frac{\dot{Q}}{x} + \frac{\ddot{Q}}{x^2} + \frac{\dddot{Q}}{x^3} + &c., \\
C(x + h)^n &= R + \frac{\dot{R}}{x} + \frac{\ddot{R}}{x^2} + \frac{\dddot{R}}{x^3} + &c.
\end{align*}
\]

&c.

Therefore, substituting these developments in the series expressing \( w' \),

\[
\begin{align*}
w' &= \left[ \frac{P}{x} + \frac{Q}{x^2} + \frac{R}{x^3} + &c. \right] h \\
&\quad + \left[ \frac{\dot{P}}{x} + \frac{\dot{Q}}{x^2} + \frac{\dot{R}}{x^3} + &c. \right] \frac{h}{x} \\
&\quad + \left[ \frac{\ddot{P}}{x^2} + \frac{\ddot{Q}}{x^3} + \frac{\ddot{R}}{x^4} + &c. \right] \frac{h}{x^2} \\
&\quad + \left[ \frac{\dddot{P}}{x^3} + \frac{\dddot{Q}}{x^4} + \frac{\dddot{R}}{x^5} + &c. \right] \frac{h}{x^3} \\
&\quad + &c.
\end{align*}
\]

Vol. VIII. Part II.
FLUXIONS:

\[ u = P \cdot Q + R + \text{&c.} \]
\[ \frac{u}{x} = \frac{P}{x} + \frac{Q}{x^2} + \frac{R}{x^3} + \text{&c.} \]
\[ u = \frac{P}{x^3} + \frac{Q}{x^4} + \frac{R}{x^5} + \text{&c.} \]
\[ x^2 + x^3 + x^4 + \text{&c.} \]

Therefore, substituting \( u, \frac{u}{x}, \text{&c.} \) for the series to
which they are respectively equal,

\[ u = u + \frac{u}{x} + \frac{u}{x^2} + \frac{u}{x^3} + \frac{u}{x^4} + \text{&c.} \]

Hence it appears that \( u \) being any function of \( x \)
whatever, if \( x + h \) be substituted in that function instead of \( x \), the series expressing the development of this new value of the function will have the general properties which have been shewn, in last \( \S \), to belong to it in the case of the function having the particular value \( x \).

The very general theorem which we have just now
investigated is one of the most elegant and important in
analysis. It was first published by Dr Brooke Taylor
in a work entitled Methodus Incrementorum, which
made its appearance about the year 1716. The the-
orem itself is generally known by the name of Taylor's
theorem. It is more general than the celebrated Bi-
nomial theorem, inasmuch as this last, and innumerable
others, are comprehended in it as particular cases.

70. We shall now give some examples to shew the
manner of applying Taylor's theorem, as well as its great
utility as an instrument of analysis.

Example 1. Suppose \( u = \alpha x^2 \), \( \alpha \) being constant and \( x \)
variable. Then \( x \) becoming \( x + h \), \( u \) becomes \( u = \alpha (x + h)^2 \).
Now from the equation \( u = \alpha x^2 \) we derive \( (\text{S. 56.}) \)
\[ \frac{u}{x} = 2 \alpha x, \quad (\text{here } \alpha \text{ denotes } \log x) \]
Again, considering \( x \) as constant, and repeating the operation of tak-
ing the fluxion \( \frac{u}{x} = \alpha x^2 \), we get \( \frac{u}{x} = \alpha x^2 \), and hence

\[ \frac{u}{x} = \alpha x^2 \]
again \( \frac{u}{x} = \alpha x^2 \), &c. Therefore, substituting for
\( u', u, \frac{u}{x}, \frac{u}{x^2}, \text{&c.} \) their values in the general theorem
\[ u = u + \frac{u}{x} + \frac{u}{x^2} + \text{&c.} \text{ it becomes} \]

\[ x^2 + x^3 + x^4 + \text{&c.} \]

Suppose now, that \( x = 0 \), then, as in this case \( x = 0 \),
we have

\[ a^x = 1 + \frac{A}{2} + \frac{A^2}{2 \cdot 3} + \text{&c.} \]

or, exchanging \( h \) for \( x \),

\[ a^x = 1 + A + \frac{A^2}{2} + \frac{A^3}{2 \cdot 3} + \text{&c.} \]

the same result as we formerly obtained in \( \S \ 54 \).

Ex. 2. Suppose \( u = \log x \). Then, \( x \) becoming \( x + h \), \( u \) becomes \( u = \log (x + h) \). Now from the
equation \( u = \log x \) we find \( (\text{by } \S \ 57.) \)
\[ \frac{u}{x} = \frac{M}{x} \]

Here \( M \) denotes the modulus of the system. Again, sup-
pposing \( x \) constant, we find by \( \S \ 26, \)
\[ \frac{u}{x^3} = \frac{M}{x^3} \]

\[ = 2M, \quad u = \frac{2M}{x^3} \]

Therefore, substituting \( u, \frac{u}{x}, \text{&c.} \) in the general for-

\[ \log (x + h) = \log x + \frac{M}{x} - \frac{M}{2x^2} \frac{h^2}{2} + \frac{M}{3x^3} \frac{h^3}{3} - \text{&c.} \]

If we suppose \( x = 0 \), and change \( h \) into \( y \), we have,
because \( \log x = \log 1 = 0 \),

\[ \log (1 + y) = M \left( y + \frac{y^2}{2} + \frac{y^3}{3} - \text{&c.} \right) \]

For the particular method of applying these two
series to the calculation of logarithms, see ALGEBRA,
\( \S \ 285 \text{ to } \S \ 291 \). See also LOGARITHMS.

Ex. 3. Suppose now \( u = \sin x \). Then \( u = \sin \)
\( (x + h) \). From \( u = \sin x \), by the application of the
rule in \( \S \ 59 \), we deduce \( \frac{u}{x} = \cos x \cdot \frac{h}{x^2} = - \sin x \cdot \frac{h}{x^2} \)
\[ = - \cos x \cdot \frac{h}{x^2} = \sin x, \text{&c.} \]
Therefore, substituting
for \( u', u, \frac{u}{x}, \frac{u}{x^2}, \text{&c.} \) their values in the general formula
as before, we have

\[ \sin (x + h) = \sin x + \cos x \cdot \frac{h}{1} - \sin x \cdot \frac{h^2}{2} - \cos x \cdot \frac{h^3}{1 \cdot 2} + \sin x \cdot \frac{h^4}{1 \cdot 2 \cdot 3} + \text{&c.} \]
or \( \sin (x + h) \) is equal to

\[ \sin x \left( 1 - \frac{h^2}{2} + \frac{h^4}{1 \cdot 2 \cdot 3} - \text{&c.} \right) + \cos x \left( h - \frac{h^3}{1 \cdot 2} + \frac{h^5}{1 \cdot 2 \cdot 3 \cdot 4} - \text{&c.} \right) \]

If we suppose \( x = 0 \), then, as in that case \( \sin x = 0 \),
the preceding formula becomes

\[ \sin.
Now, $w'$ being the value that $w$ assumes when $x=x$, is substituted in it instead of $x$, if we suppose $x=x_0$, then $w'$ becomes the very same function of $x$, that $w$ is of $x$.

Let us denote the values which each of the functions $w$, $w'$, $w''$, etc. acquire, when $x=x_0$, by $U_1, U_1', U_1''$, &c. respectively.

Then $(\frac{w}{x})'$ (considered as the same function of $\frac{w}{x}$ as $w$ of $x$) is equal to

$$U_1+U_1'\frac{x}{1}+U_1''\frac{x^2}{1.2}+U_1'''\frac{x^3}{1.2.3}+&c.$$ 

Let $x$ be now supposed to be substituted both in $w'$, and the series which is its development instead of $x$, then $w'$ becomes $w$, and we have

$$w=U_1+U_1''\frac{x}{1}+U_1'''\frac{x^2}{1.2}+U_1''''\frac{x^3}{1.2.3}+&c.$$ 

and in this formula it is to be considered, as already stated, that $U_1, U_1', U_1''$, &c. denote the particular values which the functions $w$, $w'$, $w''$, &c. acquire respectively, by supposing that in each of them $x$ is taken $=x_0$.

72. As an example of the application of this series, let us resume the equation $w=ax^2$, then $w_1=ax^2_1$.

$(\frac{w}{x})_1'=ax^2_1-ax^2_1$.

Suppose now that $x=x_0$, then $w$, or $a-x$ becomes $a-x_0$, then $w_0=ax^2_0$ becomes $a-x_0^2$. The series $a-x_0^2$ becomes $a-x^2$, &c. so that $U_1=0$, $U_1'=a-x^2$, $U_1''=a-x^2$, &c. substituting therefore these values in the general formula, it becomes

$$a-x^2+\frac{a-x^2}{1}+\frac{a-x^2}{1.2}+\frac{a-x^2}{1.2.3}+&c.$$ 

Let us next suppose that $w$ is an arc of a circle of which the sine is $w$ (radius being unity), then $w=sinw$.

Now the ratio of the fluxion of $w$ to the fluxion of $w$ will be the very same whether we consider $w$ as a function of $x$, or as a function of $w$; therefore $(\frac{w}{x})_1'=sinw_1, \frac{w}{x}=\frac{1}{\sqrt{1-sin^2}}$, but since $sinw=x$, cos.

$$w=sin(1-x^2), \text{ therefore, } \frac{w}{x}=\frac{1}{\sqrt{1-x^2}}.$$ 

Taking $\frac{w}{x}=\frac{n}{x^{n-1}}$.

(For the sake of illustration let us take a particular example. Suppose $w=(a+x)^n$, then $\frac{w}{x}=n(a+x)^{n-1}$, $\frac{w}{x}=n(a+x)^{n-1}$, &c. Suppose now that $x=x_0$, then $w$ becomes $a-x_0$, $\frac{w}{x}=n(a-x_0)^{n-1}$, $\frac{w}{x}=n(a-x_0)^{n-1}$, &c. so that in this particular case we have $U_1=a-x_0$, $U_1'=n(a-x_0)^{n-1}$, $U_1''=n(a-x_0)^{n-2}$, &c.)
FLUXIONS.

Direct Method.

Taking now the fluxion of \( \sqrt[3]{(1-x^a)} \), and the fluxion of the result, &c., we have

\[
\frac{du}{dx} = \frac{x}{x^a (1-x^a)^{\frac{3}{2}}}
\]

\[
\frac{d^2 u}{dx^2} = \frac{1}{x^a} + \frac{3a}{(1-x^a)^{\frac{5}{2}}}
\]

\[
\frac{d^3 u}{dx^3} = \frac{3.3a^2}{(1-x^a)^{\frac{7}{2}}} + \frac{3.5a^3}{(1-x^a)^{\frac{9}{2}}},
\]

&c.

Suppose now that \( x = 0 \), then \( u \) becomes \( 0 \); \( -\frac{du}{dx} \) becomes

\[
\frac{1}{x^a}
\]

\( \frac{1}{x^a} \) becomes \( 0 \); \( \frac{d^2 u}{dx^2} \) becomes \( 0 \), &c. So that

\( U = 0 \), \( U = 1 \), \( U = 0 \), \( U = 1 \), \( U = 0 \), &c.

Therefore, substituting in the general formula, we find

\[
u = x + \frac{a^3}{1.2.3} + &c.
\]

By prosecuting the computation further, we may find

\[
u = x + \frac{a^3}{1.2.3} + \frac{3a^5}{2.3.4.5} + \frac{3a^7}{2.3.4.5.6.7} + &c.
\]

Application of the Method of Fluxions to the Drawing of Tangents.

73. The theory of tangents to curve lines furnishes a good illustration of the truth of the principle which we have considered as the foundation of the method of fluxions, namely, that whatever be the form of a function, the ratio of its increment to the increment of the variable quantity from which the function is formed, is in every case susceptible of a limit.

Let \( AB \), the abscissa of a curve, be the geometrical expression of a variable quantity \( x \); and let \( BP \) be the corresponding ordinate, be the expression for \( y \); any function of \( x \); then the curve line itself is the locus of the equation expressing the relation between \( x \) and \( y \). Let \( PT \), a tangent to the curve at \( P \), meet \( AB \) the abscissa in \( T \); through \( P \) draw any straight line meeting the abscissa in \( D \), and the curve in \( P \); from \( P \) draw the ordinate \( p \), and from \( D \) draw \( Pn \) parallel to the abscissa, meeting the ordinate \( BP \) in \( n \).

The triangles \( DBP \), \( Pn \), are similar; therefore

\[
p : n \propto BP : BD.
\]

Now \( p \), \( n \), and \( PB \), \( BO \), are the increments of \( PB \) and \( BA \), or of \( y \) and \( x \) respectively, therefore the ratio of the simultaneous increments of \( PB \) and \( BA \), or of \( y \) and \( x \), whatever be their magnitudes, is equal to the ratio of \( PB \) to \( BD \). Conceive now the point \( p \) to approach continually to \( P \), then the angle contained by the straight line \( pF \), and the tangent \( PT \), will decrease, and the point \( D \) will approach to \( T \); at the same time \( n \), \( p \), and \( nP \), the increments of \( y \) and \( x \), will be continually diminished; still, however, they will have to each other the ratio of \( PB \) to \( BD \), but this ratio approaches continually to the ratio of \( PB \) to \( BT \), and becomes at last more nearly equal to it than any assignable ratio; therefore the ratio of \( PB \) to \( BT \) is the limit of the ratio of \( PB \) to \( BD \), and consequently is also the limit of the ratio of \( PB \) to \( BT \), the increment of \( y \), to \( a \), the increment of \( x \). And as this conclusion does not depend upon the particular nature of the curve, or upon any particular relation supposed to subsist between \( x \) and \( y \), we may conclude, that whatever be the form of the function, the ratio of the simultaneous increments of the function, and the variable quantity from which it is formed, has a limit to which it approaches when the increments are conceived to be continually diminished.

It is now easy to see how the method of fluxions may be applied to the determination of tangents to curves, since the ratio of the ordinate \( PB \) to the subtangent \( BT \) is always the limiting ratio of the increments of the ordinate and abscissa, it is equal to the ratio of their fluxions, that is

\[
\frac{y}{x} = \frac{\text{subt. BT}}{a},
\]

Hence in any curve whatever, referred to an axis, the subtangent, (that is, the segment of the abscissa between the ordinate and tangent) is equal to \( \frac{y}{x} \) where \( \frac{x}{y} \) denotes the abscissa, and \( y \) the ordinate at the point of contact; and the subtangent being found, the position of the tangent is thereby determined.

Let us apply the above general formula to some examples.

Example 1. Let the proposed curve be a circle. It is required to determine the position of \( PT \), a tangent at any point \( P \) in its circumference.

Put \( 2a \) for \( AE \), the diameter, also \( x \) for \( AB \) the abscissa, and \( y \) for \( BP \) the ordinate at the point of contact.

From the nature of the curve, we have

\[
AB \times BE = EB^2, \text{ that is } x(2a-x) = y^2.
\]

Hence taking the relations of the fluxions of \( x \) and \( y \), we have

\[
2ax - 2x^2 = 2yy,
\]

therefore \( \frac{x}{y} = \frac{y}{a-x} \), and \( BT = \frac{x}{y} \cdot \frac{y}{a-x} \);

from which it appears that \( BT \) the subtangent is a third proportional to \( a-x \) and \( y \), that is, to \( CB \) the distance of the ordinate from the centre, and \( BP \) the ordinate, agreeing with what is known from the elements of geometry.

Example 2. Let the curve be a parabola, required the same as before.

Put \( x \) for \( AB \), the abscissa, and \( y \) for \( BP \) the ordinate at \( P \) the point of contact; also \( a \) for the parameter; then, from the nature of the curve

\[
PB^2 = ax \times AB, \text{ that is } ax = y^2,
\]

therefore,
Fluxions.

Ex. 5. Suppose the curve APD to be a cycloid, of Fig. 11, which AE is the axis, and AQE a semicircle described on the axis as a diameter. Suppose AC, the radius, to be unity; put AB = x, BP = y, and the arch AQ = v; then, AB = 1 - cos v, and BQ = sin v. Now, from the nature of the curve, PB = arch AQ + BQ; hence we have

\[ x = 1 - \cos v, \quad y = v + \sin v, \]
and taking the fluxions, by § 59,

\[ \dot{x} = v \sin v, \quad \dot{y} = v + v \cos v; \]

therefore,

\[ \frac{\dot{y}}{\dot{x}} = \frac{v \sin v}{v} = \sin v. \]

But from the nature of the circle, \[ \frac{BQ}{EB} = \frac{AB}{BP}, \] therefore, \[ BT = \frac{PB \times AB}{BQ}, \] and consequently \[ BQ : BA :: BP : BT, \] from which it appears that if the chord AQ be drawn, the tangent PT is parallel to the chord QA.

74. If PT (Fig. 6.) be a tangent to the curve AP at Fig. 6, the point P, and PC be drawn perpendicular to the tangent, meeting AC the axis of the curve in C, then the line PC is called a normal to the curve at the point P; and BC, the distance between the ordinate and the extremity of the normal, is called the sub-normal.

The triangles TBP, BPC being similar, we have \[ TB : BP :: BP : BC; \] or, since \[ TB : BP :: \frac{\dot{y}}{\dot{x}} : y, (\text{§ 72}) \]

\[ \frac{\dot{y}}{\dot{x}} : y :: BC, \] hence in any curve, BC the sub-normal is equal to \( \frac{\dot{y}}{\dot{x}} \); and from this expression, we may find the sub-normal in the same way as we have found the sub-tangent in the examples of last §.

75. As by plane trigonometry

\[ TB : BP :: \tan \theta : \text{tangent of } T, \]

and from § 73, \[ TB : BP :: x : y, \]

therefore \[ \frac{\dot{y}}{\dot{x}} :: x : \tan T, \]

hence it appears that \( \frac{\dot{y}}{\dot{x}} \) expresses the numeral tangent of the angle T, that is, the angle contained by a tangent to the curve, and the axis of the curve. In like manner we have

\[ \frac{\dot{y}}{\dot{x}} :: BP : BD :: CB : BP :: x : \tan C, \]

therefore \( \frac{\dot{y}}{\dot{x}} \) expresses the tangent of the angle C, that is, the angle contained by a normal to the curve and its axis.

Application
FLUXIONS.

76. If a variable quantity be supposed to change its magnitude, then any function of that quantity will also change its magnitude. When the variable quantity is supposed to increase continually so as to acquire successively all degrees of magnitude, there are some functions of such a form, that they either increase continually, or decrease continually; but there are others again which increase to a certain limit, after which they decrease; or else they decrease to a certain limit, after which they increase.

If, in consequence of the continual increase of a variable quantity, a function of that quantity first increases to a certain limit, and afterwards decreases, when it arrives at that limit it is then said to be a maximum. Or if it decrease to a certain limit, and afterwards increase, when it arrives at that limit, it is then said to be a minimum.

77. Let us consider the function \(y = b - (x - a)^2\). If we suppose \(x = a\), then \(y = b - a^2\). Suppose now \(x\) to be at first very small, and to increase; then as \((x - a)^2\) will decrease, \(y\) will also increase, till \(x\) become \(\approx a\), and then \(y\) will become \(\approx b\), when it is a maximum; for \(x\) being supposed to become greater than \(a\), \(y\) will be less than \(b\). By supposing \(x\) to increase till \((x - a)^2\) becomes equal to \(b\), then \(y\) will decrease to \(0\); and \(x\) being still supposed to increase, \(y\) will become negative.

Let us next suppose \(y = b + (x - a)^2\). In this case when \(x = a\), \(y = b + a^2\); as \(x\) increases, \((x - a)^2\) decreases, and consequently \(y\) decreases, till \(x = a\), and then \(y = b\), a minimum; for \(x\) becoming greater than \(a\), \(y\) becomes greater than \(b\).

78. Every function that either increases or decreases continually has neither maximum nor minimum; for whatever value such a function may acquire, in the one case it may always have a greater, and in the other a less value.

The characteristic property of a maximum value of a function, by which it is made the object of analytical inquiry, consists in its being greater than the values immediately preceding, and also greater than the values immediately following it; and that of a minimum consists in its being less than the values immediately preceding, and also less than the values immediately following it.

In some cases a function may increase to a certain limit and then decrease, and afterwards increase again indefinitely; or the contrary. Hence it may happen that such a function may have values greater than its maximum or less than its minimum as they have been here defined. And indeed it is easy to conceive that a function may increase and decrease alternately several times; in such a case it must be considered as having several maxima and minima.

79. Since \(y\) any function of a variable quantity \(x\) may be considered as the ordinate of a curve, of which \(x\) is the abscissa, it is evident that to determine the greatest or least value of such a function, we have only to seek the greatest or least ordinate of the curve which is the locus of the equation expressing the relation between \(x\) and \(y\). Let us suppose this curve to be DPE, and that AB is the value of \(x\), corresponding to BP the maximum or minimum value of the ordinate \(y\); it is evident, that in the case of a maximum, the curve must be concave towards AC, at least to a certain extent, on each side of the point P, as in fig. 12; but that in the case of a minimum it must be convex towards AC, as in fig. 13; and also, that in either case, if a straight line be drawn through P parallel to AC, the curve must be wholly on one side of that line, to a certain extent on each side of the point P, and therefore, that the line PQ must be a tangent to the curve at the point P.

Now when PQ a tangent to a curve at P (fig. 8) meets the axis in T, it has been shown, § 75, that \(\frac{y}{x}\) is the expression for the tangent of the angle \(T\), radius being unity; but this angle vanishes, when PQ, instead of meeting AC, is parallel to it, as in fig. 12, and fig. 13; therefore, as in this case the tangent of the angle is \(\approx 0\), we have \(\frac{y}{x} \approx 0\).

Hence it appears, that to determine the maximum or minimum of \(y\), a function of \(x\), we must find the fluxion of the function, and divide it by \(x\), and put the result equal to 0.

80. We proceed to illustrate this rule by some examples.

Ex. 1. To divide a given number \(a\) into two such parts, that their products may be the greatest possible.

Let \(x\) denote the one part, then \(a - x\) will be the other part, and \(x(a - x)\) the product of the two parts. Therefore, by the question

\[y = x(a - x) = ax - x^2,\]

hence, taking the fluxion of the function,

\[y' = a - 2x,\]

therefore, \(a = 2x\), or \(x = \frac{a}{2}\).

Thus it appears that the product of the parts will be the greatest possible, when each is half the given number.

Ex. 2. To find the fraction which shall exceed its cube by the greatest quantity possible.

Let \(x\) denote the fraction, then its cube is \(x^3\), so that we have

\[y = x - x^3,\]

a maximum;

therefore, taking the fluxion of the function,

\[y' = 1 - 3x^2,\]

hence \(3x^2 = 1\), and \(x = \frac{1}{\sqrt{3}}\), the fraction required.

Ex. 3. To determine the greatest rectangle that can be inscribed in a given triangle.

Put the base AC of the triangle \(\equiv b\), and its altitude BD \(\equiv a\), and let \(AB\), the altitude of the rectangle, be \(x\), considered as variable, be denoted by \(x\), then, because
because of the parallel lines $AC, p, q$, it will be, as $BD:AC::Dn:pq$, that is $b:a = x = y; pq$, hence $p = \frac{b(a-x)}{a}$, and the area of the rectangle, or $p \times Bn$, will be $= \frac{b(a-x)^2}{a}$, therefore $y = \frac{b(a-x)^2}{a}$.

must be a maximum, and hence $y = \frac{b a^2 - 2 b x}{a}$; thus we have

$$\frac{y}{x} = \frac{b a^2 - 2 b x}{a} = 0,$$

and $b a - 2 b x = 0$, and $x = \frac{a}{b}$; hence it appears that the greatest inscribed rectangle is that whose altitude is half the altitude of the triangle.

81. It is proper to observe that the value of a quantity, when a maximum or minimum, may often be determined more readily by considering that any given multiple, or part of the function, likewise any power or root of it, must then be also a maximum or minimum. Thus in the preceding example, in which the function to be a maximum is $\frac{b(a-x)^2}{a}$, we may reject the constant multiplier $\frac{b}{a}$, and then the function to be a maximum is $y = (a-x) a x = a x^2$, the fluxion of which being taken, we have $y = a x^2 - 2 a x$ and $\frac{y}{x} = a - 2 a = 0$,

hence $x = \frac{a}{b}$, the same value as before.

82. Ex. 4. Of all the right-angled plane triangles having the same given hypothenuse, to find that whose area is greatest.

Let $ABC$ be the triangle; put $AB = x$, and $AC$, the given hypothenuse, $= a$, then $BC = \sqrt{a^2 - x^2}$, and consequently the area of the triangle is $\frac{a}{2} \sqrt{a^2 - x^2}$, which being a maximum, its square $x^4(a^2 - x^2)$, also four times that square, or $x^4(a^2 - x^2)$, will likewise be a maximum, therefore $y = x^4(a^2 - x^2) = a x^2 - x^2$, a max.

hence $y = 2 a x^2 - 4 x^2 = 0$, and

$$\frac{y}{x} = 2 a x - 4 x = 0,$$

hence $2 a x = 4 x$, and $x = \frac{a}{2}$.

Ex. 5. To determine the greatest cylinder that can be inscribed in a given cone.

Put $AC$ the base of the cone $= b$, BH its altitude $= a$, and DF, the diameter of the end of the cylinder DGF inscribed in the cone, $= x$. From the similar triangles BAC, BDF, we have $AC : BH :: DF : BE$, that is $b : a = x : BE$, hence $BE = \frac{a x}{b}$, and $EH = BH - BE = a x - \frac{a b - a x}{b}$. Put $c$ for the number $0.78139$, then the area of the base of the cylinder is $(by the Elements of Geometry) c \times DF^2$, and

its solid content $c \times DF \times EH = \frac{c a x^3(b-a)}{b}$, hence $\frac{c a x^3(b-a)}{b}$ is to be a maximum, therefore, leaving out the constant multiplier $\frac{c a}{b}$, we have $y = x^3(b-a) = b x^3 - a x^3$, a maximum; taking now the fluxions, we get

$$\frac{y}{x} = 2 b x^2 - 3 x^2 = 0,$$

$$\frac{x}{x} = 2 b x - 3 x^2 = 0,$$

ence $x = 2 x$ and $x = \frac{a}{2}$, and consequently HF $= \frac{3}{2}$ BH.

Ex. 6. To find the sun's place in the ecliptic, when that part of the equation of time which arises from the obliquity of the ecliptic is a maximum.

Let $EQ$ be the equator, $EC$ the ecliptic, $S$ the sun's place, and $SA$ his declination, then this part of the equation of time is the difference of the sun's longitude $ES$, and right ascension $EA$, turned into time. Put the arch $ES = x$, the arch $EA = v$, which is to be considered as a function of $x$, and put $a$ for the cosine of the angle $E = 23^\circ 28'$. Then, by Spherical Trigonometry, in the right-angled spherical triangle $EAS$, we have $\tan EA = \cos ES \times \tan ES$; therefore, to determine $x$ we have $\tan ES = \tan EA \times \tan x$, and $y = x - v$, a maximum.

From the second of these equations we get

$$\frac{y}{x} = x - v,$$

and from the first, by $60$.

$$\frac{y}{x} = x - v = \frac{a \sec^2 x}{\sec^2 v} + v = \frac{a \sec^2 x}{\sec^2 v},$$

therefore, $1 - \frac{a \sec^2 x}{\sec^2 v} = 0$, and $\sec v = a \sec^2 x$, or $\sec v + \sec x = a \sec^2 x$, but from the first equation $\sec x \cos x = \cos x \sec x$, therefore,

$$\sec x \cos x = a \sec x \cos x,$$

or $a (a-1) \sec x \cos x = a-1$,

hence $\tan x = \frac{\sqrt{a}}{a-1} \approx 1.04416$, the tangent of $46^\circ 14'$, the sun's longitude when this part of the equation is a maximum.

83. We have deduced the rule of § 79. for determining when a function is a maximum, or minimum, from the consideration of curve lines. The whole theory of maxima and minima may however be explained in a manner purely analytical, as follows:

Let us suppose that $y$ is any function whatever of $x$, and that $x$ has acquired the value that produces the maximum or minimum of the function; then, if we suppose $x = -h$ and $x = +h$ to be substituted successively in the function instead of $x$, the two resulting values ought to be both less than the maximum or both greater than the minimum value.
Let us denote the value of the function that results from the substitution of \( x + h \) by \( y \) and that which results from the substitution of \( x - h \) by \( y' \), then by the theorem given in § 69,

\[
y = y' + \frac{h}{x^2} \frac{y}{x} + \frac{1}{2} \frac{h^2}{x^3} \frac{y}{x} + \ldots + \frac{1}{n!} \frac{h^n}{x^n} \frac{y}{x} + \ldots + \text{& c.}
\]

In each of these values, \( \frac{y}{x} \), the coefficient of \( h \), must either be equal to some quantity, positive or negative, or else it must = 0. Let us suppose, if possible, that it is equal to some quantity, positive or negative; now as \( h \) may be conceived to be so small that the term \( \frac{h}{x} \) \( y \), or any other term, shall exceed the sum of all the terms that follow it in each series, (D) if we suppose \( h \) to have such a value, then, because of the term \( \frac{h}{x} \) \( y \), having the sign — in the one series, and \( + \) in the other, it follows that the one value of the function is greater, and the other less than \( y \), the maximum or minimum value. But this conclusion is inconsistent with the nature of a maximum or minimum, therefore \( \frac{y}{x} \) cannot be in the case of a maximum or minimum be equal to any positive or negative quantity whatever.

If however we assume \( \frac{y}{x} = 0 \), so that the two values are,

\[
y = y + \frac{h}{x^2} \frac{y}{x} + \frac{1}{2} \frac{h^2}{x^3} \frac{y}{x} + \ldots + \frac{1}{n!} \frac{h^n}{x^n} \frac{y}{x} + \ldots + \text{& c.}
\]

\[
y' = y' + \frac{h}{x^2} \frac{y}{x} + \frac{1}{2} \frac{h^2}{x^3} \frac{y}{x} + \ldots + \frac{1}{n!} \frac{h^n}{x^n} \frac{y}{x} + \ldots + \text{& c.}
\]

then as the second term \( \frac{h}{x^2} \frac{y}{x} \) has the same sign in both, when that term is greater than all the terms that follow it, we shall have both values greater than \( y \) when \( \frac{y}{x} \) is positive, and both less when it is negative, the first case corresponding to a maximum, and the second to a minimum.

Hence, to determine the maximum or minimum of the function \( y \), it appears that we must take the fluxion of \( y \), and divide it by \( x \), and put the result equal to 0, which agrees with what was shown in § 79.

84. Although in the case of a function admitting of a maximum or minimum we have always \( \frac{y}{x} = 0 \), we must not conclude that conversely the one or the other of these has place every time that \( \frac{y}{x} = 0 \). For if it so happens that the value of \( x \) that renders \( \frac{y}{x} = 0 \), causes also \( \frac{y}{x} \) to vanish, without at the same time making \( \frac{y}{x^2} \) to disappear, then we have

\[
y = y - \frac{h}{x^2} \frac{y}{x} + \frac{1}{2} \frac{h^2}{x^3} \frac{y}{x} + \ldots + \frac{1}{n!} \frac{h^n}{x^n} \frac{y}{x} + \ldots + \text{& c.}
\]

\[
y' = y' + \frac{h}{x^2} \frac{y}{x} + \frac{1}{2} \frac{h^2}{x^3} \frac{y}{x} + \ldots + \frac{1}{n!} \frac{h^n}{x^n} \frac{y}{x} + \ldots + \text{& c.}
\]

and as by giving a proper value to \( h \), \( \frac{h}{x^2} \frac{y}{x} \) may be rendered greater than the sum of all the following terms in each series, it follows, that \( \frac{y}{x} \) being supposed to be any quantity either positive or negative, because of its sign being different in the two values, the one of them will be greater, and the other less than \( y \), the maximum or minimum value, which result is inconsistent with the nature of a maximum or minimum. If however \( \frac{y}{x} \) be assumed = 0, then

\[y = \text{& c.}
\]

(D) If this should not appear sufficiently obvious, let

\[A + B h + C h^2 + D h^3 + \text{& c.}
\]

be such a series, where \( A, B, C, D, \text{& c.} \) denote quantities either positive or negative, but which are independent of \( h \). Then, writing the series thus,

\[A + B h + C h^2 + D h^3 + \text{& c.}
\]

it is obvious that if \( h \) be conceived to be continually diminished, and at last to become = 0, the part

\[B h + C h^2 + D h^3 + \text{& c.}
\]

will also become = 0, therefore before it vanishes it will be less than \( A \), or any other assignable quantity, therefore \( B h + C h^2 + D h^3 + \text{& c.} \) may become less than \( A h \).
FLUXIONS.

\[ \frac{y}{x^n} = \frac{-m}{x \sqrt{(1-m^2)}} \]

which equation, by putting instead of \( x \) its value \( \frac{m}{\sqrt{(1-m^2)}} \), becomes

\[ \frac{y}{x} = \frac{-1}{a \sqrt{(1-m^2)}} \]

and as this result is negative, we conclude that the value which we have found for \( y \) is a maximum.

Of the values of fractions, the numerators and denominators of which vanish at the same time.

86. There are some fractional functions of such a nature, that by giving a particular value to the variable quantity, both the numerator and denominator of the fraction vanish, and thus the fraction is reduced to this form \( \frac{0}{0} \), an expression from which nothing can be concluded. We have an example of this in the fraction \( \frac{x-a}{x-a} \), which, by supposing \( x=a \) becomes \( \frac{a-a}{a-a} = \frac{0}{0} \); we must not however conclude that the fraction has no determinate value in this particular case, for if we consider that its numerator and denominator have a common divisor, viz. \( x-a \), it is evident that by taking this divisor out of both, the fraction becomes \( \frac{x-a}{x-a} = \frac{x-a}{(x-a)(x+a)} \), which becomes \( \frac{1}{x+a} \), an expression, which in the case of \( x=a \) is equal to \( \frac{1}{2a} \).

87. In general, if we make \( x=a \) in an expression of this form \( \frac{P(x-a)^n}{Q(x-a)} \), it becomes \( \frac{0}{0} \); however its true value is either nothing, or finite, or infinite, according as \( m=n \), or \( m \geq n \), or \( m \leq n \); for by taking out the factors common to the numerator and denominator, the fraction becomes \( \frac{P(x-a)^m}{Q} \) in the first case, \( \frac{P}{Q} \) in the second, and \( \frac{P}{Q(x-a)^m} \) in the third; here we suppose that \( P \) and \( Q \) are such functions as neither become nothing, nor infinite, by the supposition of \( x=a \).

88. Therefore, when by giving a particular value to \( x \) a function of that quantity assumes the form \( \frac{0}{0} \), to discover the true value of the function in this particular case, we must disengage the factors which are common to the numerator and denominator. This may be done in most cases by finding their common measure (ALGEBRA, § 49.) but the direct method of fluxions furnishes us with another method.

In the expression \( \frac{P(x-a)}{Q(x-a)} \), where \( P \) denotes any function of \( x \) that is independent of \( x=a \), if we suppose \( x=a \), then the expression vanishes; the fluxion however of the expression, viz. \( (x-a) \cdot \frac{P}{Q} + P \cdot \frac{1}{Q} \), is a quantity which does not vanish when \( x=a \), but is then reduced to its last term, that is to \( P \cdot \frac{1}{Q} \).

Again,
Again, the function \( P(x-a)^n \) vanishes by supposing \( x=a \), but if we take its fluxions, viz. \((x-a)^{n+1} P \), and again the fluxion of this quantity, we get

\[
(x-a)^{n+1} P + 4(x-a)^n P + \ldots + 2 \cdot 2 \cdot P \cdot a^n,
\]

an expression which does not vanish upon the hypothesis of \( x=a \), but is reduced to its last term, viz. \( 1.2.3 \ldots m \cdot P \cdot a^n \), an expression free from the factor \((x-a)^n \), involving only the function \( P \).

89. It is not necessary that we should know the number \( n \), nor that we should exhibit the factor \((x-a)^n \), in order to determine when the expression \( P(x-a)^n \) is freed from that factor. We have only to ascertain after each operation of taking the fluxion, whether the result vanishes or not, when we substitute \( a \) instead of \( x \); for in the last case the operation is finished, and the result is the quantity \( 1.2.3 \ldots P \cdot a^n \). Suppose for example the function to be \( x^{a-2} a^{a-2} a^{a-2} \), which vanishes when \( x=a \), its first fluxion also vanishes when \( x=a \), but not its second fluxion, which is \( 2x-a \cdot a \cdot a \cdot a \), hence we may conclude that the function has the form \( P(x-a)^n \), which is besides obvious, because

\[
x^{a-2} a^{a-2} a^{a-2} = 2 \cdot 2 \cdot a^{a-2} \cdot (x-a) \cdot (x-a)^n.
\]

90. In applying these observations to the fraction \( \frac{P(x-a)^m}{Q(x-a)^n} \), it appears, that by repeating the operation of taking the fluxions of its numerator and denominator, they will be freed at once from the factor \( x-a \), if \( m=n \). If a result, which does not vanish, can be obtained first from the numerator, then we may be assured, that the factor, \( x-a \), is found in the numerator raised to a less power than in the denominator, and in this case the fraction is infinite when \( x=a \). If on the contrary the first result that does not vanish is found from the denominator, then the numerator contains a higher power of \( x-a \) than the denominator, and in this case, when \( x=a \), the fraction vanishes.

The rule for finding the value of a function which becomes \( 0 \) by giving a particular value to \( x \), may therefore be expressed thus. Take the successive fluxions of both the numerator and denominator until a result which does not vanish be obtained from either of the one or the other, or from both at the same time; in the first case the function is infinite, in the second it is equal to \( 0 \), and in the last case its value is finite.

91. We proceed to illustrate this rule by a few examples.

Ex. 1. The value of the function \( \frac{x^3-1}{x^2-1} \) is required when \( x=1 \).

The fluxion of the numerator is \( 3x^2 \), and that of the denominator is \( 2x \), neither of which quantities vanish when \( x=1 \); therefore, in this particular case, the value of the fraction is \( \frac{3x^2}{2x} = \frac{3}{2} \).

Ex. 2. Suppose the fraction to be \( \frac{x^2+2acx+a^2}{x^2-2bcx+b^2} \), which vanishes when \( x=a \). By taking the fluxions of the numerator and denominator we obtain \( \frac{2ax+2ac}{2b} \cdot \frac{2b}{x-b} \), a fraction, the numerator and denominator of which still vanish upon the hypothesis of \( x=a \), we therefore take the fluxions a second time, and get \( \frac{2ax}{2b} \) for the value of the proposed fraction in the particular case of \( x=a \).

Ex. 3. Suppose the fraction to be \( \frac{x^3-ax^2+2ax^2}{x^3-2x^2} \), which vanishes when \( x=a \). In this example, by taking the fluxions of the numerator and denominator once, we get

\[
\frac{x^2-ax+a}{x^2-2x^2+a^2} = \frac{x^2-2ax^2}{x^2-2x^2},
\]

an expression, of which only the numerator vanishes upon the supposition of \( x=a \); hence we may conclude the true value of the fraction in this case to be \( 0 \).

The contrary happens in the fraction

\[
\frac{a^2-2a^3}{a^2-2a^3} = \frac{a^2}{a^2},
\]

we may therefore conclude that when \( x=a \), this last fraction becomes infinite.

92. The rule § 90, can only be applied when the factors common to the numerator and denominator are integer powers of \( x-a \); for as by taking the fluxions, the index of \( (x-a)^n \) is diminished by an unit at each operation; when \( m \) is a fraction we shall at last arrive at a result containing negative powers of \( x-a \), which therefore, when \( x=a \), will become infinite. The following mode of proceeding will however apply to all cases whatever.

Let \( \frac{X}{X'} \) be a fraction of which the numerator and denominator both vanish when \( x=a \); by substituting in it \( a+h \) instead of \( x \), the functions \( X \) and \( X' \) may be expanded into a series of this form,

\[
A^h + B A^h + &c.,
\]

which are ascending, that is, having the exponents of the powers positive and increasing, because the series must become \( 0 \) upon the hypothesis that \( h=0 \). We have therefore

\[
A^h + B A^h + &c.,
\]

\[
A \cdot A^h + B A^h + &c.,
\]

instead of the proposed fraction,
Now, if \( a \to a' \), by dividing the numerator and denominator of this expression by the factor, \( a' \), which is common to all the terms of each, it becomes

\[
\frac{A \cdot a - a' + B \cdot a' - a' + \cdots}{A' + B \cdot a' - a' + \cdots}
\]

a quantity which, by supposing \( a = 0 \), is reduced to \( \frac{0}{A} \), that is to \( 0 \). If again \( a = a' \), the expression for the fraction, after dividing the numerator and denominator by \( A \cdot a' \), is

\[
\frac{A + B \cdot a' - a' + \cdots}{A' + B \cdot a' - a' + \cdots}
\]

which, by supposing \( a = 0 \), becomes simply \( \frac{A}{A'} \), a finite quantity. If, however, \( a < a' \), then the expression for the fraction is

\[
\frac{A + B \cdot a' - a' + \cdots}{A' + B \cdot a' - a' + \cdots}
\]

which, when \( a = 0 \), becomes \( \frac{A}{A'} \), an expression which may be considered as infinite. Thus it appears that in each case the true value of the fraction depends only on \( A \) and \( A' \), the first terms of the series.

The following rule is applicable to every function that can appear under the indeterminate form \( 0 \). Find the first term of each of the ascending series which express the developments of the numerator and denominator when \( a + h \) is substituted for them instead of \( x \). Reduce the new function formed of these first terms to its most simple form, and make \( h = 0 \); the result shall be the different values of the proposed function when \( x \) is made equal to \( a \).

Example. Suppose the function to be

\[
\sqrt{x - \sqrt{x}} + \frac{1}{\sqrt{x}}
\]

which, when \( x = a \), becomes \( \frac{a}{\sqrt{a}} \). By substituting \( a + h \) instead of \( x \), and developing the results into series, the numerator becomes \( a^\frac{1}{2} + \frac{h}{2a} + \cdots \), and the denominator \( a^\frac{1}{2} + \frac{h}{2a} + \cdots \). Taking now the first term of each series, we have \( \frac{a^\frac{1}{2}}{2a^\frac{1}{2}} = \frac{1}{2} \) an expression in which \( a \) is not found; therefore the value of the function is \( \frac{1}{2} \) when \( x = a \).

Of the Radii of Curvature.

93. Let HOCF represent a material curve, or mould, let a thread be fastened to it at \( H \), and made to pass along the curve, so as to coincide with it in its whole extent from \( H \) to \( F \). Let the thread be now unrolled or evolved from the curve, then its extremity \( F \) will describe another curve line FAP. The curve HCF is called the Evolute of the curve FAP; and the curve FAP is called the Involute of the curve HCF.

94. From this mode of conceiving the curve to be generated, we may draw the following conclusions.

1st. Suppose \( PC \) to be a portion of the thread detached from the evolute, then \( PC \) will be a tangent to the evolute at \( C \).

2dly. The line \( PC \) will be perpendicular to a tangent to the curve FAP at the point P, or will be normal to the curve at that point. For the point \( P \) may be considered as describing at the same time an element of the curve FAP, and an element of a circle \( q P P' \), whose momentary centre is \( C \), and which has \( PC \) for its radius.

3dly. That part of the curve between \( F \) and \( P \), which is described with radii all of which are shorter than \( CP \), is more incurved than a circle described on \( C \) as a centre, with a radius equal to \( CP \). And in like manner \( PP' \), the part of the curve on the other side of \( P \), which is described with radii greater than \( PC \), is less incurved than that circle.

4thly. The circle \( q P P' \) has the same curvature as the curve APP which itself has at \( P \); hence it is called an Equicurve circle, and its radius \( PC \) is called the Radius of Curvature at the point \( C \).

95. We are now to investigate how the radius of curvature at any point in FAP any proposed curve may be found.

Let \( AB \) and \( BP \) be the co-ordinates at \( P \) any point in the curve, and \( PC \) its radius of curvature; and let \( PC \) meet \( AB \) in \( E \). Put the abscissa \( AB = x \), the ordinate \( BP = y \), the arch \( AP = a \), the angle \( AEP \) (that is, the arch which measures that angle, radius being unity) \( = v \), the radii of curvature \( PC = r \). Take another point in the curve, and let \( P'O \) be the radius of curvature at that point. Let \( P'O \) meet \( AB \) in \( E' \), and \( PC \) in \( D \), and on \( D \) as a centre, with a radius \( = m \), describe an arch of a circle, meeting \( P'O \) in \( m \) and \( n \). Then the arch \( PP' \) will be the increment of \( m \); and since the angle \( PDP' \) is the difference of the angles \( PE'A \), \( PE'A \), the arch \( m n \) will be the corresponding increment of \( v \).

Suppose now the point \( P' \) to approach continually to \( P \), then the points \( O \) and \( D \) will approach to \( C \), and the ratio of the arch \( PP' \), the increment of \( m \), to the arch \( m n \) the increment of \( v \), will approach to the ratio of \( CP \) to \( Cm \), that is to the ratio of \( r \) to \( f \); therefore the ratio of \( r \) to \( f \) is the limit of the ratio of \( AP \) to \( m n \), or \( \frac{PP'}{m n} \) and passing to the ratio of the fluxions, \( r = \frac{a}{v} \), thus we have obtained a formula expressing the radius of curvature, by means of the fluxion of the arch of the curve, and the fluxion of the angle which a normal to the curve makes with the line of the abscissa. We proceed to deduce from this formula the other
other expressions which may involve the fluxions of \(x\) and \(y\) only.

96. Because \(PE\) is a normal to the curve at \(E\), the tangent of the angle \(PEA\) or \(\psi\) is equal to \(\frac{\dot{x}}{\dot{y}}\) (§ 75.), put \(\frac{\dot{x}}{\dot{y}} = t\), then because \(\tan \psi = t\), we have, by taking

the fluxions (§ 60.), \(\dot{v} \sec^2 t = \dot{u} = \dot{v} = 1 + \tan t\) \(u = 1 + \frac{\dot{x}}{\dot{y}}\).

\(\frac{\dot{x}}{\dot{y}} = t\), therefore \(\frac{\dot{u}}{\dot{y}} = \frac{\dot{x}}{\dot{y}} = t\)

\(\dot{v} = \frac{i}{\dot{y}}\).

Substituting now this value of \(\dot{v}\) in the formula \(r = \frac{\dot{x}}{\dot{v}}\), it becomes

\(\frac{\dot{x}}{t \dot{y}}\).

If we now recollect that \(\frac{\dot{t}}{\dot{y}} = \frac{\dot{x}}{\dot{y}}\), and that \(\ddot{x} = \dot{x}^2 + \dot{y}^2\),

it will appear that this other expression which we have found for \(r\) involves in effect the fluxions of \(x\) and \(y\) only.

97. In computing the values of \(t = \frac{\dot{x}}{\dot{y}}\), and \(\frac{\dot{x}^2}{\dot{y}^2}\) we may consider any two of the three quantities \(x, y, \dot{x}\) as a function of the remaining quantity; and upon that hypothesis compute their fluxions.

Thus if we suppose that \(y\) and \(x\) are functions of \(x\), then, as in taking the fluxions of \(y\), \(t\), and \(x\), we must consider \(x\) as a given or constant quantity, from the equation \(t = \frac{\dot{x}}{\dot{y}}\) we have \(t = \frac{\dot{x}}{\dot{y}}\) (§ 39.), and substituting this value of \(t\) in \(\frac{\dot{x}^2}{\dot{y}^2}\), the value last found for \(r\), it becomes

\(r = \frac{\dot{x}}{\dot{y}} = \frac{\dot{x}^2 + \dot{y}^2}{\dot{y}^2}\).

If again, instead of considering \(y\) and \(x\) as functions of \(x\), we consider \(x\) and \(\dot{x}\) as functions of \(y\), then from the equation \(t = \frac{\dot{x}}{\dot{y}}\) (as \(y\) must now be reckoned constant),

we get \(t = \frac{\dot{x}}{\dot{y}}\), thus the formula \(r = \frac{x}{y}\) becomes

\(r = \frac{x}{y} = \frac{\dot{x}^2 + \dot{y}^2}{\dot{y}^2}\).

We shall now apply these formulas to some examples.

98. Example 1.—It is required to find the general expression for the radius of curvature of a parabola.

The equation of the parabola is \(y = a^2 \frac{x^2}{x}\), therefore,

\(y = \frac{a^2 (a^2 x^2 - 2 x)}{2 a^2 x^2}\), and, making \(a^2\) constant,

\(y = \frac{a^2 (a^2 x^2 - 2 x)}{2 a^2 x^2}\),

\(\frac{\dot{x}^2}{\dot{y}^2} = \frac{\dot{x}^2}{\dot{y}^2} = \frac{\dot{x}^2 + \dot{y}^2}{\dot{y}^2}\),

therefore, \(\dot{x} = \frac{\sqrt{\dot{x}^2 + \dot{y}^2}}{\dot{y}^2}\), and, putting \(r\) for the radius of curvature,

\(r = \frac{\dot{x}^2 + \dot{y}^2}{\dot{y}^2} = \frac{\dot{x}^2 + \dot{y}^2}{\dot{y}^2}\),

\(\frac{\dot{x}^2 + \dot{y}^2}{\dot{y}^2}\).

If in this general expression, we put \(x = 0\), we find \(r = \frac{a^2}{2}\), for the radius of curvature at the vertex of the curve.

Ex. 2. Suppose the curve to be an ellipse, required as in the last example.

Putting \(a\) and \(c\) to denote the two axes, the equation of the ellipse is \(a^2 y^2 = c^2 (ax - x^2)\). Hence taking the first and second fluxions, we have \(2ax y y = c^2 x (a - 2x)\), and \(2ax y y + 2ax y y = 2c^2 x x^2\); whence \(y = \frac{c^2 x (a - 2x)}{2a^2 y}\), and \(-\dot{y} = \frac{c^2 x (a - 2x)}{2a^2 y}\), which expressions, by substituting the values of \(x\) and \(y\), become

\(\dot{y} = \frac{c^2 x (a - 2x)}{2a^2 y}\),

\(\frac{c^2 x (a - 2x)}{2a^2 y}\),

\(\frac{c^2 x (a - 2x)}{2a^2 y}\),

therefore,

\(\dot{x} = \frac{\sqrt{c^2 x (a - 2x)} \sqrt{(ax - x^2)}}{2a^2 y}\),

\(\dot{x} = \frac{\sqrt{c^2 x (a - 2x)} \sqrt{(ax - x^2)}}{2a^2 y}\),

and

\(\frac{\dot{x}^2}{\dot{y}^2} = \frac{\dot{x}^2}{\dot{y}^2} = \frac{\dot{x}^2 + \dot{y}^2}{\dot{y}^2}\),

which expression, when \(x = 0\), becomes simply \(\frac{a^2}{2a}\), the radius of curvature at the vertices of the transverse axis; but when \(x = a\), it becomes \(\frac{a^2}{2a}\), the radius of curvature at the vertices of the conjugate axis.
PART II. THE INVERSE METHOD OF FLUXIONS.

99. AS the Direct Method of fluxions treats of finding the relation between the fluxions of variable quantities, having given the relation subsisting between the quantities themselves; so the Inverse Method treats of finding the relation subsisting between the variable quantities, having given the relation of their fluxions.

Whatever be the relation between variable quantities, we can in every case assign the relation of their fluxions; therefore the direct method of fluxions may in this respect be considered as perfect. But it is not the same with the inverse method, for there are no direct and general rules, by which we can in every case determine, from the relation of the fluxions, that of their flowing quantities or fluents. All we can do is to compare any proposed fluxion with such fluxions as are derived from known fluents by the rules of the direct method, and if we find it to have the same form as one of these, we may conclude that the fluents of both, or at least the variable parts of these fluents, are identical.

100. In the direct method we have shown, that by proper transformations, the finding of the fluxion of any proposed function is reducible to the finding of the fluxions of a few simple functions, and of the sums, or products, or quotients of such functions. In like manner, in the inverse method we must endeavour to transform complex fluxionary expressions into others more simple, so as to reduce them, if possible, to some fluxion, the fluent of which we already know.

SECT. I. Of the Fluents of Fluxions involving one variable quantity.

101. As when $y$ is such a function of a variable quantity $x$, that $y = a x^n + C$, where $A$, $m$ and $C$ denote constant quantities, we find by the direct method (§ 36. and § 26.) that $y = m A x^{n-1}$, or (putting $a$ instead of $m A$, and $n$ instead of $n-1$), $y = a x^{n-1} + C$; on the contrary, as often as we have the fluxional equation

$$y = a x^{n-1} + C,$$

we may conclude that the relation of the fluents is expressed by the equation

$$y = \frac{a x^n}{n-1} + C;$$

for by substituting $m A$ instead of $a$, and $m-1$ instead of $n$ in this equation, it becomes $y = A x^m + C$, the same equation as that from which the fluxional equation was derived.

102. The value of the constant quantity $C$, which is generally called by writers on fluxions, the correction of the fluent, is to be determined from the particular inquiry in which the fluxional equation $y = a x^n + C$ occurs. If it be known that $y = c$, when $x$ acquires some known magnitude, which may be denoted by $b$, then the general equation $y = \frac{a b^{n+1}}{n+1} + C$, becomes in that particular case

$$c = \frac{a b^{n+1}}{n+1} + C;$$

Hence, by subtracting each side of this last equation from the corresponding side of the former, we get

$$y = \frac{a (x^{n+1} - b^{n+1})}{n+1}$$

an equation that is independent of the constant and arbitrary quantity $C$.

103. By giving particular values to $n$ in the fluxional equation $y = a x^n + C$, and in that of the fluents $y = \frac{a (x^{n+1} - b^{n+1})}{n+1}$, we may obtain particular fluxional equations, and corresponding equations of the fluents. There is however one case which requires to be noticed; it is when $n$ is $-1$; then the equation of the fluxions is $y = a x^{-1} = \frac{a}{x}$, and that of the fluents, according to the general formula $y = \frac{a (x^{m-1} - b^{m-1})}{m-1}$

$$= \frac{a (x^0 - b^0)}{0} = \frac{a (1 - 1)}{0} = 0;$$

but from this expression it is manifest, that nothing can be concluded. The value of the function $\frac{a (x^{n+1} - b^{n+1})}{n+1}$, in the particular case of $n+1 = 0$ may be found by the rule given in § 90 for determining the value of a function when it assumes the form $0^0$; but it may be otherwise found by proceeding thus. Put $n+1 = m$, and let $p = \frac{\log \frac{x}{x}}{\log \frac{b}{b}}$; then, by the formula of § 54,

$$x^m = p m + \frac{p^m m^1}{m} + \&c.$$

and therefore

$$x^m - b^m = (p - q) m + \frac{(p^m - q^m) m^1}{m} + \&c.$$

and

$$\frac{x^m - b^m}{m} = (p - q) + \frac{(p^m - q^m) m^1}{m} + \&c.$$

Thus
Thus we have \( \frac{m^n - b^n}{m - b} \); or \( \frac{e^{a+b} - e^b}{a+b - b} \) expressed generally by a series, all the terms of which, except the first, being multiplied by \( m \) or \( n+1 \), will vanish when \( m + 1 \) and \( n + 1 \); hence it appears that the general equation \( y = \frac{a(e^{n+1} - e)}{n+1} \), becomes in the particular case of \( x = -1 \), \( y = (p - q) \) (p - q), which, substituting for \( p \) and \( q \) their values, and observing that

\[
\frac{\log x}{\log e} = \frac{1}{\log e} \times \log e \times \log x
\]

becomes

\[
y = a \log e \times \frac{x}{b}
\]

where \( \log e \) and \( \log x \) are to be taken according to the same system, which may be any system of logarithms whatever. So that if we take the Napierian system in which \( e = 1 \), then

\[
y = a \log e \times \frac{x}{b}
\]

where \( C \) denotes a constant quantity, and where the letter \( i \) in this formula, and in others in which it may occur, is put as an abbreviation of the words Napierian logarithm, so that by \( a \log e \times \) is meant \( a \) multiplied by the Napierian logarithm of \( x \), &c.

This expression which we have found for the value of \( y \) in the particular case of \( y = a e^{-x} \frac{x}{a} \), or \( \frac{a^n}{a} \), coincides with what we might have found by considering that when \( y = a \), \( a \) has been shown (§ 57.), that

\[
y = \frac{a}{x}
\]

so that consequently, when \( y = \frac{a^n}{a} \), we may conclude that \( y = a \log e \times \frac{x}{b} + C \), where \( C \) denotes a constant quantity, to be determined from the particular question in which the fluxional equation may occur.

104. It must now be evident that if

\[
y = a e^{x^n + b t^n} + c t^m + \text{&c.}
\]

where \( m, n, p, \text{&c.} \) are constant numbers, then

\[
y = a e^{x^{n+1} + b t^{n+1}} + c t^{m+1} + \text{&c.} + C
\]

where \( C \) denotes a constant arbitrary quantity that may be considered as the sum of the constant quantities which ought to be added to the terms \( \frac{a e^{x^n}}{x^n} + \text{&c.} \), each being regarded as a distinct fluent.

105. In general, since that when

\[
y = a e^{x^n + b t^n} + c t + \text{&c.} + C
\]

where \( t, v, \text{&c.} \) denote any functions of a variable quantity, and \( C \) a constant quantity, we have (§ 35. and § 36.)

\[
y = a e^{x^n + b t^n} + c t + \text{&c.}
\]

So, on the contrary, if we have any fluxional equation of this last form, we may conclude that

\[
y = a e^{x^n + b t^n} + c t + \text{&c.} + C
\]

And since that when \( x = u \), \( y = u \), \( u \) and \( t \) denote any function of a variable quantity, and \( C \) a constant quantity, we have, § 37., \( x = u, y = u, t = u \), so on the contrary, if

\[
y = u t + C,
\]

we may conclude that

\[
y = u t + \text{&c.} + C
\]

and in like manner if we have

\[
y = \frac{u t - v i}{e} = \frac{v}{e} - \frac{v i}{e}
\]

we may infer from § 39. that

\[
y = \frac{v}{e} + C
\]

106. It is often convenient to denote the fluent of a fluxional expression without actually exhibiting that fluent. For this purpose we shall employ the sign \( \int \), putting it before the fluxion whose fluent we mean to denote. Thus, by the expression \( \frac{\int a \log e x}{n+1} + C \), we may express this conclusion in symbols shortly thus,

\[
\int a \log e x \times \frac{x}{n+1} + C
\]

107. Suppose we have \( y = (a x + b)^n \), we may expand \( (a x + b)^n \) into a series, and multiply the series by \( x \), and find the fluent of each term of the result. But we may also find the fluent of this expression without employing the development of \( (a x + b)^n \), by proceeding thus. Put \( a x + b = x \), then \( x = \frac{a x + b}{a} \), and \( a x + b = \frac{x}{a} \).

Substitute now these values of \( a x + b \) and \( x \) in the expression for \( y \), and it becomes \( y = \frac{x^{n+1}}{a} \); hence we have

\[
(\int 101.) y = \frac{x^{n+1}}{a} + C, \text{and consequently, by substituting} \ (a x + b) \ \text{for} \ x,
\]

\[
y = \frac{(ax + b)^{n+1}}{a(m+1)} + C.
\]

108. Suppose that \( y = (a x + b)^n \). By putting \( a x + b = x \), we have \( a x + b = \frac{x}{a} \), and \( a x + b = x \); hence \( y = \frac{x}{a} \), and \( y = \frac{x^{n+1}}{a(m+1)} + C \), and substituting for \( x \) its value \( a x + b \),
FLUXIONS.

Let us now consider fractional functions, and to begin with a simple case let us suppose that
\[
y = \frac{(ax^2 + b)^n}{n a (m + 1)} + C.
\]

Put \(x + b = u\), then \(x = \frac{u - b}{a}\), \(\frac{dy}{du} = \frac{A}{a}(u - b)^{n-1}\), and consequently,
\[
y = \frac{A}{a} \left(\frac{x - b}{a}\right)^{n-1} + C.
\]

We have now only to find the development of \((x - b)^n\), to multiply each of its terms by \(a^n\) and divide it by \(a^n\), and take the fluent of the result.

Let us take for example the case of \(n = 3\), and \(m = 2\), then
\[
y = \frac{A}{a^2} \left(\frac{x - b}{a}\right)^3 = \frac{A}{a^2} \left\{ x^2 - 3 bx + 3 b^2 x - b^3 x + b^4 x \right\} + C.
\]

Hence, taking the fluent of the several terms, as in § 105, we have
\[
y = \frac{A}{a^2} \left\{ \frac{x^3}{3} - 3 bx + 3 b^2 x + b^3 x \right\} + C.
\]

Let us now restore the value of \(x\), and then it appears that when
\[
y = \frac{A}{a^2} \left(\frac{x^2}{2} - bx + \frac{b^2 x + b^3 x}{3} \right) + C.
\]

The general method of finding the fluent of a fractional expression of this form consists in decomposing it into a series of other fractions, the denominators of which are more simple. These fractions may be found by proceeding as follows: By putting the denominator of the proposed fraction equal to \(0\), we get this equation,
\[\frac{s^n + A s^{n-1} + B s^{n-2} + \ldots + C}{s^n + A s^{n-1} + B s^{n-2} + \ldots + C} = 0\]

Suppose now that the roots of this equation are found, and that they are denoted by
\[-\alpha, -\alpha', -\alpha'', -\alpha''', &c.,
\]

which quantities we shall suppose, in the first place, are all unequal. Then the expression which has been assumed as equal to \(0\), may (ALGEBRA, Sect. XI.) be considered as the product of \(n\) factors
\[x + \alpha, x + \alpha', x + \alpha'', x + \alpha''', &c.
\]

Let the proposed fraction \(\frac{R}{V}\) be now assumed as equal to the sum of the simple fractions
\[\frac{N}{x + \alpha} + \frac{N'}{x + \alpha'} + \frac{N''}{x + \alpha''} + \ldots + \frac{N'''}{x + \alpha'''}
\]

having for their denominators the simple factors of the denominator of the proposed fraction, and for their numerators quantities which are constant, but as yet are indetermined.

That we may avoid complicated calculations, and present a determinate object to the mind, let us suppose that the fluxion of which we are to find the fluent is
\[\frac{(A s^n + B s^{n-1} + C s^{n-2} + &c.)}{s^n + A' s^{n-1} + B' s^{n-2} + C'}
\]

and that we have by the resolution of the cubic equation
\[s^n + A' s^{n-1} + B' s^{n-2} + C' = 0\]

found
\[s^n + A' s^{n-1} + B' s^{n-2} + C' = (s + \alpha)(s + \alpha')(s + \alpha'')
\]

The
The fractions
\[
\frac{N(x+a)}{x+a(x+a)} \quad \frac{N'(x+a)}{x+a(x+a)} \quad \frac{N''(x+a)}{x+a(x+a)}
\]
when reduced to a common denominator are
\[
\frac{N(x+a)(x+a)}{(x+a)(x+a)} \quad \frac{N'(x+a)(x+a)}{(x+a)(x+a)} \quad \frac{N''(x+a)(x+a)}{(x+a)(x+a)}
\]
The common denominator of these fractions is the same as that of the proposed fraction, and each of the numerators, as well as their sum, is a function of \( x \) of a degree lower than the denominator, that is, in the present case, it is a function of the second degree. By taking the actual products of the factors in the numerators, and adding the results, we find the sum of the fractions equal to
\[
\frac{(N+N'+N'')x}{x+a(x+a)} + \cdots
\]
where \( V \) denotes the common denominator \( (x+a)(x+a) = x^2 + \alpha x + \beta \). Setting aside the factor \( \frac{x}{V} \) of the above expression, we are now to compare that part of it which involves the three indeterminate quantities \( N, N', N'' \), with \( A x^2 + B x + C \), the numerator of the proposed fraction, thus we obtain these three equations
\[
N + N' + N'' = A,
N(x+a) + N'(x+a) + N''(x+a) = B,
N x^2 + N' x a + N'' x a^2 = C.
\]
By these equations, which are all of the first degree, we may determine the values of \( N, N' \) and \( N'' \), and thus we have the proposed fraction \( \frac{N x}{x+a(x+a)} \) equal to
\[
\frac{N x}{x+a(x+a)} = \frac{N x + N' x^2 + N'' x^2}{x+a(x+a)}
\]
where \( N, N', N'' \), and \( a, a', a'' \), are constant and known quantities.

Put \( x + a = \alpha \), then \( x = \alpha - a \), and the fraction \( \frac{N x}{x+a} \) is transformed to \( \frac{N x}{\alpha} \), of which the fluent is \( N l x = N l \).

(\( x + a \)) (§ 109). In like manner we find \( \int \frac{N x}{x+a} \) for \( N l \), \( (x + a) \), and \( \int \frac{N x}{x+a} \) for \( N l \). \( (x + a) \), and consequently
\[
\int (A x^2 + B x + C) x = \frac{N l (x + a) + N' l (x + a) + N'' l (x + a)}{x + a} + \text{const.}
\]
where by \text{const.} is meant a constant quantity.

It is easy to extend this mode of proceeding to the general formula given at the beginning of this §, and it is obvious, that as often as the denominator of a rational fraction can be decomposed into real and unequal factors, the determination of the fluent of that fraction is attended with no other difficulty than this decomposition, which requires the numerical resolution of equations.

112. We have supposed that the factors of the denominator of the proposed fraction are unequal among themselves, and it is only when this is the case that the fraction can be decomposed into others, having all this form \( \frac{N}{x+a} \). If we suppose that the denominator \( x^2 + \alpha x + \beta \) has a factor of the form \( (x + a)^n \), then the proposed fraction
\[
\frac{(A x^2 + B x + C) x}{x^2 + \alpha x + \beta} = \frac{N l x}{x+a(x+a) + \text{const.}}
\]

must be assumed equal to
\[
\frac{(P x^2 + Q x + R) x}{x+a(x+a)} + \frac{N x}{x+a(x+a)}
\]
where \( P, Q, R, Y, N, N', N'', \ldots \) denote indeterminate but constant quantities, and \( x + a, x + a', x + a'' \), \&c. are the remaining factors of the denominator of the proposed fraction. To determine the quantities \( P, Q, R, Y, N, N', N'', \&c. \) we must now proceed in all respects as in last §, that is, we must reduce the fractions involving these quantities to a common denominator, which will be the same as the denominator of the proposed fraction; then we must add the numerators, and put the coefficient of each power of \( x \) in the sum equal to the coefficient of the same power in the numerator of the proposed fraction. Thus we shall have as many equations as indeterminate quantities, and by resolving these equations, the value of these quantities will be found.

Having thus determined all the quantities \( P, Q, R, \ldots, Y, \ldots \), which enter into the fraction
\[
\frac{(P x^2 + Q x + R) x}{x+a(x+a)}
\]
its fluent may be found as shewn in § 109. But we may also assume it equal to
\[
\frac{M x}{(x+a)^n} + \frac{M' x}{(x+a)^n - 1} + \frac{M'' x}{(x+a)^n - 2} + \cdots
\]
and, it is easy to see, that by reducing these fractions to
Part II.

FLUXIONS.

In like manner

\[ \int \frac{M}{(x^2 + a^2)^n} \, dx = \frac{M}{(1-p) (x^2 + a^2)^{n-1}} \]

\[ \text{and so on, all the \textit{fluentions} being algebraic, except the last } \frac{\ldots M^{n-1}}{n+a} \text{ which is } M^{n-1} \cdot (x+a), \text{ a logarithmic function.} \]

113. In resolving the equation

\[ x^n + Ax + Bx^m + \ldots + T = 0, \]

it may happen that some of its roots \( \alpha, \beta, \gamma, \) etc. are imaginary quantities, and then some of the simple factors \( x+\alpha, x+\beta, x+\gamma, \) etc. will be imaginary. These factors always occur in pairs (ALGEBRA, § 179.) and have this form

\[ x + \alpha + \beta \sqrt{-1}, \quad x + \alpha - \beta \sqrt{-1}, \]

so that their product

\[ x^2 + 2\alpha x + \alpha^2 + \beta^2 \]

is a real factor of the second degree. As every corresponding pair of imaginary simple factors may be united in this manner into a real factor of the second degree, if these factors are all unequal, we may avoid introducing imaginary quantities into the fluent of the proposed fraction by proceeding thus. Let \( x + \alpha + \beta \sqrt{-1} \) and \( x + \alpha - \beta \sqrt{-1} \) denote two corresponding imaginary simple factors of the denominator. Instead of the two simple fractions

\[ \frac{N}{x + a + \beta \sqrt{-1}}, \quad \frac{N}{x + a - \beta \sqrt{-1}} \]

which would have been assumed if the factors had been real, assume a single fraction

\[ \frac{(K x + L) \, x}{x^2 + 2\alpha x + \alpha^2 + \beta^2} \]

the denominator of which is a real function of \( x \) of the second degree, viz., that which is the product of the two imaginary factors. Here \( K \) and \( L \) denote two constant but indeterminate coefficients, the values of which, as \( \text{Vol. VIII. Part II.} \]

also those of the other indeterminate coefficients are to be found as before.

If the denominator of the proposed fraction have several equal factors of the second degree resulting from its imaginary simple factors, so that the product of these equal factors is

\[ (x^2 + 2a x + a^2 + \beta^2) \]

then, corresponding to this product, we must, among the fractions having indeterminate coefficients, assume one of this form

\[ \frac{(Q x + R) \, x}{(x^2 + 2a x + a^2 + \beta^2)} \]

where \( Q, R, \ldots Y \) denote constant and indeterminate coefficients, the values of which will be found in all respects as those of the others.

We are now to find the fluxions of these two fluxional expressions, beginning with the first, viz.

\[ \frac{(K x + L) \, x}{x^2 + 2a x + a^2 + \beta^2} \]

Put \( x + \alpha = \eta \), then it becomes

\[ \frac{(K \eta + L) \, \eta}{\eta^2 + \beta^2} \]

and this again, by putting \( L - K \alpha = M \), is resolved into these two fluxions

\[ \frac{K \eta}{\eta^2 + \beta^2} + \frac{M \eta}{\eta^2 + \beta^2} \]

We can immediately find the fluent of the first of these, by putting \( \eta^2 + \beta^2 = \nu \), for then \( \eta = \frac{\nu}{\beta} \), and

\[ \int \frac{K \eta \, \nu}{\nu^2 + \nu} = \int_{\nu} \frac{K}{\nu} = K \ln \nu \quad (\text{§ 103.}) \]

With respect to the other fluxion, if we put \( \eta = \beta, \) we have

\[ \frac{M \beta}{\beta^2 + \beta^2} = \frac{\beta}{\beta^2 + \beta^2} \]

but we have seen (§ 60.) that \( \frac{\nu}{\beta + \nu} \) is the fluxion of an arch of which the tangent is \( \beta \), therefore

\[ \int M \frac{\nu}{\beta + \nu} = M \ln \beta \text{ (tan. = } \beta \text{) + const.} \]

It is proper to remark, that if \( \frac{x}{\beta} \) be the tangent of an arch, then the sine of that arch is \( \frac{x}{\sqrt{(x^2 + \beta^2)}} \) and its cosine is \( \frac{\beta}{\sqrt{(x^2 + \beta^2)}} \), thus we may express the fluent of

\[ sA \]

under
F L U X I O N S.

Under different forms, by introducing the sine or cosine
of the arc instead of its tangent.

If instead of \( s \) we substitute in these two fluxions \( s + \alpha \)
we find that the fluent of \( \frac{(Kx + L)\alpha}{s^2 + 2\alpha x + s^2 + \beta^2} \)
is

\[ K \frac{\sqrt{s^2 + 2\alpha x + s^2 + \beta^2}}{\alpha} \]
\[ + \frac{L - Ks}{\beta} \text{ arc} \left( \tan \frac{s + \alpha}{\beta} \right) + \text{const.} \]

114. To find the fluent of the expression

\[ \frac{Q'\alpha^{n-1} + R'\alpha^{n-2} \cdots + Y'}{(s^2 + 2\alpha x + s^2 + \beta^2)^r} \]
we first transform it to

\[ \frac{(Kx + L)x}{(s^2 + 2\alpha x + s^2 + \beta^2)^r} \]
\[ + \frac{(K'x + L')x}{(s^2 + 2\alpha x + s^2 + \beta^2)^{r-1}} \]
\[ \cdots + \frac{(K''x + L''x + \cdots + x)}{s^2 + 2\alpha x + s^2 + \beta^2} \]

where \( K, L, K', L', \&c. \) denote indeterminate but
certain constants, which may be determined by reducing
these fractions to a common denominator, and
proceeding as in the two preceding \( \S \) \S. Then the whole
difficulty is reduced to the finding of the fluent of the expression

\[ \frac{(Kx + L)x}{(s^2 + 2\alpha x + s^2 + \beta^2)^r} \]
\[ = \frac{(Kx + L)x}{(s^2 + \alpha x)^r} \]

where \( q \) denotes some integer number. To simplify this
expression put \( s + \alpha = \varepsilon \), and \( L = Ks = M \), then it
becomes \( \frac{(Kx + M)x}{(s^2 + \alpha x)^r} \), which we shall now show may be
reduced to \( \int \frac{Hs}{(s^2 + \alpha x)^r} \). To effect this reduction
we decompose its fluent into two parts

\[ \int \frac{Ks}{(s^2 + \alpha x)^r} + \int \frac{Mx}{(s^2 + \alpha x)^r} \]
The fluent of the first part may be immediately found
by putting \( s + \alpha = \cos \vartheta \); for then \( \cos \vartheta = \frac{s}{\alpha} \) and

\[ \int \frac{Ks}{(s^2 + \alpha x)^r} = \int \frac{K\cos \vartheta}{2 \alpha^2} \]
\[ = \frac{K\alpha^{r+1}}{2(1 - q)} \]

Let us now suppose, that the fluent of the second part
\( \frac{Mx}{(s^2 + \alpha x)^r} \) is equal to the sum of the algebraic function

\[ \frac{Gx}{(s^2 + \alpha x)^{r-1}} \text{ and another function, which is the first} \]

of \( \frac{Hs}{(s^2 + \alpha x)^{r-1}} \); that is, let us assume

\[ \int \frac{Mx}{(s^2 + \alpha x)^r} = \frac{Gx}{(s^2 + \alpha x)^{r-1}} + \int \frac{Hs}{(s^2 + \alpha x)^{r-1}} \]

where \( G \) and \( H \) are constant but indeterminate coefficients. To determine these, let the fluent of each side of this equation be taken (observing that the fluent of
a quantity having the sign \( \int \) prefixed to it is the same
quantity only without that sign); thus we have

\[ \frac{Mx}{(s^2 + \alpha x)^r} = \frac{Gx}{(s^2 + \alpha x)^{r-1}} + \frac{2(q - 1)Gx}{(s^2 + \alpha x)^{r-1}} \]

and from this equation, by rejecting what is common to
each term, we find

\[ M = G(s^2 + \alpha x)^{-2(q - 1)} \text{ and } H = 2(q - 1)C + H s \]

Therefore by comparing together like terms, we find

\[ M = G s + H s, \quad G = 2(q - 1)C + H s = 0 \]

and from these equations we get

\[ G = \frac{M}{(2q - 2)^2} \]
\[ H = (2q - 2)M \]

Let these values of \( G \) and \( H \) be now substituted in our
assumed equation, and it becomes

\[ \int \frac{Mx}{(s^2 + \alpha x)^r} = \frac{M}{(2q - 2)^2} \int \frac{x}{(s^2 + \alpha x)^{r-1}} \]
\[ + \frac{M(2q - 1)}{(2q - 2)^2} \int \frac{x}{(s^2 + \alpha x)^{r-1}} \]

Thus we have reduced the determination of the fluent of
\( \frac{Mx}{(s^2 + \alpha x)^r} \) to that of \( \frac{x}{(s^2 + \alpha x)^{r-1}} \), and by proceeding in
the same manner with this last fluent, its fluent may
be made to depend on that of \( \frac{x}{(s^2 + \alpha x)^{r-1}} \); but this
will be more readily effected by simply substituting \( q - 1 \)
instead of \( q \), and supposing \( M = 1 \) in the preceding equation.

Thus
Thus we shall obtain
\[
\int \left(\frac{s}{a^2+b^2}\right)^{r-1} = \frac{1}{2(2q-4)b^2} \int \left(\frac{s}{a^2+b^2}\right)^{r-1} + \frac{(2q-3)}{(2q-4)b^2} \int \left(\frac{s}{a^2+b^2}\right)^{r-1}.
\]
Substituting now this value of \(\int \frac{s}{a^2+b^2}^{r-1}\) in the former equation, we have\(\int \frac{M}{(a^2+b^2)^{r-1}}\) equal to
\[
\frac{M}{(2q-2)(2q-4)b^2} \int \frac{s}{a^2+b^2}^{r-1} + \frac{(2q-3)}{(2q-4)b^2} \int \frac{s}{a^2+b^2}^{r-1}.
\]
It is easy to see, that like as we obtained an expression for the fluxion of \(\frac{s}{a^2+b^2}^{r-1}\) by substituting \(q=1\) for \(q\), and supposing \(M=r\) in the equation preceding the last one; so by substituting \(q=2\) for \(q\), we shall obtain an expression for the fluxion of \(\frac{s}{a^2+b^2}^{r-1}\), which expression will consist of two terms, one an algebraic function of \(s\), and the other \(\int \frac{s}{a^2+b^2}^{r-1}\) multiplied by a constant and given coefficient. This value of \(\frac{s}{a^2+b^2}^{r-1}\) when substituted in the last equation will produce an expression for \(\int \frac{M}{(a^2+b^2)^{r-1}}\), consisting of algebraic quantities and \(\int \frac{s}{a^2+b^2}^{r-1}\). By continuing this process it is evident that we shall at last have\(\int \frac{s}{a^2+b^2}^{r-1}\) expressed by a series of algebraic quantities, and \(\int \frac{s}{a^2+b^2}^{r-1}\) and here we must stop, for if we repeat the process with a view to make the fluent depend on \(\int \frac{s}{a^2+b^2}^{r-1}\) that is on \(\int s\), or \(s\), we shall find that the coefficient of this quantity becomes infinite. As to the fluent of \(\frac{s}{a^2+b^2}\) we have exhibited the expression for it in last \(\frac{1}{s}\).

In comparing together the results which have been obtained in the preceding articles, it must appear that when a fluxion is expressed by a rational fraction, if we grant the resolution of equations, the fluent may always be assigned either algebraically, or by means of calculus of a circle or logarithms; and that to prepare it for a solution, we must decompose the fraction into others, whose denominators may be either binomial or trinomial quantities. This decomposition may always be effected by the method of indeterminate coefficients. There are, however, several analytical artifices by which the labour of calculation may be greatly shortened. These we now proceed to explain.

115. Let us recur to the fraction \(\frac{U}{V}\), and suppose that \(a+b\) is one of the unequal factors of the denominator \(V\), so that we have \(V = (x+a)Q\). Let us now put \(U = \frac{A}{V} = \frac{P}{x+a}\), \(A\) being supposed a constant quantity, and \(P\) an indeterminate function of \(x\), but such as not to be divisible by \(x+a\). Then we have
\[U = AQ + P(x+a),\]
and hence \(P = \frac{U - AQ}{x+a}\). As \(P\) is an integer function with respect to \(x\), it follows from this equation that \(U - AQ\), which is also a rational and integer function of \(x\), is divisible by \(x+a\), and consequently has \(x+a\) for a factor; therefore, the function \(U - AQ\) will vanish when we substitute \(-a\) instead of \(x\), seeing that \(-a\) is the value of \(x\) that makes the factor \(x+a=0\). Let us denote by \(u\) and \(g\), what \(U\) and \(Q\) become by this substitution, which however will not affect the indeterminate quantity \(A\), because it is independent of \(x\). We have therefore \(u = Aq = 0\), and consequently \(A = \frac{u}{q}\).

This value of \(A\) requires that we should know the function \(Q\) given by the equation \(V = (x+a)\), and we may always find it by dividing \(V\) by \(a+x\). The direct method of fluxions affords also a very simple method of determining it. For by taking the fluxion of the above equation we have
\[
\frac{Q}{x} = Q + (x+a)\frac{Q}{x};
\]

if in this result we make \(x=-a\), or \(x=\infty\), and denote by \(u\) what \(Q\) becomes by that substitution, we shall have \(u = g\), and consequently \(A = \frac{u}{q}\).

The expression \(A=\frac{u}{q}\) has always a finite value, for the numerator and denominator can never become \(\pm\infty\), because we suppose the fraction \(\frac{U}{V}\) reduced to its lowest terms, and consequently, that the numerator \(U\) has set for a factor \(x+a\), which is a factor of the denominator, but which being contained in it only once does not enter into \(Q\).

116. Let us now consider how the numerators of the fractions, into which the proposed fraction \(\frac{U}{V}\) is to be decomposed, are to be found in the case of the denominator
The direct method of fluxions facilitates greatly the preceding operations. For the numerator of $P$ being divisible by $(x+a)^n$ is necessarily of this form $X(x+a)^n$, $X$ being an integer function of $x$, but which does not contain the factor $x+a$. Now agreeably to what has been shewn in § 88, the successive fluxions of this numerator, as far as the $n-1$ order inclusive, vanish when $x-a$ is supposed $=c$. By giving to the numerator the following form,

$$Q \left( \frac{U}{Q} - A - B (x+a) - C (x+a)^2 - \ldots \right)$$

and observing that the function $Q$ does not contain the factor $x+a$, it is manifest that it is only the part of this expression between the parentheses which ought to be divisible by $(x+a)^n$. Let us put $U \left( \frac{U}{Q} = Z \right)$, then the successive fluxions of that part are

$$\frac{Z}{x} - 2 C (x+a)x - 3 D (x+a)^2 x \ldots$$

$$\frac{Z}{x^2} - 2 C x - 3 D x^2 \ldots$$

$$\frac{Z}{x^3} - 2 \ldots$$

&c.

and these results ought all to vanish when we put $x+a=c$. Thus we have

$$Z - A = 0, \text{ and } A = -\frac{u}{q}$$

$$\frac{Z}{x} - B = 0, \text{ and } B = \frac{z}{x}$$

$$\frac{Z}{x^2} - 2 C x = 0, \text{ and } C = \frac{z}{2 x^2}$$

$$\frac{Z}{x^3} - 2 \ldots$$

&c.

observing that in each of these functions $x'$, we must substitute $-a$ instead of $x$.

The most simple way to find the value of $Q$ in this case is to divide $V$ by $(x+a)^n$, but we may also find it by the direct method of fluxions, as in the preceding § for, since $V = Q (x+a)^n$, if we take the fluxion of each side of this equation $n$ times, and then make $x+a=c$, we shall find, § 88, the $n$th fluxion of $V$ equal to $1 \cdot 2 \ldots n Q x^n$, and consequently

$$Q = \text{nth flux. of } V \frac{1 \cdot 2 \ldots n x^n}{1 \cdot 2 \ldots n x^n}$$

117. Let us now consider how we are to find the numerator of the fraction which forms a part of $V$ when it has this form

$$A \frac{x + B}{x^3 + 2 a x + c + \ldots}$$

Assume
Assume

\[
\frac{U}{V} = \frac{Ax+B}{x^2 + 2ax + a^2 + b^2 + Q}\]

then, reducing the latter part of this equation to a common denominator, we find

\[
U = Q(\Delta x + B) + P(x^2 + 2ax + a^2 + b^2).
\]

Hence we deduce

\[
P = \frac{U}{V} - \frac{Q(\Delta x + B)}{x^2 + 2ax + a^2 + b^2}.
\]

As \(P\) is supposed to be an integer function with respect to \(x\), it follows that \(U - Q(\Delta x + B)\) is divisible by \(x^3 + 2ax + a^2 + b^2\); therefore, the factors of these two quantities must contain among their factors those of the latter, and the quantities, which, being substituted for \(x\), cause the latter to vanish, must also make the former vanish. But the factors of \(x^3 + 2ax + a^2 + b^2\) are \(x + a + b\sqrt{-1}\), and \(x + a - b\sqrt{-1}\), and these, being put each \(= 0\), gives us \(x = -(a + b\sqrt{-1})\), and \(x = -(a - b\sqrt{-1})\), therefore, each of these values of \(x\) being substituted in \(U - Q(\Delta x + B)\), it is made to vanish. Let us denote by \(u + q\sqrt{-1}\) and \(v + q\sqrt{-1}\) what \(U\) and \(Q\) respectively become when \(-a\pm b\sqrt{-1}\) is substituted in each instead of \(x\); then, after this transformation, we have

\[
\begin{align*}
\frac{u + q\sqrt{-1}}{v + q\sqrt{-1}} & \cdot \frac{u + q\sqrt{-1}}{v + q\sqrt{-1}} = c. \\
\end{align*}
\]

This equation is twofold, because of the sign \(\pm\) with which several of its terms are affected, and it is equivalent to those which would be formed by putting the real part equal to \(a\), and the imaginary part \(= 0\); from this consideration we have

\[
\begin{align*}
u + q &= A + q\sqrt{-1} = A - qB = 0, \\
v + q &= A + q\sqrt{-1} = A - qB = 0,
\end{align*}
\]

two equations which give us the values of \(A\) and \(B\).

The function \(Q\) may be found as in § 115. For, if we take the fluxions of each side of the equation

\[
Q = \frac{x^3 + 2ax + a^2 + b^2}{x^3 + 2ax + a^2 + b^2},
\]

and afterwards make

\[
\begin{align*}
x^3 + 2ax + a^2 + b^2 &= 0, \\
x^3 + 2ax + a^2 + b^2 &= 0,
\end{align*}
\]

we find \(Q = \frac{2x + 2ax + a^2 + b^2}{2x + 2ax + a^2 + b^2}\), and hence

\[
Q = \frac{x}{2x + 2ax + a^2 + b^2}.
\]

Let the two values of \(x\), to wit \(-a\pm b\sqrt{-1}\), be substituted instead of it in this equation, then, putting

\[
\sqrt{-1} = q + q\sqrt{-1}
\]

by that substitution, and writing \(q + q\sqrt{-1}\) instead of \(Q\), we have

\[
\begin{align*}
q &= q' + q\sqrt{-1} = \frac{v}{2b}, \\
q &= q' + q\sqrt{-1} = \frac{v}{2b}.
\end{align*}
\]

which, by multiplying the terms of the fraction on the latter side of the equation by \(\sqrt{-1}\), becomes

\[
q = q' = \frac{v}{2b},
\]

Hence by putting the real parts of each side of this equation equal to each other, and also the imaginary parts equal to each other, we find

\[
\begin{align*}
q &= q' = \frac{v}{2b}, \\
q &= q' = \frac{v}{2b}.
\end{align*}
\]

118. If the factor \(x^3 + 2ax + a^2 + b^2\) is found several times in the denominator of \(V\), so that

\[
V = Q(x^3 + 2ax + a^2 + b^2)^n,
\]

then, § 113, we assume

\[
U = Q \quad \text{in this case}
\]

\[
\begin{align*}
\frac{A + B}{(x^3 + 2ax + a^2 + b^2)^n} &= (x^3 + 2ax + a^2 + b^2)^{n-1} \\
&= \frac{A + B}{(x^3 + 2ax + a^2 + b^2)^n} + \frac{P}{Q}
\end{align*}
\]

reducing this expression to a common denominator, and so ordering the equation as to bring \(P\) to stand alone on one side, we find \(P\) equal to

\[
\begin{align*}
U - Q(\Delta x + B) = (A + B)(x^3 + 2ax + a^2 + b^2) \\
&= \frac{A' + B'}{(x^3 + 2ax + a^2 + b^2)''} + \frac{P}{Q}
\end{align*}
\]

By reasoning in this as in the preceding case, it may be concluded that the numerator of this expression ought to vanish when \(-a\pm b\sqrt{-1}\) is substituted in it instead of \(x\); therefore putting \(u + q\sqrt{-1}\), and \(v + q\sqrt{-1}\) to denote the same things as before, we deduce from that substitution

\[
\begin{align*}
\frac{u + q\sqrt{-1}}{v + q\sqrt{-1}} - \frac{u + q\sqrt{-1}}{v + q\sqrt{-1}} = 0,
\end{align*}
\]

the very same equation for the determination of \(A\) and \(B\), as we have already found in last §.

Having found the values of these quantities, they may be substituted in the numerator of \(P\), and the terms

\[
U - Q(\Delta x + B)\]

becoming divisible by \(x^3 + 2ax + a^2 + b^2\), the whole expression becomes divisible by the same quantity. Calling therefore \(U\) the quotient arising from the division of \(U - Q(\Delta x + B)\) by \(x^3 + 2ax + a^2 + b^2\), we have \(P\) equal to

\[
U - Q(\Delta x + B) + (A'B' + B')(x^3 + 2ax + a^2 + b^2) \\
= \frac{A' + B'}{(x^3 + 2ax + a^2 + b^2)''} + \frac{P}{Q}.
\]

If in this numerator we substitute instead of \(x\) its values deduced from the equation \(x^3 + 2ax + a^2 + b^2 = 0\), and put the result \(= 0\), we may determine \(A'\) and \(B'\) in the very same way that we have already determined \(A\) and \(B\), and by proceeding in this manner we shall find the remaining coefficients \(A'\), \(B'\), &c.

This case is quite analogous to that which has been already treated in § 115, and the direct method of fluxions applies to it in the same manner as to the other. For since \(Q\) does not contain the factor \(x^3 + 2ax + a^2 + b^2\), if the numerator of \(P\) be divided by the function \(Q\), the result, which may be denoted by \(r\), ought to be of this form.
FLUXIONS.

Inverse Method.

The form \( r = x^{n} + 2ax + \beta \), and consequently on to the \( n+1 \)th of it, which ought also to be \( = 0 \) each of these equations becomes twofold when we substitute, instead of \( x \), the values of which it is susceptible in consequence of the equation \( x^{n} + 2ax + \beta = 0 \). By putting the real and the imaginary parts separately \( = 0 \), we shall obtain as many equations as are sufficient to determine \( A, B, A', B', \&c. \)

It may also be remarked, that from the equation

\[ V = Q \left( x^{n} + 2ax + \beta \right)^{0} \]

we find \( Q \) equal to the quotient arising from the division of the \( n \)th fluxion of \( V \) by the \( n \)th fluxion of \( x^{n} + 2ax + \beta \), observing to assume

\[ x^{n} + 2ax + \beta = 0. \]

119. We shall now give some applications of what has been said relative to the fluxents of rational fractions. Suppose the fraction to be

\[ \frac{x^{n} + 2ax + \beta}{x^{n-1} + 2ax + \beta}. \]

The factors of its denominator are easily found, for it may be put under this form

\[ x^{n}(x + 1)(x - 1). \]

The factor \( x - 1 \) may be decomposed into \( x - 1 \) and \( x + 1 \), \( x - 1 \) and \( x + 1 \), and \( x^{2} + 1 \), thus we have the denominator equal to

\[ x^{n}(x - 1)(x + 1)(x^{2} + 1). \]

Therefore (§ 111, § 112, and § 113) the proposed fraction is to be decomposed as follows

\[ \frac{A}{x - 1} + \frac{B}{x + 1} + \frac{C}{x^{2} + 1}. \]

By comparing this particular example \( \frac{x}{x^{2} + 2ax + \beta} \)

with the general expression \( \frac{U}{V} \), it appears that \( U = 1 \), and \( V = x^{n} + 2ax + \beta \). First let us investigate the numerators of the fraction \( \frac{A}{x - 1} \), and for this purpose we employ the formula \( A = \frac{U}{V} \) (§ 115). As we have \( U = 1 \), it is evident that \( a = 1 \); and since \( V = x^{n} + ax \)

\[ -x^{n} + ax, \text{ therefore } \frac{V}{x} = \frac{8x^{n} + 7x^{2} + 1}{8x}, \]

in this expression we substitute \( t \) instead of \( x \), and then we have the value of \( x \) deduced from the equation \( x = 2 \), the result to be 8, therefore \( c = 8 \). So that

\[ \frac{U}{V} = \frac{1}{8} \text{ and } \frac{A}{x - 1} = \frac{1}{8x - 1}. \]

Let us next investigate the values of \( B \) and \( C \) by means of the same

§ 116, and that we may make the symbol equal to the quantity under consideration agree with the

employed in that formula, let us exchange the letters

and \( C \) for \( A \) and \( B \), so that we are to consider

\[ + \frac{B}{x + 1}. \]

In the first place we have

\[ Q = \frac{x^{n} + 2ax + \beta}{(x + 1)^{2}} \]

Put \( x + 1 = 0 \); then \( x = -1 \); substituting this value of \( x \) in the value of \( Q \), the result is \( -1 \), and

\[ \frac{A}{x - 1} = \frac{1}{4}. \]

Let this value of \( A \) be substituted in the expression for \( U \) in the § above cited, and we have

\[ U = \frac{U - AQ}{x - 1} = \frac{4x^{n} + 2ax + \beta}{4x + 1}. \]

Hence putting \( t \) instead of \( x \) in the expression for \( U \), we have \( a = 2 \) and \( B = \frac{2}{q} \). Then the

fractions under consideration are found to be

\[ \frac{1}{x + 1}. \]

We might have deduced the value of \( B \) from the formula \( B = \frac{(n - 2)}{2} \), § 116, where \( Z \) put \( = t \) for we have

\[ Z = \frac{U}{Q} = \frac{(x^{n} + 2ax + \beta)}{(x^{n} - 2ax - \beta)} \]

and \( \frac{Z}{x} = \frac{6x^{n} + 2ax + \beta}{(x^{n} - 2ax - \beta)} \).

If in this expression we substitute \( t \) instead of \( x \) becomes \( \frac{18}{16} = \frac{9}{8} \), the same value for \( B \) as before.

Let us now consider the fraction \( \frac{D}{x^{n} + 2ax + \beta} \) exchanging the symbols \( D, E, F \) for \( A, B, C \),

\[ \frac{A}{x - 1} + \frac{B}{x + 1} + \frac{C}{x^{2} + 1}. \]

The numerators \( A, B, C \) may all be found, using the

formulas of § 116.
FLUXIONS.

The union of all the algebraic terms produces the inverse fraction \( \frac{2 - x + 5 x^4}{4 x^3 (1 + x)} \), and that of the logarithmic quantities gives

\[
\frac{1}{8} l. (x+1) + \frac{1}{8} l. (x+2) + l. (x+1) \\
= \frac{1}{8} l. (x^2 + 1) - l. x
\]

We have therefore upon the whole equal to

\[
\frac{2x-2x^3-\frac{x^3}{x^3}}{4x^3(1+x)} + \frac{1}{8} l. \left( \frac{x^2-1}{x^2+1} \right) \\
+ l. \left( \frac{x+1}{x} \right) - \frac{1}{4} \cos (\tan = x) + \text{const.}
\]

120 When a fluxion is a rational fraction having either of these forms

\[
\frac{x^2}{x^3 + x^2 + x^3} \quad \text{we can always, by the application of a particular theorem in analysis, resolve its denominator into real factors of the first and second degrees. The theorem to which we allude is this. Let } a \text{ be any positive integer, and let } x \text{ denote any arch of a circle, of which the radius is unity, then}
\]

\[
(\cos x = \sqrt{1 - \sin x}) = \cos x = \sqrt{1 - \sin x}.
\]

We proceed to prove this theorem. Because

\[
(\cos x = \sqrt{1 - \sin x}) (\cos x = \sqrt{1 - \sin x})
\]

\[
= \cos x + \sin x = 1
\]

If we put \( x = \sqrt{1 - \sin x} = v \),

Then \( x = \sqrt{1 - \sin x} = \frac{3}{v} \)

Therefore taking the sum of these two equations,

\[
2 \cos x = v + \frac{1}{v}
\]

Now by the arithmetic of sines, (ALGEBRA, § 358.)

\[
2 \cos x = v + \frac{1}{v}
\]

Therefore, substituting in the first of these equations \( v + \frac{1}{v} \) instead of \( 2 \cos x \), we have

\[
2 \cos x
\]
from that in which it is odd, we shall write for the first 
2m, and for the second 2m+1; we therefore make 
\[ n = 2m, \text{ and } \sin(2m+1) = \sin(n). \]

By the first hypothesis, we find 
\[ y' = 1, \quad y = \cos \left( \frac{2m\pi}{n} + \sqrt{-1} \sin \left( \frac{2m\pi}{n} \right) \right), \]
and by the second 
\[ y' = -1, \quad y = \cos \left( \frac{(2m+1)\pi}{n} + \sqrt{-1} \sin \left( \frac{(2m+1)\pi}{n} \right) \right). \]

121. By means of the indeterminate number \( m \), each of these expressions for \( y \) furnishes all the values of which this quantity is susceptible, for we may take successively 
\[ m = 0, \quad m = 1, \quad m = 2, \quad m = 3, \text{ &c.} \]

The first formula gives 
\[ y = \cos \left( \frac{m\pi}{n} \right) = 1 \]
\[ y = \cos \left( \frac{2m\pi}{n} + \sqrt{-1} \sin \left( \frac{2m\pi}{n} \right) \right), \]
\[ y = \cos \left( \frac{4m\pi}{n} + \sqrt{-1} \sin \left( \frac{4m\pi}{n} \right) \right), \]
\[ &c. \]

It is evident that we shall always have different results as far as \( m = n-1 \). If, however, we suppose \( m = n \), then we have \( y = \cos \theta \), which is the same as the first of the values already obtained, and if we suppose \( m = n+1 \), then (\text{ALGEBRA, § 25.}) 
\[ \cos \left( \frac{(2m+2)\pi}{n} \right) = \cos \left( \frac{2m\pi}{n} + \sqrt{-1} \sin \left( \frac{2m\pi}{n} \right) \right) = \cos \frac{2m\pi}{n}, \]
\[ \sin \left( \frac{(2m+2)\pi}{n} \right) = \sin \left( \frac{2m\pi}{n} + \sqrt{-1} \sin \left( \frac{2m\pi}{n} \right) \right) = \sin \frac{2m\pi}{n}, \]

which is the same as the second value, and so on with respect to the others.

By this mode of proceeding we shall not only obtain the \( n \) roots of the equation \( y = 1 \), or \( y = n-1 \), but, with a little attention, we shall discover that these roots may be arranged in pairs, by bringing together those that only differ in the sign of the radical \( \sqrt{-1} \); for since 
\[ \cos \left( \frac{(2m-p)\pi}{n} \right) = \cos \frac{p\pi}{n}, \]
\[ \sin \left( \frac{(2m-p)\pi}{n} \right) = -\sin \frac{p\pi}{n}, \]

it follows that 
\[ y = \cos \left( \frac{(2m-2m)\pi}{n} + \sqrt{-1} \sin \left( \frac{(2m-2m)\pi}{n} \right) \right) = \cos \frac{2m\pi}{n}, \]

Hence it appears that we may comprehend all the roots of the equation \( y = 1 \) or \( n = 0 \) in a single expression 
\[ y = \cos \left( \frac{2m\pi}{n} \right). \]
The first and last of the factors of the second degree are the squares of $y^\pm 1$, and $y^\mp 1$, factors of the first degree, each of which only enters once into the proposed function; it will therefore be necessary, when we employ the factors of the second degree, to reject the first and last, and take instead of them

$$(y^2 - 1)(y^2 + 1) = y^4 - 1.$$ 

The factors of the first degree of the function $y^4 - 1$ are

$$y^4 - 1$$

$$y^2 = (\cos \frac{2\pi}{5} \pm \sqrt{-1} \sin \frac{2\pi}{5})$$

$$y^2 = (\cos \frac{4\pi}{5} \pm \sqrt{-1} \sin \frac{4\pi}{5}).$$

Those of the third degree are

$$y^3 - 2y^2 + 1,$$

$$y^3 - 2y \cos \frac{2\pi}{5} + 1,$$

$$y^3 - 2y \cos \frac{4\pi}{5} + 1;$$

but it is to be observed that the first factor of the second degree is the square of $y^2 - 1$, which enters only once into the proposed function.

123. When the function to be decomposed into factors is $y^2 + 1$, the formula

$$y^2 = \cos \frac{(2m+1)\pi}{n} \pm \sqrt{-1} \sin \frac{(2m+1)\pi}{n},$$

which corresponds to that case ($\S\ 121.$) is also susceptible of the double sign $\pm$, provided we stop at the value of $m$, which gives

$$2m + 1 = n$$
or

$$2m + 1 = n - 1;$$

according as $n$ is odd or even; hence it follows that

$$m = \frac{n - 1}{2},$$

the factors of the first degree are

$$y^2 = (\cos \frac{(2m+1)\pi}{n} \pm \sqrt{-1} \sin \frac{(2m+1)\pi}{n}),$$

and those of the second

$$y^2 = 2y \cos \frac{(2m+1)\pi}{n} + 1.$$
and those of the second,

\[ y^2 - 2y \cos \frac{n}{2} + 1, \]
\[ y^2 - 2y \cos \frac{3n}{2} + 1, \]
\[ y^2 - 2y + 1. \]

The function \( y^2 - 1 \) has for factors of the first degree

\[ y = \left( \cos \frac{n}{2} \pm \sqrt{-1} \sin \frac{n}{6} \right), \]
\[ y = \left( \cos \frac{3n}{2} \pm \sqrt{-1} \sin \frac{3n}{6} \right), \]
\[ y = \left( \cos \frac{5n}{2} \pm \sqrt{-1} \sin \frac{5n}{6} \right), \]

and those of the second,

\[ y^2 - 2y \cos \frac{n}{6} + 1, \]
\[ y^2 - 2y \cos \frac{3n}{6}, \text{ or } y^2 + 1, \]
\[ y^2 - 2y \cos \frac{5n}{6} + 1. \]

124. Such functions as are of this form \( a^2 + 2ay + y^2 \) may be treated in the same manner as those which consist of only two terms. By putting the function \( = 0 \), and resolving the equation which is thus produced, in the same manner as if it were of the second degree, we find the factors to be

\[ a \pm (p \pm \sqrt{(p-\xi)}). \]

If \( p \) exceed \( \xi \), the second term of these factors is real, and by making

\[ a \pm (p \pm \sqrt{(p-\xi)}), \]

we have the functions of the form

\[ a = a^2 \]

to decompose into factors.

When \( p^2 < \xi \), then we put \( q = a^2, \quad q = b^2, \quad a = b \), and the function becomes

\[ b^2 = y^2 + 2a^2 \cos \frac{3a}{2} y^2 + b^2, \]
\[ b^2 = (y^2 + 2a^2 \cos \frac{3a}{2} y^2 + 1) ; \]

but the condition \( p^2 < \xi \), or \( a^2 < b^2 \), makes \( a^2 < b^2 \), and \( \xi < 1 \), therefore \( \frac{a}{b} \) may be represented by the cosine of a given arch \( \beta \), and the proposed function will be reduced to

\[ b^2 = (y^2 + 2y \cos \beta + 1), \]

we have then only to resolve the equation

\[ y^2 + 2y \cos \beta + 1 = 0, \]

and we immediately find

\[ y^2 = -\cos \beta \pm \sqrt{1 - \sin^2 \beta}; \]

we now assume, as in \( \beta \),

\[ y = \cos \beta \pm \sqrt{1 - \sin^2 \beta}; \]

then we find (\( \beta \))

\[ y^2 = \cos \beta \pm \sqrt{1 - \sin^2 \beta}. \]

which expression for \( y^2 \), being compared with its other value, gives

\[ \cos \beta = \cos \frac{1}{m} \sin \frac{n}{m}, \text{ or } \sin \beta = \pm \sin \frac{n}{m}. \]

These relations will be satisfied if we suppose \( m \)

\[ a = a + b, \]

\[ a \text{ being any whole number whatever, for } \cos (a + b) = \cos \beta, \text{ or } (a + b) \equiv \cos \beta; \]

we have therefore

\[ m = \frac{2a + b}{n}, \]
\[ y = \cos \frac{2a + b}{n} \pm \sqrt{1 - \sin\frac{2a + b}{n}} \]

The factors of the first degree of the function

\[ y^2 + 2y \cos \beta + 1 \]

will consequently be comprehended in this formula,

\[ y = \{ \cos \frac{2a + b}{n} \pm \sqrt{1 - \sin\frac{2a + b}{n}} \} \]

If \( p \) the coefficient of the second term of the proposed function be negative, the only change necessary is to make \( p = -a^2 \), and to take the arch \( \beta \) greater than a quadrant.

Of the Fluents of Irrational Functions.

125. When a fluxionary expression involves irrational functions, we must endeavour either to transform it into another that is rational, or to reduce it to a series of irrational terms of this form \( \sqrt{n} \), and these, in either case its fluent may be found by the rules already delivered.

Let us take for example the fluxion \( \frac{(1 + \sqrt{n} + \sqrt{1 + x})}{x}. \)

It is evident that by putting \( x = a^2 \), all the exponents indicated by the radical signs may be effected, and the fluxion may be transformed to \( \frac{6(a + x + x^2 + x^3 + x^4 + x^5 + x^6)}{1 + x^7} \), which, by dividing the numerator by \( 1 + x^7 \), may be otherwise expressed thus,

\[ -6(\sqrt{x} + \sqrt{x^2} + \sqrt{x^3} + \sqrt{x^4} + \sqrt{x^5} + \sqrt{x^6}) \]

The fluent of which is

\[ -6\left\{ \frac{\sqrt{x}}{5} + \frac{\sqrt{x^2}}{7} + \frac{\sqrt{x^3}}{9} + \frac{\sqrt{x^4}}{11} + \frac{\sqrt{x^5}}{13} + \frac{\sqrt{x^6}}{15} \right\} \]
FLUXIONS.

Let us now assume

\[ \sqrt{\frac{x-a}{x-a}} = (x-a)_n, \]

then squaring both sides of the equation it becomes divisible by \( x-a \), and we have \( s' = \frac{a}{(x-a)n} \), from which we find

\[ s = \frac{a^2 + s'}{s'^2 + 1}, \quad (a-s) s = \frac{(s-a)n}{s'^2 + 1}, \]

values which render the proposed fluxion \( X_\frac{a}{x} \) rational.

127. Let us now take for example the fluxion \( X_\frac{a}{(a+b)x+C} \); by applying to it the first of the preceding transformations it becomes \( \frac{2}{c(2n-b)} \), the

fluent of which is \( \frac{y}{c} \). 

Substituting now for \( x \) its value \( a+b+\sqrt{(a+b)x+C} \), and for \( a, b, \) and \( c \), the quantities they severally represent, the fluent becomes

\[ \frac{1}{c} \int \left\{ \frac{B}{\sqrt{C}} - \frac{2y \sqrt{C}}{c(2n-b)} \right\} \, dx + \text{const.} \]

a result to which we may also give this form,

\[ \frac{1}{c} \int \left\{ \frac{B}{\sqrt{C}} - n \sqrt{C} \right\} \]

\[ + \sqrt{(a+b)x+C} \]

\[ + t \cdot \frac{2}{\sqrt{C}} \cdot \text{const.} \]

By uniting the constant quantities into one, and observing that the radical quantity \( \sqrt{C} \) may have the sign \( \pm \) prefixed to it, we have at last

\[ \int \sqrt{(a+b)x+C} \]

equal to

\[ \frac{1}{c} \int \left\{ \frac{B}{\sqrt{C}} + t \sqrt{C} + \sqrt{(a+b)x+C} \right\} \, dx + \text{const.} \]

128. Let us take for the second example \( X_\frac{a}{(a+b)x-C} \). By employing the latter transformation of \( \int \frac{\sqrt{a-b}x}{x-a} \), we have \( \frac{-2}{c(a+b-x)} \) of which the

fluent is

\[ \frac{-2}{c} \text{arc} \tan \frac{m}{n} \] 

Substituting now instead of \( x \) its value

\[ \frac{\sqrt{a-b}x}{x-a} \]
deducted from the equation \( a-b = (x-a)n \),

\[ 5 B \]

and
and putting \(\sqrt{C}\) for \(c\), we get
\[
\frac{2}{C} \arctan \left( \frac{\sqrt{1+x}}{\sqrt{1-x}} \right) + \text{const.}
\]
\(x\) and \(x'\) being the roots of the equation
\[
x^2 - \frac{B}{C} x - \frac{A}{C} = 0.
\]

Let us suppose that \(A=0\) and \(B=0\), then the proposed fluxion becomes in this particular case \(\frac{2}{\sqrt{1-x^2}}\), and the preceding formula gives for its fluent \(-2\arctan x\).

We may, however, give this fluent another form by proceeding thus: Let \(v\) be the arc of the branch that is
\[
= \frac{\sqrt{1-x^2}}{\sqrt{1+x^2}},
\]
then \(v = \frac{1}{\tan^{-1} - x}\) and \(x = \frac{1}{\tan^2 - x}\).

Then
\[
\frac{2}{1+\tan^2 v} = \frac{2}{\sec^2 v} = 2 \cos^2 v - 1,
\]

and
\[
\frac{2}{\cos v - 1} = \cos v.
\]

Therefore
\[
\int \frac{2}{\cos v - 1} = 2 \sec v - 2 v + \text{const.}
\]

and
\[
\int \frac{2}{\cos v - 1} = 2 \sec v + \text{const.}
\]

Since, by including the arch \(\frac{1}{2}\) in the constant quantity, \(\int \frac{1}{\sqrt{1-x^2}} = \frac{1}{2} \pi + \text{const.}\), this conclusion agrees with what has been shown in § 59.

Instead of finding the fluent of
\[
\frac{x}{\sqrt{A+Bx+Cx^2}} = \frac{c}{\sqrt{a+bx+cx^2}}
\]

by first transforming it to a rational expression, we may reduce it directly to an arch of a circle by proceeding as follows. Put \(x = \frac{b}{2} u\), then \(\frac{b}{2} u\) and the fluxion
\[
\frac{b}{2} u
\]

is transformed to \(\frac{b}{2} u\); again, put \(a+bx\)
\[
= g u,
\]
and \(a=g\), then \(a=g\); and this last fluxion is transformed to
\[
\frac{b}{2} u \frac{1}{v} \arctan \left( \frac{\sqrt{1+a}}{\sqrt{1-a}} \right) + \text{const.}
\]

Of the Flucts of Binomial Fluxions.

130. Let us now consider such fluxions as have this form,
\[
x^{m-1} \sin (a+bx) \frac{1}{x},
\]

and which are sometimes called binomial fluxions. We may here suppose \(m\) and \(a\) to be whole numbers,
FLUXIONS.

\[
\int \left(1 + \frac{m-n}{(p+1)n} \right) \int x^{n-1} \dot{x} \ (a+bx)^p = \frac{1}{b(pn+m)} \left\{ \frac{x^{m-n} (a+bx)^{p+1}}{n} \right\}
\]

hence at last we get

\[
\int x^{n-1} \dot{x} \ (a+bx)^p = \frac{1}{b(pn+m)} \left\{ \frac{x^{m-n} (a+bx)^{p+1}}{n} \right\}
\]

It is easy to see that, as we have, by this formula, reduced the determination of the fluent of \(x^{m-n} (a+bx)^p\) to that of \(x^{m-n} (a+bx)^p\), we may reduce this last to that of \(x^{m-n} (a+bx)^p\) by writing \(m-n\) in place of \(m\) in equation (A), then by changing \(m\) into \(m-n\) we may reduce the fluent of \(x^{m-n} (a+bx)^p\) to that of \(x^{m-n} (a+bx)^p\), and so on.

In general, if \(r\) denote the number of reductions, we shall at last come to

\[
\int x^{m-n} (a+bx)^p, \quad \text{and the last formula will be}
\]

\[
\frac{x^{m-n} (a+bx)^{p+1}}{b(pn+m-(r-1)n)}
\]

It appears by the last formula, if \(m\) is a multiple of \(n\), then \(x^{m-n} (a+bx)^p\) will be an algebraic quantity, for in that case the coefficient \(m-n\) will be \(0\), and therefore the term containing \(x^{m-n} (a+bx)^p\) will vanish. This result coincides with what we have already found, § 129.

131. We may also obtain a reduction, by which the exponent \(p\) will be diminished by unity. For this purpose it is sufficient to observe that \(x^{m-n} (a+bx)^p\) is equal to

\[
\int x^{n-1} \dot{x} \ (a+bx)^{p-1} \ (a+bx)^p = a \int x^{n-1} \dot{x} \ (a+bx)^p + b \int x^{n-1} \dot{x} \ (a+bx)^p,
\]

and that the formula (A) by changing \(m\) into \(m+n\), and \(p\) into \(p-1\) gives

\[
\int x^{n-1} \dot{x} \ (a+bx)^{p-1}\]
FLUXIONS.

\[
\frac{a^m(\alpha + br)^{m+1}}{a \cdot m} = \frac{b(m+n+np)\int x^{m-n} \frac{d}{dx} \left( \alpha + br \right)^{m-n} dx}{(m+np)\frac{a}{a}}.
\]

This formula diminishes the exponents without the parentheses, because \( m+n \rightarrow m \) becomes \( -m+n \rightarrow m \), when \( -m \) is substituted instead of \( m \).

To reverse formula (B) we first take

\[
\int x^{m-n} \frac{d}{dx} \left( \alpha + br \right)^{m-n} = \frac{a^m(\alpha + br)^{m+1}}{a \cdot m}.
\]

Then, writing \( p+1 \) instead of \( p \), we find

\[
\int x^{m-n} \frac{d}{dx} \left( \alpha + br \right)^{m-n} = \frac{a^m(\alpha + br)^{m+1}}{(p+1) \cdot m}.
\]

This formula answers the purpose we have in view, because \( p+1 \) becomes \( -p+1 \) when \( p \) is negative.

These formulas (A), (B), (C), (D), are inapplicable when their denominators vanish. This is the case with formula (A); for example, when \( m = np \); but, in every such case, the proposed fluxion may have its fluent determined either algebraically or by logarithms.

132. It is evident, that if \( m \) and \( n \) were negative, the formulas (A) and (B) would not answer the purpose for which they have been investigated, because, in that case, they would increase the exponents instead of diminishing them. If, however, we reverse them, we shall find that they then apply to the case under consideration.

From formula (A) we get

\[
\int x^{m-n} \frac{d}{dx} \left( \alpha + br \right)^{m-n} dx = \frac{a^m(\alpha + br)^{m+1}}{a \cdot m-n}.
\]

Substitute now \( m+n \) in place of \( m \), and it becomes

(C)

\[
\int x^{m-n} \frac{d}{dx} \left( \alpha + br \right)^{m-n} dx = \frac{a^m(\alpha + br)^{m+1}}{a \cdot m-n}.
\]

Let

\[
\frac{a^m(\alpha + br)^{m+1}}{a \cdot m} = \frac{b(m+n+np)\int x^{m-n} \frac{d}{dx} \left( \alpha + br \right)^{m-n} dx}{(m+np)\frac{a}{a}}.
\]
Part II.

Let us suppose, for example, that \( m = 1 \), then

\[
\int \frac{u}{\sqrt{1-u^2}} = \sqrt{1-u^2} + \text{const.}
\]

Let us now suppose that \( m = 3 \), then

\[
\int \frac{u^3}{\sqrt{1-u^2}} = \left\{ \begin{array}{l}
\int \frac{u^3}{\sqrt{1-u^2}} + \frac{3u^2}{2}\sqrt{1-u^2} + \text{const.} \\
\frac{3u^2}{2}\sqrt{1-u^2} + \text{const.}
\end{array} \right.
\]

or, substituting for \( \int \frac{u}{\sqrt{1-u^2}} \) its value,

\[
\int \frac{u^3}{\sqrt{1-u^2}} = \left\{ \begin{array}{l}
\frac{3u^2}{2}\sqrt{1-u^2} + \text{const.} \\
\frac{3u^2}{2}\sqrt{1-u^2} + \text{const.}
\end{array} \right.
\]

If we suppose \( m = 2 \), then

\[
\int \frac{u^2}{\sqrt{1-u^2}} = \left\{ \begin{array}{l}
\frac{3u^2}{2}\sqrt{1-u^2} + \text{const.} \\
\frac{3u^2}{2}\sqrt{1-u^2} + \text{const.}
\end{array} \right.
\]

But we have already found, § 128, that

\[
\int \frac{u}{\sqrt{1-u^2}} = \arcsin u + \text{const.}
\]

therefore, putting \( \Delta \) for \( \arcsin u \),

\[
\int \frac{u^2}{\sqrt{1-u^2}} = -\frac{u}{\Delta} \sqrt{1-u^2} + \frac{u^2}{\Delta} + \text{const.}
\]

In the very same way we find that

\[
\int \frac{u^m}{\sqrt{1-u^2}} \text{ is equal to}
\]

\[
\left\{ \begin{array}{l}
\frac{1}{4} u^4 + \frac{3}{2} u^2 \sqrt{1-u^2} + \frac{3}{2} \Delta + \text{const.} \\
\frac{1}{4} u^4 + \frac{3}{2} u^2 \sqrt{1-u^2} + \frac{3}{2} \Delta + \text{const.}
\end{array} \right.
\]

134. In the case of \( m \), a negative number, we must have recourse to formula (C), from which we find

\[
\int \frac{u^m}{\sqrt{1-u^2}} = \left\{ \begin{array}{l}
\frac{u^{m+1}}{m+1} \sqrt{1-u^2} \\
\frac{u^m}{m} \int \frac{u^{m-1}}{\sqrt{1-u^2}} + \text{const.}
\end{array} \right.
\]

which formula, by writing \(-m\) instead of \(-m-1\), becomes

\[
\int \frac{u^m}{\sqrt{1-u^2}} = \left\{ \begin{array}{l}
\frac{1}{m} u^{m-1} \sqrt{1-u^2} \\
\frac{1}{m} \int \frac{u^{m-2}}{\sqrt{1-u^2}} + \text{const.}
\end{array} \right.
\]

We cannot here suppose \( m = 1 \), for that value would render the denominator \( u^0 \), therefore, before we can apply this formula, it is necessary to investigate the

\[
\text{fluent of } \frac{u}{\sqrt{1-u^2}}. \quad \text{We may easily find it from § 126,}
\]

or otherwise, put \( m = \frac{m}{a^2} \), then

\[
\frac{n}{\sqrt{1-n^2}} = \frac{n}{\sqrt{1-n^2}} + \text{const.}
\]

Therefore

\[
\frac{u}{\sqrt{1-u^2}} = \frac{u}{\sqrt{1-u^2}} + \frac{u}{\sqrt{1-u^2}}
\]

The fluent of the right hand side of this equation is evidently (§ 103.)

\[
-\frac{1}{4} \left( 1 + u^2 \right) + \frac{1}{2} \left( 1 - u^2 \right) = -\frac{1}{4} \left( 1 + u^2 \right)
\]

or, since \( \frac{1 + u^2}{1 - u^2} = \frac{1 + u^2}{1 - u^2} \), the same fluent may be expressed thus,

\[
-\frac{1}{4} \left( 1 + u^2 \right) + \frac{1}{2} \left( 1 - u^2 \right) = -\frac{u}{\sqrt{1-u^2}}
\]

therefore, by substituting \( \sqrt{1-u^2} \) for \( n \), and \( n \) for \( \sqrt{1-u^2} \), we have

\[
\int \frac{u}{\sqrt{1-u^2}} = -\frac{1}{4} \left( 1 + u^2 \right) + \text{const.}
\]

If we suppose \( m = 2 \), the formula becomes

\[
\int \frac{u^2}{\sqrt{1-u^2}} = -\frac{u}{\sqrt{1-u^2}} + \text{const.}
\]

If we suppose \( m = 3 \), then

\[
\int \frac{u^3}{\sqrt{1-u^2}} = \left\{ \begin{array}{l}
\frac{1}{4} u^4 + \frac{3}{2} u^2 \sqrt{1-u^2} + \frac{3}{2} \Delta + \text{const.} \\
\frac{1}{4} u^4 + \frac{3}{2} u^2 \sqrt{1-u^2} + \frac{3}{2} \Delta + \text{const.}
\end{array} \right.
\]

which expression, by substituting for

\[
\int \frac{u^m}{\sqrt{1-u^2}} \text{ its value, becomes}
\]

\[
\int \frac{u^m}{\sqrt{1-u^2}} = \left\{ \begin{array}{l}
\frac{1}{m} u^{m-1} \sqrt{1-u^2} \\
\frac{1}{m} \int \frac{u^{m-2}}{\sqrt{1-u^2}} + \text{const.}
\end{array} \right.
\]

Of Finding Fluxents by Series.

135. We can always easily find an expression for the

\[
\int X \, t \, dt, \quad \text{where } X = \text{any function of } t; \quad \text{when}
\]

that function is expanded into a series, each term of

\[
\text{which is some power of } t \text{ multiplied by a constant quantity; thus suppose}
\]

\[
X = A + B t + C t^2 + D t^3 + E t^4.
\]

then \( X \, t \) is equal to

\[
A t + B t^2 + C t^3 + D t^4 + E t^5.
\]
FLUXIONS.

Part II.


d_3 a
-- = \frac{1}{a} \left( \frac{n^2}{a^2} + \frac{n^4}{4a^4} + \cdots \right) + \text{const.}

d_2 a

Hence, multiply both sides by \( \dot{n} \), and taking the fluent of each term, we get

\int \frac{d \dot{a}}{\dot{n}^2} = \text{arc} \left( \tan \left( \frac{\dot{n}}{a} \right) \right) + \text{const.} =
\frac{\dot{n}^3}{3a^3} + \frac{n^6}{5a^6} - \frac{n^9}{7a^9} + \cdots + \text{const.}

If we wish to deduce from this equation, the value of the least arch whose tangent is \( \frac{n}{a} \), it is necessary to suppress the arbitrary constant quantity, for when that arch \( = 0 \), then \( a = 0 \); thus we have the arch whose tangent is \( \frac{n}{a} \) expressed by the infinite series

\frac{n}{a} = \frac{n^3}{3a^3} + \frac{n^6}{5a^6} - \frac{n^9}{7a^9} + \cdots + \text{const.}

Let \( \pi \) denote the circumference of a circle whose diameter is unity, or half the circumference of a circle whose radius is unity, then, as the sine of 30 degrees, or \( \frac{\pi}{2} \), is \( \frac{\sqrt{3}}{2} \), and its cosine \( \sqrt{1 - \left( \frac{\pi}{2} \right)^2} = \frac{\sqrt{3}}{2} \), we have \( \pi = \frac{\sqrt{3}}{\cos \frac{\pi}{2}} \). Let \( \sqrt{\frac{3}{2}} \) be substituted instead of \( n \) in the above series, and \( a \) be supposed \( = 1 \), then we get

\frac{\pi}{\sqrt{\frac{3}{2}}} = \sqrt{\frac{3}{2}} \times \left( 1 - \frac{1}{3} \times \frac{1}{3 \cdot 3} - \frac{1}{3 \cdot 5 \cdot 3} - \frac{1}{3 \cdot 7 \cdot 3} + \cdots \right) + \text{const.}

and therefore

\pi = \sqrt{\frac{3}{2}} \times \left( 1 - \frac{1}{3} \times \frac{1}{3 \cdot 3} - \frac{1}{3 \cdot 5 \cdot 3} - \frac{1}{3 \cdot 7 \cdot 3} + \cdots \right) + \text{const.}

by taking the sum of about fifteen terms of this series, we shall find \( \pi = 3.1415927 \). The determination of this number is of great importance in every branch of mathematics.

138. By proceeding with the fluxion \( \frac{a^2}{n^2} \), in the same manner as we have done with \( \frac{a^2}{n^2} \), we get

\int \frac{d^2 a}{n^2} = \frac{a^{n+2}}{(m+1)a^m} - \frac{a^{n+m+2}}{(m+n+1)a^{m+n+1}} + \cdots + \text{const.}

This series proceeds by the positive powers of \( n \), or is an ascending series, but we may also express \( \frac{1}{a^2 + n^2} \) into a series proceeding by the negative powers of \( n \), and which will therefore be called a descending series. Thus because

\frac{1}{a^2 + n^2}
We may easily find an expression for the flux of the rational fraction \( \frac{\mu}{\nu} \) by expanding the quantity \( \frac{\mu}{\nu} \) into a series, but the result thus obtained is in general very complicated, and seldom convergent; besides, this manner of finding the flux is hardly of any use, since it may be expressed by means of arches of a circle and logarithms, both of which are readily obtained from the common trigonometrical tables.

139. The flux of \( n^{-\alpha} \cdot (a + b x)^{2/3} \) is easily obtained by first expanding the quantity \( (a + b x)^{2/3} \) into a series by the binomial theorem, then multiplying each term of that series by \( n^{-\alpha} \), and taking the fluxes of the results by § 101. Thus we have

\[
\int \frac{n^{-\alpha}}{1 + x^n} \text{d}x = \int \frac{\frac{n^{-\alpha}}{1 + x^n}}{1 + x^n} \text{d}x + \text{const.}
\]

But although the expression \( \frac{n^{-\alpha}}{1 + x^n} \) is the flux of the arch having \( n \) for its tangent, we must not conclude that this series is the development of that arch, for \( n \) being supposed \( \infty \), each of the terms of the series becomes infinite.

The consideration of the constant quantity added to the flux will remove this apparent difficulty, if we remark, that to know the true value of a series, it is always necessary to begin with the case in which it is convergent. Now the series

\[
\text{arc (tan. } \equiv \text{ }) = \frac{1}{n^2} + \frac{1}{3n^2} + \frac{1}{5n^2} + \text{const.}
\]

converges so much the faster as \( n \) is greater, and it vanishes when \( n \) is infinite; but in this extreme case the equation

\[
\text{arc (tan. } \equiv \text{ }) = \frac{1}{n^2} + \frac{1}{3n^2} + \frac{1}{5n^2} + \text{const.}
\]

becomes simply \( \text{arc } \equiv \text{ const.} \), where \( \equiv \) denotes half the circumference of the circle; therefore, substituting this value of the constant quantity, we have

\[
\text{arc (tan. } \equiv \text{ }) = \frac{n}{2} - \frac{1}{n} + \frac{1}{3n} + \frac{1}{5n} + \text{const.}
\]
FLUXIONS

Inverse Method. \( \left( 1 - x^2 \right)^{\frac{1}{2}} \), an expression which when expanded by the binomial theorem, is

\[
1 + \frac{1}{2} x^2 + \frac{1}{2} \cdot \frac{3}{2} x^4 + \frac{1}{4} \cdot \frac{3}{2} \cdot \frac{5}{2} x^6 + \text{&c.}
\]

therefore, multiplying each term of this series by \( x \), and taking the fluent, we get

\[
\int \frac{\frac{1}{2} x^3}{\sqrt{1 - x^2}} + \frac{1}{2} \cdot \frac{3}{2} x^5 \cdot \frac{1}{2} \cdot \frac{3}{2} \cdot \frac{5}{2} x^7 + \text{&c.}
\]

\[
= \frac{1}{2} x^3 + \frac{1}{2} \cdot \frac{3}{2} x^5 + \frac{1}{4} \cdot \frac{3}{2} \cdot \frac{5}{2} x^7 + \text{&c.} + \text{const.}
\]

If we suppose \( x \) to denote the sine of an angle, then \( \sqrt{1 - x^2} \) is its cosine, and \( \frac{d}{dx} \sqrt{1 - x^2} \) is the fluxion of the arch itself (§ 59); therefore the series which we have just found, expresses the length of the arch of a circle, radius being unity, and the sine of the arch \( x \).

If we suppose the series to express the smallest arch which corresponds to the sine \( \pi \), then, as when the sine of that arch \( \approx 0 \), the arch itself \( \approx 0 \), the series expressing the arch must vanish when \( x \approx 0 \); therefore we must suppress the constant quantity added to complete the fluent; or suppose it \( = 0 \). The same series has already been found by the direct method of fluxions in §72.

Let \( x \) denote the same as in § 137, then, as the sine of 30 degrees, or of \( \frac{\pi}{6} \), is \( \frac{1}{2} \), we have, by substituting \( \frac{1}{2} \) instead of \( x \) in the preceding series, and multiplying both sides by \( 6 \),

\[
\frac{x}{2} \cdot \frac{3}{2} \cdot \frac{1}{2} \cdot \frac{3}{2} \cdot \frac{5}{2} x \cdot \frac{1}{2} \cdot \frac{3}{2} \cdot \frac{7}{2} x + \text{&c.}
\]

by means of this series, which involves only rational numbers, we may compute (but with more labour), the value of \( x \) as before.

Suppose the fluxion to be \( x \cdot \sqrt{\left( \frac{d}{dx} - x^2 \right)} \), which may be otherwise expressed thus, \( x \cdot \sqrt{\left( \frac{\pi}{6} - \frac{x}{2} \right)} \). By the binomial theorem \( \left( 1 - \frac{x}{2} \right)^{\frac{1}{2}} \),

\[
1 - \frac{x}{2} + \frac{\frac{1}{2} \cdot \frac{3}{2}}{2} \cdot \frac{1}{2} \cdot \frac{3}{2} \cdot \frac{5}{2} \cdot \frac{2}{2} \cdot \frac{7}{2} \cdot \frac{3}{2} \cdot \frac{5}{2} \cdot \frac{7}{2} \cdot \frac{9}{2} \cdot \text{&c.}
\]

Let each term of this series be multiplied by \( x \cdot \frac{\pi}{6} \cdot \frac{x}{2} \), and the fluent taken by § 101, thus we get

\[
\int x \cdot \sqrt{\left( \frac{d}{dx} - x^2 \right)} =
\]

\[
\cdot \frac{x}{2} \cdot \frac{1}{2} \cdot \frac{3}{2} \cdot \frac{1}{2} \cdot \frac{3}{2} \cdot \frac{5}{2} \cdot \frac{1}{2} \cdot \frac{3}{2} \cdot \frac{7}{2} \cdot \frac{3}{2} \cdot \frac{5}{2} \cdot \frac{7}{2} \cdot \frac{9}{2} \cdot \text{&c.} + \text{const.}
\]

141. By resolving a fluxion into an infinite series, the object in view is to transform it into a series of other fluxions, each of which may have its fluent determined by known methods; but it is not always neces-

sary that the terms of the series should be a power of \( x \) multiplied by a constant.

If, for example, we have the fluxion

\[
\frac{d}{dx} \left( \frac{3}{x^4} \right) \cdot \sqrt{\left( 1 - x^2 \right)}
\]

in which \( x \) is supposed to denote a small quantity, we may expand \( \sqrt{\left( 1 - x^2 \right)} \) as a series, which will thus become

\[
\frac{1}{2} x \left( 1 - \frac{x^2}{2} + \frac{\frac{1}{3} \cdot \frac{3}{2} \cdot \frac{5}{2} \cdot \frac{7}{2} \cdot \frac{3}{2} \cdot \frac{5}{2} \cdot \frac{7}{2} \cdot \frac{9}{2} \cdot \text{&c.} + \text{const.} \right)
\]

and the fluxion \( \frac{d}{dx} \left( \frac{3}{x^4} \right) \cdot \sqrt{\left( 1 - x^2 \right)} \) will be chain

\[
\frac{x}{\sqrt{\left( 1 - x^2 \right)}} \cdot \left( 1 - \frac{x^2}{2} + \frac{\frac{1}{3} \cdot \frac{3}{2} \cdot \frac{5}{2} \cdot \frac{7}{2} \cdot \frac{3}{2} \cdot \frac{5}{2} \cdot \frac{7}{2} \cdot \frac{9}{2} \cdot \text{&c.} \right)
\]

the series will converge very fast when \( x \) is

that \( \sqrt{\left( 1 - x^2 \right)} \) may be a real quantity, as

than \( x \). We must now multiply each term

the quotient \( \frac{x}{\sqrt{\left( 1 - x^2 \right)}} \) by the constant \( \frac{x}{\sqrt{\left( 1 - x^2 \right)}} \) and binomial

which being all contained in the genera

\[
\int x \cdot \frac{x}{\sqrt{\left( 1 - x^2 \right)}}
\]

A to denote an arch of which \( x \) is the sine, we

\[\text{A} = \int \frac{x}{\sqrt{\left( 1 - x^2 \right)}} \cdot \sqrt{\left( 1 - x^2 \right)} + \text{const.}
\]

\[+ \frac{x}{2} \cdot \sqrt{\left( 1 - x^2 \right)} - \frac{1}{2} \cdot \frac{3}{2} \cdot \frac{1}{2} \cdot \frac{x}{2} \cdot \frac{3}{2} \cdot \frac{5}{2} \cdot \frac{1}{2} \cdot \frac{3}{2} \cdot \frac{7}{2} \cdot \frac{3}{2} \cdot \frac{5}{2} \cdot \frac{7}{2} \cdot \frac{9}{2} \cdot \text{&c.} + \text{const.}
\]

Of the Fluxions of such Fluxions we include Linear and Exponential functions.

142. Let it be required to find the fluent of \( \frac{1}{x} \), where \( n \) denotes the Napierian logarithm of \( n \), this case, as well as in some following cases, shall have recourse to the principle stated in § 130, namely, that if \( u \) and \( v \) denote any two variable quantities; then

\[\int u \cdot v = u \int v.
\]

Let us therefore assume \( x^n = v \), and \( \frac{1}{x} = u \), then

\[\int x^n \frac{1}{x} = u \int v = u \cdot \text{const.}
\]

\[\text{A} = \int \frac{x^n}{x} = u \cdot \text{const.}
\]
Part II. FLUXIONS.

755

If we suppose \( n = \frac{1}{a} \), then observing that \( \int \frac{a^\prime}{a} \, dz = \frac{a^\prime}{a} \) \( \frac{1}{2} \),

\[
\int a^\prime \cdot a = \frac{a^\prime}{a} \frac{1}{2} \alpha + \text{const.}
\]

If \( n = 2 \), then

\[
\int a^\prime \cdot a^\prime = \frac{a^\prime}{1} \frac{2}{a} \int a^\prime \, dz.
\]

In this expression we substitute the value of \( \int a^\prime \, dz \) just found, thus it becomes

\[
\int a^\prime \cdot a = \frac{a^\prime}{1} \frac{2}{a} \int a^\prime \, dz + \text{const.}
\]

Proceeding in this way, we may find the fluent when \( n = 3 \), or when \( n = 4 \), or in general, when \( n \) is any integer number whatever, the number of terms in the fluent being in this case always finite; it is not so however when \( n \) is either negative or fractional.

Of the Fluxions of such Fluxions as contain functions related to a circle.

144. Let suppose that \( n \) is an arch whose sine is \( u \), and that it is required to find the fluent of \( u^a \). Put \( u^a = v \), then

\[
\int u^a \, dz = \int v = v \, dz - \int v \, dx;
\]

but since \( \dot{v} = u^a \), we have \( \frac{a^\prime}{n} \), § 101, and since \( n = \sin x \), we have \( \frac{a^\prime}{n} = \cos x \cdot \sqrt{1 - u^2} \) (§ 59.), and therefore \( \frac{u^a}{\sqrt{1 - u^2}} \), thus we have

\[
\int a = \frac{a^\prime}{n} = \frac{\frac{a^\prime}{n}}{\sqrt{1 - u^2}} \int \frac{a^\prime}{n} \, dz;
\]

hence the determination of the proposed fluent is reduced to \( \int a^\prime \cdot a^\prime \cdot a \) which we have already considered in § 133. By the same mode of reasoning we may determine the fluent when \( n \) denotes the cosine of the arch \( u \).

145. It appears from § 59. that \( u \) being put to denote any arch of a circle to radius unity, the fluxion of the sine of that arch is \( u = \cos x \cdot u \); therefore, on the contrary,

\[
\int u^2 = \sin \cdot u = \frac{1}{n} \sin n \cdot u + \text{const.}
\]

In like manner, from the formulas of § 59. and § 60. we find

\[
\frac{\pi}{2} a \cdot \frac{1}{n} \sin n \cdot u.
\]
therefore, multiplying by \( \frac{\mathrm{d} \omega}{\mathrm{d}x} \), and taking the fluents,
\[
\int \frac{\mathrm{d} \omega}{\mathrm{d}x} \cos^2 \omega = \frac{1}{2} \left( \frac{\sin 3 \omega + 3 \sin \omega}{\cos \omega} \right) + \text{const.}
\]
and proceeding in this way we may find the fluents of
\( \cos^2 \omega, \omega \) being any positive integer number.

148. The fluents of \( \sin^m \omega \) and \( \cos^m \omega \) may be expressed under another form, by proceeding as in § 142. Thus, beginning with \( \sin^m \omega \), and resolving it into \( \sin \), \( \sin^2 \), and \( \sin^3 \), we have by § 145, \( \sin^m \omega = \cos \omega + \text{const.} \), and (by § 146 and § 147) \( \cos^m \omega \), therefore, substituting in the formula \( \int \omega = \int \omega^{\prime} \), we have
\[
\int \sin^m \omega = \cos \omega + \frac{1}{2} \int \sin^{m-1} \omega + (m-1) \int \sin^{m-3} \omega + \text{const.}
\]
but \( \cos^m \omega = \sin^m \omega \), therefore \( \int \sin^m \omega = \int \cos^m \omega \), becomes
\[
\int \sin^m \omega = \frac{1}{2} \cos \omega + \frac{1}{2} \int \sin^{m-1} \omega + \text{const.}
\]
which expression, by bringing together the terms containing \( \int \sin^m \omega \) becomes
\[
\int \sin^m \omega = \frac{1}{2} \cos \omega + \frac{1}{2} \int \sin^{m-1} \omega + \text{const.}
\]

By giving particular values to \( m \) we have
\[
\int \sin^m \omega = \frac{1}{2} \cos \omega + \frac{1}{2} \int \sin \omega + \text{const.}
\]
\[
\int \sin^m \omega = \frac{1}{2} \cos \omega + \frac{1}{2} \int \sin^{m-1} \omega + \text{const.}
\]
\[
\int \sin^m \omega = \frac{1}{3} \cos \omega + \frac{1}{3} \int \sin^{m-1} \omega + \text{const.}
\]

We may proceed in this way as far as we please, deducing the fluents of \( \sin^m \omega \) from that of \( \sin \omega \), and the fluent of \( \cos^m \omega \) from that of \( \sin^2 \omega \), and so on.

If in the general formula we substitute every where \( \omega = x \) instead of \( \omega \), it becomes
\[
\int \sin^m \omega = \frac{1}{2} \cos \omega + \frac{1}{2} \int \sin^{m-1} \omega + \text{const.}
\]
Part II.

FLUXIONS.

an expression which, by bringing \( \int \frac{1}{\sin^m x} \) or \( \int \frac{1}{\sin^m x} \) to stand on one side of the equation, becomes

\[
\int \frac{1}{\sin^m x} = \frac{1}{(m-1) \sin^{m-2} x} + \frac{m-2}{m-1} \int \frac{1}{\sin^{m-2} x}
\]

This formula is not applicable to the case of \( n = 1 \), because then each of the terms of the fluent is divided by \( \sin x \), and therefore becomes infinite. In order to obtain the expression for the fluent in this particular case, we proceed thus. It is evident that

\[
\frac{1}{\sin x} = \frac{1}{1 - \cos^2 x} = \frac{1}{2(1 - \cos x + \frac{1}{2} \sin x) + \frac{1}{2} \sin x}
\]

as will be found by reducing the fractions to a common denominator, therefore

\[
\int \frac{1}{\sin x} = \frac{1}{2(1 - \cos x)} + \frac{1}{2} \log(1 + \cos x)
\]

and in like manner from the formula expressing the fluent of \( \int \frac{1}{\sin x} \) we deduce

\[
\int \frac{1}{\cos x} = \frac{1}{1 - \sin x} + \log\left(\frac{1 + \sin x}{1 - \sin x}\right)
\]

150. It has been shown in ALGEBRA, § 357, that

\[
16 \cos^2 x \sin^2 x = -\sin 5x + \sin 3x + 2 \sin x,
\]

therefore

\[
\int \frac{1}{\sin^m x} \sin^2 x \, dx = \frac{1}{10} \left( \frac{1}{3} \cos 5x - \frac{1}{3} \cos 3x - 2 \cos x \right) + \text{const.}
\]

The same mode of finding the fluent will apply to any fluent of this form \( \sin^m x \cos^n x \); or by resolving the fluent into two parts, the determination of its fluent may be reduced to that of a fluent in which the exponents \( m \) and \( n \) are less than in the proposed fluent, by the method of proceeding already employed in § 146.

151. Let us now denote \( \sin x \) by \( y \), then \( \cos x = \sqrt{1 - y^2} \), and since \( \cos x = \frac{x}{\sqrt{x^2}} \) (§ 59) therefore is

\[
\frac{\sqrt{1 - y^2}}{y} = \frac{\sqrt{x^2}}{x} \]; these values being substituted in any function involving \( x \), \( \sin x \), and \( \cos x \) will immediately reduce it to an algebraic form. Thus, for example, we shall have \( \sin x \cos^2 x \) transformed to

\[
\sin x (x^2 - 1)^{\frac{x^2}{2}}
\]

an expression which may have its fluent determined by the formulas of § 133 and § 134.

Sect. II. Application of the Inverse Method of Fluxions to the Resolution of Problems.

To find the Area of Curves.

152. It has been shown in § 61, that if the abscissa of a curve be denoted by \( x \), the ordinate by \( y \), and the area
**Fluxions.**

In the Inverse Method, the general formula expressing the area of any curve will be

\[ s = \int \frac{y}{x} \, dx. \]

Hence to find the area of any curve, we must either find from the equation of the curve the value of \( y \) in terms of \( x \), or else the value of \( x \) in terms of \( y \), and \( y \), and either the one or the other of these being substituted in the above formula, and the fluent found by the methods already explained, we shall have a general expression for the curvilinear area as required.

**Ex. 1.** Let it be required to find the area of any curve of the parabolic kind, of which, putting the abscissa \( AB = x \), and the ordinate \( BP = y \), the equation is

\[ y = a \cdot x^m. \]

Then we have \( y = a \cdot x^m \), and

\[ s = \int \frac{y}{x} \, dx = \int \frac{a \cdot x^m}{x} \, dx = \int a \cdot x^{m-1} \, dx. \]

\[ = \frac{a}{m-1} \cdot x^{m-1} + C, \]

where \( C \) denotes the constant quantity that may be required to complete the fluent. As in the present case, it is required to find the areas of the portion of the curve next its vertex, so that when \( x = 0 \), then \( s = 0 \), therefore, also \( C = 0 \), and the area is simply

\[ \frac{a}{m-1} \cdot x^{m-1}. \]

If it be required to find the area comprehended between two ordinates \( PB, p, b \), put \( AB = d \), then when \( x = 0 \), we have \( x = d \), therefore the general expression

\[ s = \int \frac{a \cdot x^m}{x} \, dx = \frac{a}{m-1} \cdot x^{m-1} + C \]

becomes in this case \( s = \frac{a}{m-1} \cdot d^{m-1} \), hence \( C = - \frac{a}{m-1} \cdot d^{m-1} \), and consequently the area \( BP, p, b \), or \( s \), is equal to

\[ \frac{a}{m-1} \cdot \left\{ x^{m-1} - d^{m-1} \right\}. \]

When \( n \) is an even number, the expression for the area, viz.

\[ \frac{a}{m-1} \cdot n^{m-1} \]

may be considered as negative as well as positive, on account of the radical quantity \( n \), or \( \sqrt[n]{m} \), which has then a twofold value, it may therefore have the sign \( \pm \) prefixed to it; but in this case the same abscissa \( AB \) belongs to two branches of the curve \( AP \) and \( AP' \), as in fig. 19, \( N^o \), therefore the two values of the expression \( \pm \frac{a}{m-1} \cdot n^{m-1} \) may be considered as indicating the two areas \( AP, AP' \),

the quantity \( x \), has only one sign, and remains always positive whatever be the sign of \( x \), but in this case one of the two branches of the curve has its abscissas and its ordinates negative at the same time (as in fig. 19, \( N^o \)), it follows therefore that the areas corresponding to the negative abscissas and ordinates ought to be regarded as positive.

If \( n \) alone is odd, then the quantity \( x \), becomes negative at the same time as \( x \), but in this case the two branches of the curve are on the same side of the line in which the abscissas are taken (as in fig. 19, \( N^o \)), and the ordinates remain always positive.

Upon the whole it may be concluded, that the area of a curve is positive when the abscissas and the ordinates have the same sign, and negative when they have contrary signs.

If we suppose \( m = 1 \), and \( n = 2 \), then the curve is the common parabola, the area of which from the general formula is found to be \( \frac{2}{3} \cdot \frac{a}{n} \cdot d = \frac{2}{3} \cdot xy \); hence it appears that the parabola is \( \frac{2}{3} \) of its circumscribing parallelogram.

**Ex. 2.** Suppose the curve to be a circle. Put \( AB = x, BP = y \), the diameter \( AD = x \), the area \( ABP = a \). From the nature of the circle \( y = a - x^2 \), therefore \( y = \sqrt{a - x^2} \), and

\[ s = \int \frac{y}{x} \, dx = \int \sqrt{a - x^2} \, dx. \]

This expression does not require a constant quantity to be added to it, because when \( x = 0 \), we must also have \( s = 0 \).

If we suppose the arch \( AP \) to be \( \frac{1}{4} \) of the quadrature \( AE \), then it is known that \( PB = y \), the rad. \( AC = \frac{1}{2} x \), therefore, if we suppose the radius \( = 1 \), we have in this case \( BC = \sqrt{3} \), and \( AB = 1 \), and \( \sqrt{3} = 0.1339746 \) nearly. If this number be substituted instead of \( x \), and a few terms of the series computed, we shall find the area \( ABP = 0.1339746 + \frac{1}{2} \cdot \frac{1}{3} \cdot \frac{1}{4} \cdot \frac{1}{5} + \frac{1}{6} \cdot \frac{1}{7} \cdot \frac{1}{8} \cdot \frac{1}{9} + \ldots \), which number when multiplied by \( 3 \) gives \( 0.8373932 \) for the area of the quadrant. This number also expresses the area of a circle of which the diameter is 1.

**Ex. 3.** Suppose the curve to be an ellipse. Put \( \frac{x}{a} = \cos \theta \), the area \( APB, APB' \), the
Part II.  

The transverse axis $AD=a$, the conjugate axis $2CE=b$, also $AB=\alpha$, $BP=\beta$; then by the nature of the curve $y=\frac{b}{a}\sqrt{(a-x^2)}$, and $x=y=\frac{b}{a}\sqrt{(a-x^2)}$; but if a circle be described on $AD$ as a diameter, and $BP$ the ordinate of the ellipse produced to meet the circle, it appears from example that $\frac{b}{a}\sqrt{(a-x^2)}$ is the fluxion of $AQB$ the segment of the circle corresponding to the elliptic area $ABP$ or $\alpha$; therefore, putting $v$ for the segment $AQB$, we have:

\[ x = \frac{bv}{a} \quad \text{and} \quad y = \frac{bv}{a} \]

here the constant quantity $c$ must be suppressed, because $x$ and $y$ must vanish together. Hence it appears that the area of any segment of an ellipse is to the area of the corresponding segment of its circumscribing circle as the lesser axis of the ellipse is to the greater; therefore the whole ellipse must be to the whole circle in the same ratio.

**Fig. 12.**

**Ex. 5.** Let the curve be a hyperbola, of which $C$ is the centre. Put the semi-transverse axis $CA=\alpha$, the semiconjugate axis $=b$, $CB=\beta$, $BP=\gamma$, the area $APB=\gamma$. From the nature of the curve $y=\frac{b}{a}\sqrt{(a-x^2)}$, therefore:

\[ x = \int y \, dx = \frac{b}{a} \int \sqrt{(a-x^2)} \, dx. \]

But it appears from formula B ($\S\,131$) that:

\[ \int \sqrt{(a-x^2)} = \frac{1}{2} \left( a + \sqrt{a^2-x^2} \right)^{\frac{3}{2}} + c, \]

and again by $\S\,130$:

\[ \int \sqrt{(a-x^2)} = \frac{1}{2} \left( a + \sqrt{a^2-x^2} \right)^{\frac{3}{2}} + c, \]

therefore:

\[ x = \frac{b}{a} \sqrt{(a-x^2)} - \frac{a}{2} \int \left[ x + \sqrt{(a-x^2)} \right]^{\frac{3}{2}} + c. \]

To discover the value of the constant quantity $c$, we must consider that when $x=\alpha$, then $x=\beta$, and in this extreme case the general equation just found becomes:

\[ a = \frac{ab}{a} \left( 1 - \beta \right) + c, \]

hence $c = \frac{ab}{a} \beta$, and consequently, observing that:

\[ \frac{ab}{a} \beta = \frac{ab}{a} \left( 1 - \frac{a}{b} \right) + \frac{ab}{a} \beta, \]

we get:

\[ x = \frac{b}{3a} \sqrt{(a-x^2)} = \frac{ab}{a} \beta, \]

It immediately follows from this formula that the triangle $CBP$, it is manifest that $\frac{b}{2a} \sqrt{(a-x^2)}$ is equal to $\frac{1}{2} CB \times BP$, that is, to the triangle $CBP$, therefore the excess of the triangle $CBP$ above the area $\alpha$, that is the hyperbolic sector $CAP$, is equal to the logarithmic function:

\[ \frac{ab}{2} \left( \frac{a}{a} \sqrt{(a-x^2)} \right) \]

**Ex. 5.** Suppose the curve to be an equilateral hyperbola, whose axes are equal, and that is required to find the curvilinear area $DCBP$ comprehended between $DC$, a perpendicular from $D$ (a given point in the curve) to one of the asymptotes, and $PB$, a perpendicular from any other point in the curve to the same asymptote.

Let $A$ be the centre, put $AC=\cent$, $CD=b$, $AB=\omega$, $BP=\gamma$, the area $DCBP=\gamma$. From the property of the asymptotes we have $\frac{\omega \gamma}{\omega b}$, and therefore $y = \frac{ab}{\alpha}$, hence ($\S\,108$):\n
\[ \gamma = \int y \, dx = \int \frac{ab}{\alpha} \, dx = \omega b \ln x + c. \]

To find the value of $c$, let us suppose $x=\omega$, then $x=\omega$, and the general formula becomes in this case:

\[ \omega = b \ln x + c, \]

and hence $\omega = b \ln \frac{\omega}{b} + c, \text{and therefore} \omega = b \ln \frac{\omega}{b} + c$.\n
Therefore:

\[ \omega = b \ln \frac{\omega}{b} + c. \]

If we suppose $\omega = \omega$, then $\omega = \omega$, from which it appears that in this case the hyperbolic area $DGBP$ represents the Napierian logarithm of the number $x$; it was from the consideration of this property that the logarithms, originally invented by Napier, were called hyperbolas.

But the logarithms of any other system may also be represented by areas of the same hyperbola; for this purpose it is only necessary to determine the magnitudes of $a$ and $b$, so that $\frac{b}{a} = M$, where $M$ denotes the modulus of the system, thus we shall have $ab=\omega M$, and $\omega = \omega M \cdot \frac{\omega}{a}$, etc., putting $\omega = \omega$, $\omega = \omega M \cdot \frac{\omega}{a}$, as an expression for the logarithm of $x$ according to any system whatever of which the modulus is $M$ ($\text{ALGEBRA}, \S\,137$).

**Ex. 6.** Let the curve be the cycloid of which $AE$ is the axis and $A$ the vertex, let a semicircle be described on $AE$ as a diameter, draw $AG$ perpendicular to the axis, and from any point in the curve draw $PB$ perpendicular to $AG$ and $PD$ perpendicular to $AE$, meeting the circle in $Q$, and draw $QC$ to $C$ the centre of the circle. Put $AC=\omega$, $AB=\omega$, $BP=\gamma$, the area $ABP=\gamma$, and put $\theta$ for the angle $ACQ$, that is for the arch of a circle which measures $ACQ$, the radius of...
ion of a curved linear area, in § 61, is not immediately applicable when the nature of a curve is expressed in this way, we shall therefore investigate another formula suited to this particular manner of considering curves.

Let us suppose that APR is a curve the position of Fig. 8, any point $P$ of which is determined by $PF$, its distance from a given point $F$, and the angle which $PF$ makes with $AP$ a line given by position. Let a circle be described on $F$ as a centre with a radius, then $FP$, as also the area $FAP$, may be considered as functions of the arch of that circle which measures the angle $PAF$. From $F$ draw $FP'$ to any other point $P'$ of the curve meeting the circle $BD$ in $D'$. Put $FP = r$, the area $FAP = s$, the angle $AFP$, or the arch $BD = v$, then the area $FPF'$, and the arch $DD'$, will be the corresponding increments of $s$ and $v$, therefore, § 21,

$$\frac{s}{v} = \text{limit of} \frac{\text{area } FPF'}{DD \times DF}$$

Here $DD'$ the increment of $v$ is multiplied by $FD = 1$, to render the terms of the ratio homogeneous. On $F$ as a centre, with $FP$ as a radius, describe an arch of a circle meeting $FP'$ in $Q$, then, as the sectors $FDD'$, $FPQ$ are similar, we have

$$FE' : FP' :: FD \times DD' : FP \times PQ = s \text{ sect. } FPQ,$$

hence $DD' \times FD = \frac{2FD}{FD'}$ sect. $FPQ = \frac{2}{r}$ sect. $FPQ$

and $\frac{r}{v} = \frac{r^2}{2} \lim \text{ area } FPP'$

but the point $P'$ being supposed to approach continually to $P$, it is manifest that the limit of $\frac{\text{area } FPF'}{DD \times DF}$ is unity, or, therefore

$$\frac{s}{v} = \frac{1}{2} \text{ and } \frac{v}{s} = \frac{1}{r^2}.$$

154. By means of this formula we may find the areas of that class of curves called spirals. Let us take for example the spiral of ARCHIMEDES, which may be defined thus. Conceive a straight line $FF'$ to revolve about $F$ the centre of a given circle, departing from a given position $FB$; conceive also a point $P$ to move in the revolving line, so that $PF$ its distance from the centre may be $BD$ the arch of the circle passed over by the revolving line, as $m$ to $n$, then the point $P$ will generate the spiral.

Put $BF = a$, the angle $BFR = t$, the line $FP = u$, and the area generated by the line $FP = \pi a$, then the arch $BD = a v$, and since from the nature of the curve

$$r : a v :: m : n,$$

therefore $u = \frac{a r}{a v}$ and $v = \frac{a r}{a r}$, hence the general formula $u = \frac{a r}{a v}$ becomes $u = \frac{a r}{2 a m}$

$$u = \frac{a r}{2 a m} = \frac{a}{2 a m}$$

this fraction does not require a constant quantity to be added,
156. As the general expression for a curvilinear area BCFD is \( \int x \, dx \), where \( x = AB \) the abscissa reckoned from a given point \( A \) in the axis, and \( y = BC \) the ordinate, it follows that \( X \) being put to denote any function of a variable quantity \( x \), the fluent of \( X \) may always be exhibited by means of a curvilinear area. Thus let \( CP \) be a curve of such a nature that \( AD = \alpha \) and \( DP \) the co-ordinates being denoted by \( x \) and \( y \), the equation of the curve is \( y = X \), then, assuming any ordinate \( BC \) as given by position, we have evidently

\[ \int X \, dx = \text{area CBDP}. \]

As the ordinate \( BC \) (which is assumed as given by position) may be taken anywhere, the fluent of the area being the same wherever it is taken, it appears, as has been already observed (§ 101) that the function \( \int X \, dx \) may be considered as indeterminate, for it admits of innumerable values corresponding to any particular value of \( x \), and in this respect it differs from an algebraic function, which for a given value of \( x \) has always a determinate number of values. If however \( x \) be supposed to increase from any determinate magnitude \( a \), to any other determinate magnitude \( a' \), then, taking the abscissa \( AD = \alpha \), and \( \Delta d = \alpha' \), and drawing the ordinates \( DP, dP \), we have

when \( a = \alpha \), \( \int X \, dx = \text{area CBDP}, \)

and when \( a = \alpha' \), \( \int X \, dx = \text{area CB}dP, \)

therefore, while \( x \) increases from \( a \) to \( a' \), or receives the increment \( \alpha' - \alpha \), the function \( \int X \, dx \) increases from area CBDP to area CB\( dP \), and thus receives the increment area PD \( dP \), which is of a determinate magnitude, as the ordinates PD, \( dP \) have both a determinate position. Hence it appears that in assigning the fluent of \( X \), we only determine the change that takes place in the value of the function \( \int X \, dx \) while \( x \) passes from one particular value to another particular value.

157. As there are general and known methods by which an approximate value of any curvilinear area may be found, when a fluent is expressed by such an area, those methods may be applied to find an approximate value of the fluent. Let \( PD \) be a curvilinear area, supposed to represent the fluent \( \int X \, dx \) between the limits of \( x = AD \) and \( x = AD \). Conceive \( Dd \) to be divided into a number of equal parts \( DD', DD'', DD''' \), and the ordinates \( P'P', P''P'' \), drawn, and the two sets of parallelograms \( DE, D' E', D'' E'' \), \( D' E', D'' E'' \) and \( D'a, D'd', d''a' \) to be completed, the former constituting a rectilinear figure circumscribed about the curvilinear space \( DPP'P'' \), and the latter a rectilinear figure inscribed in that space; then as the circumscribed figure must necessarily be greater than the curvilinear space, that is, greater than

\[ \int \frac{dx}{1 + x^2} \text{ taken between the limits of } x = AD \text{ and } x = AD \text{.} \]

and the inscribed figure must be less, it follows that if we compute the areas of the circumscribed and inscribed figures we shall obtain two limits, the one greater, and the other less than \( \int X \, dx \). And as by increasing the number of equal parts into which \( Dd \) is divided we may bring the circumscribed and inscribed rectilinear figures as near to a ratio of equality as we please, it is always possible to find two limits which shall differ from each other, and consequently from \( \int X \, dx \) (which lies between them), by less than any assignable quantity.

158. If we join \( P, P', P'' \), the tops of the ordinates, the rectilinear space formed by the trapeziums \( DPP'P'' \), \( D''P''P''' \) \( dP \) will be more nearly equal to the curvilinear area, than the circumscribed rectilinear figure formed by the parallelograms \( DE, D' E', D'' E'' \); therefore, the sum of those trapeziums being found, it will be equal to the fluent \( \int X \, dx \) nearly.

Suppose, for example, that it is required to find the value of \( \int \frac{x}{1 + x^2} \) between the limits of \( x = 0 \), and \( x = t \).

In this case \( X = \frac{x}{1 + x^2} \), so that the equation of the curve \( pp \) is \( y = \frac{x}{1 + x^2} \); let us suppose \( Dd \) the distance between the extreme ordinates to be divided into ten equal parts, then putting \( 0 = 1, 2, &c. \) instead of \( x \) in the formula \( y = \frac{x}{1 + x^2} \), we obtain eleven successive values of \( y \), or eleven equidistant ordinates, the numerical values of which will be as follows,

| The first = 1 | the 7th = 73529
| the 2nd = 00000 | the 8th = 67114
| the 3rd = 96154 | the 9th = 60975
| the 4th = 91743 | the 10th = 55249
| the 5th = 86207 | the 11th = 50000
| the 6th = 80000 |

By the elements of geometry the area of the rectilinear figure formed by the trapeziums is found by adding together all the ordinates except the first and last, and half the sum of the first and last, and multiplying that sum by the breadth of one of the trapeziums; now the sum of the ordinates, with the exception of the first and last, together with half the sum of the first and last, is \( 7.84981 \), and the common breadth of the trapezium is \( 1 \), therefore \( \int \frac{x}{1 + x^2} = 7.84981 \times \)

\( \times 1 = 7.958 \) nearly, as required. It is evident from § 137, that \( \int \frac{x}{1 + x^2} \) taken between the limits of \( x = 0 \), and \( x = t \), is accurately equal to an arch of \( 45^\circ \), radius being unity, which arch being \( \frac{1}{4} \) will be found to be \( 7.954 \) nearly.

If we recur to the series which has been found to express the above fluent in § 137, and put \( x = 1 \), and

\( x = t \), we shall have

\( \int \frac{x}{1 + x^2} \text{ taken between the prescribed limits equal to} \)

\[ \frac{t}{2} \]
It is impossible, however, to compute the fluent simply by the addition of the terms of this series, on account of the slowness of its convergence.

159. As the curvilinear area \( D\, p \, d \) is the limit of the sum of the parallelograms \( D\, p', D\, p'', \&c. \) which constitute the rectilinear figure inscribed in that area; as also the limit of the sum of the parallelograms \( D\, E, D\, E', \&c. \) which constitute the circumscribed figure, the number of parts into which \( D\, d \) is divided being in each case conceived to be increased indefinitely, so that each may be continually diminished and (this being the case it is of no consequence whether the parts be conceived as all equal or as unequal) so from analogy we may conclude that if \( x', x'', x''', \ldots x^{(m)} \) be put to denote successive values of a variable quantity \( x \), and \( X', X'', X''', \ldots X^{(m)} \) the corresponding values of \( X \) any function of \( x \), the limit of the sum of the products \( x' \cdot X', x'' \cdot X'', x''' \cdot X''', \&c. \) when the number of successive values of \( x \) and \( X \) is continually increased, so that the difference between any two of them immediately following each other may be continually diminished, is equal to \( \int X \, dx \), the fluent to be taken between the two extreme values of \( x \).

160. It was in this manner that the first writers on the differential calculus conceived a fluent; as the difference between any two of its succeeding values is the product of the function \( X \) by the increment of \( x \) denoted by \( x' - x \) the increment of \( x \); they called that product (when \( x' - x \) was conceived to be infinitely diminished) the "Differential of the fluent"; and as the fluent is the sum of all the products, or differentials, instead of calling it a fluent they called it an "Integral"; the process by which an integral is found from its differential or fluxion they called Integration. The terms "Integral" and "Integration" are sometimes employed by writers in applying the method of fluxions to mathematical enquiries.

To find the Lengths of Curves.

161. It has been shown in § 63, that if the abscissa of a curve be denoted by \( x \), the ordinate by \( y \), and the curve line by \( s \), then \( s = \int \sqrt{(x' + y')^2} \), hence the general formula for finding the length of a curve is

\[
s = \int \sqrt{(x' + y')^2}.
\]

Therefore, if from the equation expressing the nature of a curve we find the value of \( y \) in terms of \( x \) and \( s \), or else the value of \( x \) in terms of \( y \) and \( s \), and substitute the one or the other in the above general formula, we shall obtain a fluence the fluent of which will be the length of the curve.

Ex. 1. Suppose the curve to be a parabola, and that \( AB = x, BP = y \), the arch \( AP = s \), the parameter \( = a \), then the equation of the curve being \( a \cdot x = y^2 \), we have

\[
x = \frac{2y^2}{a}, \quad \text{and} \quad s = \int \sqrt{\left(\frac{2y^2}{a} + y^2\right)^2},
\]

This fluent can only be expressed by an infinite series, under which form it has been already exhibited in § 140, the radius being there supposed unity.

Ex. 2. Suppose the curve to be a circle, and that \( C \) is its centre, and \( AE \) a quadrant of the circle. Put \( CB = x, BP = y \), the arc \( EP = s \), the radius of the circle \( = a \), then \( x^2 + y^2 = a^2 \), and \( y = \sqrt{(a^2 - x^2)} \), hence

\[
s = \int \sqrt{(x' + y')^2} = \int \sqrt{(x' + \frac{x^2}{a^2 - x^2})},
\]

Ex. 3. Let the curve be an ellipse, and let it be required to find the length of the curve between \( E \) the vertex of the lesser axis, and \( P \) any point in the curve. To simplify the calculation, let us suppose that the semi-transverse axis \( AC = 1 \), put the semi-conjugate axis \( CE = b \), the eccentricity (that is \( \sqrt{(1 - b^2)} = e \), the abscissa \( CB = s \), the ordinate \( FB = y \), the arc \( EP = s \); then, the equation of the curve being \( y = b \sqrt{(1 - x^2)} \), we have
Part II.

**FLUXIONS.**

In the Method have

\[
y = b \sqrt{1 - x^2}, \quad \text{and} \quad \frac{dy}{dx} = \frac{-b \times 2x}{\sqrt{1 - x^2}}, \quad \text{therefore,}
\]

\[
z = \int \sqrt{\left(x^2 + y^2\right)} = \int \sqrt{\left(x^2 + b^2 x^2 \right)} \sqrt{1 - x^2}.
\]

This fluent can only be expressed by means of an infinite series and it has been already given in this form in § 141.

If we take \(x = 1\), then all the quantities in that series which are multiplied by \(\sqrt[4]{(1-x^2)}\) will vanish, but in this particular case \(x\) is the elliptic quadrant \(EA\), and

\[
A \text{ is a quadrant of the circumscribing circle, or } \frac{1}{4} \pi, \text{ therefore the ellipse quadrant is equal to}
\]

\[
\pi \left(1 - \frac{x^2}{2} - \frac{x^4}{2.4} - \frac{x^6}{2.4.6} - \cdots \right).
\]

This series converges very fast if \(x\) be a small fraction.

Ex. 4. Suppose the curve to be a cycloid. Let a circle be described on its axis meeting the ordinate PB in Q and draw CQ to the centre of the circle. Put \(AB = x\), \(BP = y\), the cycloidal arch \(AP = x\), the radius \(AC = a\), the angle \(ACQ = \alpha\), then \(AB = (1 - \cos \alpha)\), \(BQ = \cos \alpha\), \(CQ = \sin \alpha\), the circ. arch \(AQ = x\), so that \(x = \cos(1 - \cos \alpha)\), from the nature of the curve \(y = a(\frac{1}{2} \sin \alpha)\), therefore \(x = (\frac{1}{2} \sin \alpha)\), (§ 59.)

\[
\begin{align*}
\dot{x} &= a \sin \alpha, \\
\dot{y} &= a \cos \alpha (1 + \cos \alpha), \\
\dot{x}^2 + \dot{y}^2 &= a^2 \dot{v}^2 (1 + \cos \alpha) \dot{v} + (1 + \cos \alpha) \dot{v} \\
&= a^2 \dot{v}^2 (1 + 2 \cos \alpha),
\end{align*}
\]

but \(2 + 2 \cos \alpha = \cos 2 \alpha \neq 0\) (Algebra, § 59.) therefore

\[
z = \int \sqrt{\left(\dot{x}^2 + \dot{y}^2\right)} = 2a \int \sqrt{\cos \alpha \cos \dot{v}} \dot{v}
\]

\[
= 4a \int \cos \alpha \dot{v} + C, \quad (§ 145.)
\]

but when \(v = 0\), then \(x = 0\), therefore \(C = 0\), and \(x = 4a \cos \alpha \dot{v} + C\); but if the chord \(AQ\) be drawn, \(2a \sin \frac{1}{4} \pi = \text{chord} \ AQ\), therefore \(z = 2a \text{ chord} \ AQ\).

162. The formula \(z = \int \sqrt{\left(\dot{x}^2 + \dot{y}^2\right)}\) not being applicable in its present form to curves of the spiral kind, we shall here investigate another suited to that particular class of curves.

Let APR be a curve of such a nature that the position of any point \(P\) in the curve is determined by \(PF\), its distance from a given point \(F\), and by the angle which \(PF\) makes with \(AF\) a line given in position.

We shall employ the same construction and notation here as in § 144, with the addition of drawing the chords \(DD', PP', \text{and putting the arch } AP = x\); then it is manifest that the simultaneous increments of \(v, x, \text{and } r\) will be the arches \(DD', PP', \text{and the straight line } PP' \text{ respectively.}

Hence

\[
\frac{\dot{z}}{v} = \lim_{\text{arch } PP' \to 0} \frac{\text{arch } PP'}{\text{arch } DD'}
\]

but it is evident from § 62, that the limiting ratio of

\[
\frac{\dot{z}}{v} = \lim_{\text{arch } PP' \to 0} \frac{\text{arch } PP'}{\text{arch } DD'}
\]

then the limit of the angle \(PQD\) being evidently a right angle, we have

\[
\frac{\dot{z}}{v} = \lim_{\text{arch } DD' \to 0} \frac{\sqrt{\left(\dot{PQ}^2 + \dot{QD}^2\right)}}{\sqrt{\left(\dot{DD}'^2 + \dot{DD}^2\right)}}.
\]

but

\[
\frac{\dot{PQ}^2}{\dot{DD}^2} = \frac{\dot{PQ}^2}{\dot{DD}^2} \dot{r}^2, \text{and } \lim_{\text{arch } DD' \to 0} \frac{\dot{PQ}^2}{\dot{DD}^2} = \frac{\dot{r}}{\dot{v}}.
\]

\[\frac{\dot{r}}{\dot{v}} = \sqrt{\left(\dot{r}^2 + \dot{r}^2\right)}, \text{and } \dot{z} = \sqrt{\left(\dot{r}^2 + \dot{r}^2\right)}.
\]

Let us apply this formula to the spiral of Archimedes, Fig. 17.

the equation of which (§ 155.) is \(a m = \pi r\), and therefore

\[\frac{\dot{r}}{\dot{v}} = \frac{\dot{r}}{\dot{v}}, \text{ and } \dot{z} = \sqrt{\left(\dot{r}^2 + \dot{r}^2\right)}.
\]

This fluent may be found by formula B, § 131, and it is worthy of remark that the fluolution has the same form as that which we have found in § 161 for an arch of a parabola; thus the length of any portion of the spiral of Archimedes may be exhibited by means of an arch of a parabola.

To find the Contents of Solids.

163. If \(AD\) the abscissa of a curve be denoted by \(x\), Fig. 4, and \(PD\) the ordinate by \(y\), and the solid generated by the revolution of the curve \(APD\) about \(AD\) as an axis by \(z\), it has been shown in § 64, that \(z = \pi r^2 x\), therefore the general formula for finding the content of a solid is

\[
z = \pi \int \dot{y}^2 dx.
\]

Ex. 1. Suppose the solid to be a paraboloid, or that which is generated by the revolution of a parabola about its axis; in this case \(y = x^2\), and taking the fluent so that when \(x = 0\), then \(z = 0\),

\[z = \pi \int \dot{y}^2 dx = \pi \int x^2 dx = \frac{x^3}{3} + C = \pi a x^3,
\]

or \(z = \pi x^3\); but \(\pi x^3\) is the content of a cylinder having \(y\) for the radius of its base and \(x\) for its altitude, therefore the content of a paraboloid is half that of a cylinder having the same base and altitude.

Ex. 2. Suppose the solid to be a parabolic spindle, Fig. 31, which is generated by the revolution of \(APB\) an arch of a parabola about \(AB\) an ordinate to its axis. In this case let \(AD = x\), \(DP = y\), \(AB = a\), the parameter of the parabola.

axis

\[
z = \int \dot{y}^2 dx = \pi \int \pi a x^3 dx = \frac{1}{4} \pi a x^4
\]
FLUXIONS.

Inverse Method.

axis = a, then from the nature of the parabola $AD \times DB = PD$, that is $y(b-x) = xy$, hence $y = \frac{xy}{a}$, and taking the fluent, so that $x$ and $x$ may vanish together;

$$
\ell = \frac{x}{a} \int y'(b-x) \cdot \frac{xy}{a} \\
= \frac{x}{a} \int \left(\frac{b^2 - x^2}{3} - \frac{2bx^2}{2} + \frac{x^3}{3}\right) \\
= \frac{x}{a} \left(\frac{b^2 - x^2}{3} - \frac{2bx^2}{2} + \frac{x^3}{3}\right)
$$

or, since $a = \frac{(b-x)x^2}{y}$,

$$
\ell = \frac{x}{a} \left(\frac{b^2 - x^2}{3} - \frac{2bx^2}{2} + \frac{x^3}{3}\right)
$$

which expression (by supposing $\ell = AC = \frac{d}{2}$, and putting $d$ for $CE$, the greatest value of $y$) gives $4 \pi \frac{dx}{b}$ for the content of half the solid generated by the curve $AEB$, therefore the entire spindle is $8 \pi \frac{dx}{b}$, or (by observing that $\pi d^2 b$ is the content of a cylinder having $d$ for the radius of its base and $b$ for its length) it is $\frac{4}{3}$ of the circumscribing cylinder.

Ex. 3. Suppose the solid to be a spheroid produced by the revolution of an ellipse about either of its axes; put $a$ for $\frac{1}{6}EF$ the other axis, $x$ for $AD$ the height of any segment made by a plane perpendicular to the axis of the solid, $y$ for $PD$ the radius of its base, and $s$ for its content. Then from the nature of the curve $y' = \frac{a^2}{x^2} (2ax - x^2)$, therefore taking the fluent upon the supposition that $x$ and $x$ vanish together,

$$
\ell = \frac{x}{a} \left(\frac{b^2 - x^2}{3} - \frac{2bx^2}{2} + \frac{x^3}{3}\right)
$$

To find the content of the whole spheroid, we have only to take $a = 2a$, then the formula becomes

$$
\ell = 4 \pi \frac{b a}{3}
$$

and as $2 \pi b/a$ expresses the content of a cylinder having $2b$ for the diameter of its base, and $2a$ for its height, it follows that the contents of a spheroid is $\frac{4}{3}$ of that of its circumscribing cylinder.

It is obvious that what has been found for the spheroid will apply also to the sphere, by supposing the axes equal, or $a = b$.

Ex. 4. If instead of supposing the solid $AQP$ to be formed by the revolution of a curve round its axis (in which case it is called a solid of revolution) we had supposed it to have any figure whatever, then by referring the solid to some straight line $AC$, given by position, as an axis, and in which $A$ is a given point, and supposing $PQ$ to be a section of the solid made by a plane perpendicular to that axis, moving it in $D$, and letting $AD = a$, and the variable solid $AQP$ (as a function of $x$) $= \ell$, by proceeding as before, we would have found the limit of the increment of $\ell$ upon the increment of $a$.

seqeuntly $\ell$, equal to the area of the section in a made by the plane $PQ$, therefore putting $\ell$ a function of $x$ which expresses the area of the section, we have $\ell = \sqrt{V}$, and $\ell = \int \sqrt{V}$.

Let us suppose for example that $AEP$ is bounded by any plane figure $EFG$ as a base, the surface which will be generated if $EFG$ is straight line drawn from $A$ any given point, and plane to revolve in the circumference of the line.

Let $AC$ be a perpendicular drawn from $A$ of the figure to its base, and let $PQ$ be the solid by a plane parallel to the base, then perpendicular in $D$. Put $a$ for the area of the solid, $V$ for the area of the section $PQ$, $b$ for the altitude of the whole solid, $= AD$ the solid part cut off by the plane $PQ$, and $x$ for the base that part; then, as from the nature of the figure, pretty evident that the part of it cut off by $PQ$ is similar to the whole, and as the base and solids are as the squares of their altitudes,

$$
a : V :: b : a^2, \text{ hence } V = \frac{a^2}{b}
$$

this expression for $x$ does not require the altitude constant quantity, for by putting $a = \omega$, we have it ought to be. Suppose now $a = b$, then $x = \frac{a}{\sqrt{2}}$ from which it appears that the content of the solid is $\frac{2}{3}$ of the product of the base by the particular. It is evident that pyramids and cones of all kinds we have been considering.

To find the Surfaces of Solids.

165. The altitude $AD$ of a solid, general revolution of a curve about $AD$ as an axis, being denoted by $x$, and $PD$ the radius of its base, let us now put $x$ to denote the curved surface of the solid, then, as it has been shown, $165$, that

$$
\sqrt{\left(\frac{a}{b} + \frac{y}{b}\right)}
$$

as a general formula for the surface of a solid.

Ex. 1. Suppose the solid to be a sphere, the revolution of a circle about its diameter the radius of the sphere $= a$, then $AD$ being by $a$, and $PD$ by $y$, we have from the nature curve $y' = \sqrt{2a - x^2}$, therefore

$$
y = \sqrt{2a - x^2}, \text{ and } \frac{d}{dx} = \frac{1}{\sqrt{2a - x^2}}.
$$
Part II.

**FLUXIONS.**

Inverse Method.

\[ \dot{x}^2 + \dot{y}^2 = \dot{z} (1 + \frac{(a-e)^2}{2a^2}) \]

\[ \frac{\dot{x}^2}{2a} = \frac{\dot{z}}{2} \cdot \dot{z} \]

therefore, \( y \sqrt{(x^2 + y^2)} = a \dot{z} \) and taking the fluent, so that when \( n = 0 \), then \( \dot{z} = 0 \),

\[ \dot{z} = 2\pi \int y \sqrt{(x^2 + y^2)} = 2\pi a \dot{z} \]

now if it be considered that a \( 2a \) is the circumference of a great circle of the sphere, it will immediately appear that the surface of a segment of a sphere is equal to the circumference of a great circle of the sphere multiplied into the height of the segment. Hence it follows that the whole surface of the sphere is equal to four times the area of one of its great circles.

Fig. 5.

Ex. 2. Suppose the curve be a parabola, then putting \( AD = a \), \( DP = y \), the parameter of the axis \( = a \), we have (§ 161. example 1.)

\[ \sqrt{(x^2 + y^2)} = \frac{1}{a} y \sqrt{(a^2+4y^2)} \]

\[ \ddot{z} = 2\pi \int \frac{y}{a} \sqrt{(a^2+4y^2)} \]

\[ = \frac{2\pi}{a} \int y \sqrt{(a^2+4y^2)} \]

\[ = \frac{\pi}{6a} (a^2+4y^2)^{\frac{3}{2}} + C, \text{ by } § 108. \]

To discover the value of the constant quantity \( C \), we must observe that when \( n = 0 \), then \( y = 0 \), and \( \dot{z} = 0 \), therefore putting \( a \) instead of \( s \) and \( y \), the above equation becomes \( C = \frac{na^3}{6} + C \), hence \( C = -\frac{na^3}{6} \), and

\[ z = n \left\{ \frac{(a^2+4y^2)^{\frac{3}{2}} - na^3}{6a} \right\}. \]

To find the Centre of Gravity of any Line, Surface, or Solid.

166. It belongs to the theory of MECHANICS to explain what is meant by the centre of gravity, and to demonstrate its general properties, and here it is only necessary to shew how the method of fluxions may be applied to deduce from some one of those properties rules for finding that centre in any proposed case.

The properties of centres of gravity which we shall employ as the foundation of the application of the method of fluxions to its determination may be enunciated shortly thus.

Fig. 36.

Let \( C \) be the centre of gravity of a mass \( M \) denoted by \( M \), and \( c \) the centre of gravity of another mass \( m \), and \( D \) the centre of gravity of the two masses \( M \) and \( m \), from these points let perpendiculars \( CA, c \) and \( DE \) be drawn to any straight line \( PQ \), then

\[ M \times CA + m \times c = (M+m) \times DE. \]

Fig. 37.

167. Let us now suppose that \( AP \) is any curve line (having weight), of which the centre of gravity is required, and that \( PB, PD \) are co-ordinates drawn from any point in the curve perpendicular to \( AB, AD \) two axes at right angles to each other; let the arch \( AP \) receive any increment \( Pp \), let \( C \) be the centre of gravity of \( AP \), \( G \) the centre of gravity of \( Pp \), and \( O \) the centre of gravity of \( APp \). From \( C \) and \( G \) draw \( CE, CF, CH, GK \) perpendicular to the axes \( AB, AD \). Put \( PF = a, PB = y, CF = X, CE = Y, AP = n, \) also let the arch \( AP = a \), and let the distances of \( O \) its centre of gravity from the axes \( AD, AB \) be denoted by \( X \), and \( Y \) respectively; then, observing that the arch \( Pp = a \), by the proposition in last §,

\[ n \frac{X + (a-x) \times GK}{y} = \frac{aX}{y}. \]

\[ a \frac{X + (a-x) \times GK}{y} \]

hence

\[ \frac{X}{y} = \frac{a}{y} = (\frac{a}{y} - g). \]

If we now suppose the arch \( Pp \) to be continually diminished, and observe that \( x \sqrt{X} - x \), \( a \sqrt{a} \) are the simultaneous increments of \( ax \) and \( a \), it will appear (§ 23.) that

\[ \text{flux of } (ax) = \text{limit of } GK. \]

By the very same way of reasoning we find:

\[ \text{flux of } (ay) = \text{limit of } GH. \]

but the point \( p \) approaching to \( P \), it is manifest that the point \( G \) will also approach to \( P \), so that the limit of \( GK \) is \( PD \) or \( a \), and the limit of \( GH \) is \( PB \) or \( y \), hence

\[ \text{flux of } (ax) = n, \frac{\text{flux of } (ay)}{y} = y; \]

\[ \text{flux of } (ax) = n, \text{flux of } (ay) = y. \]

Taking now the fluents of each side of these equations, and dividing by \( y \),

\[ x = \int \frac{x}{y}, \quad y = \int \frac{y}{y}; \]

it is evident that by these two equations the position of \( C \) the centre of gravity is determined.

168. Let us now suppose that it is required to find the centre of gravity of the plane area \( APB \). As the arch \( AP \) was in last § supposed to receive the increment \( Pp, Pp \), let the area \( APB \) now receive the increment \( BPpB \), and let \( C, O \) and \( G \) (which in the former case were supposed to be the centres of gravity of the arches \( AP, APp \), and \( Pp \) respectively) now be supposed to be the centres of gravity of the areas \( AP, APp, \) and \( Pp \) respectively) now be supposed to be the centres of gravity of the areas \( AP, APp, \) and \( Pp \) respectively); put the area \( APB = n, \) the area \( Pp \) \( = e \), and let \( X, Y, X', Y' \) denote as before. Then, reasoning exactly as in last case, we have (by § 116),

\[ x \frac{X + (\alpha-x)}{y} \times GK = x \frac{X}{y}. \]

\[ y \frac{Y + (\beta-y)}{y} \times GH = y \frac{Y}{y}. \]

hence
and the point $p$ being supposed to approach to $P$, so that $x^\prime-x, y^\prime-y,$ and $s\to s$, the simultaneous increments of $x, y$ and $s$, may be continually diminished,

$$\text{flux.} \left( \frac{x}{s} \right) = \lim \frac{\text{flux.} \left( x \right)}{s} = \lim \frac{\text{flux.} \left( x \right)}{s} = \lim \frac{\text{flux.} \left( x \right)}{s}$$

but as the ordinate $p b$ approaches to $P b$, it is manifest that the ultimate position of $G$, the centre of gravity of the area $BP p b$, will be in the middle of $P b$, therefore the limit of $G K$ is $x$, and the limit of $G H$ is $y$, thus we have

$$\frac{\text{flux.} \left( x \right)}{s} = x, \quad \frac{\text{flux.} \left( y \right)}{s} = y,$$

and consequently,

$$X = \int x, \quad Y = \int y,$$

or since $y = x^2$, and $s = y^\prime$ (§ 64),

$$X = \int y^\prime, \quad Y = \int y^\prime.$$

170. If instead of the centre of gravity of the surface generated by $AP$, the centre of gravity of the solid generated by the revolution of the curve $APB$ about $AB$ as an axis be required, the result will be the same as in last §, since the solid generated by the plane figure instead of the surface generated by the curve line $y$ is that for the content of the solid, and $x$ is the distance of its centre of gravity from the vertex.

$$X = \int s \times \frac{\text{flux.} \left( x^2 \right)}{s} = \int s \times \frac{\text{flux.} \left( x^2 \right)}{s}$$

but in this case $s = y^\prime \times$ (§ 64) therefore

$$X = \int s \times \frac{\text{flux.} \left( x^2 \right)}{s} = \int s \times \frac{\text{flux.} \left( x^2 \right)}{s}.$$

171. We shall now apply these formulæ to a concrete example.

**Example 1.** Let it be required to find the centre of gravity of $AP$ of an arch of a circle, Suppose $a$ to be a part of the diameter, and in addition to the condition of § 167, put $a$ for the radius of the circle from the nature of the curve, $y^2 = 2ax - a^2$.

(proceeding as in § 165, Ex. 1) we have

therefore $x = ax$, and $s = \frac{ax}{y}$, but from the second equation $y^2 = 2ax - a^2$, by taking the limits $a x = a x$, and hence $x = \frac{ax}{y^2} = \frac{ax}{y^2} - \frac{ax}{y^2}$, therefore $a x = a x - a x$, substituting the limits of $x$ and $y$ in the formula of § 167, we have

$$X = \int a x = \frac{a}{a} \int (x - y),$$

$$X = \int a x = \frac{a}{a} \int (x - y),$$

$$Y = \int a x = \frac{a}{a} \int (x - y).$$

To discover the values of the constant quantities $c, c'$, we have from the equations in which they occur

$$a = ax = a x + ay, \quad c = ay = a x + a y,$$

but when $x = 0$, then $y = x$ and $y = x$, and therefore $c = 0$, and $c = 0$, thus we have

$$X = \frac{a(x - y)}{x}, \quad Y = \frac{a x}{x}.$$
Ex. 2. Let it be required to find the centre of gravity of APB an area bounded by AP an arch of a circle and PB, BA its sine andversed sine. Let \( a \) denote the radius, and let the remaining notation be as in § 168. Then, because \( i \equiv x \), we have \( n \equiv y = x \), but from the equation \( y^2 = 2ax - x^3 \) (which expresses the nature of the curve), we find

\[
\frac{n}{x} = \frac{a}{y}, \text{ therefore} \\
\frac{x}{n} = \frac{ay}{y} = \frac{a}{y} \frac{y}{y}. 
\]

We have also \( y^2 = (2ax - x^3) \), therefore,

\[
X = \int x \frac{y}{y} = \int \frac{(2ax - x^3) \frac{y}{y}}{y} = \frac{1}{2a} (a + \frac{1}{2} y^2 + c) 
\]

By proceeding as in the last example we find \( c \) and \( c' \) each \( = c \), thus we have

\[
X = \frac{1}{2a} (a + \frac{1}{2} y^2 + c), \quad Y = \frac{3a^2 - x^3}{6y}. 
\]

Ex. 3. Suppose now the figure to be the surface generated by the revolution of AP an arch of a circle about the diameter AB, and that the centre of gravity of the generated surface is required. Then because from the nature of the circle \( \frac{x^2}{y^3} \) we have \( \frac{y}{x} = \frac{s}{x} \), and \( n = ax \), therefore, substituting these values in the formula of § 169, it becomes

\[
X = \int \frac{y^3}{x} = \int \frac{x}{x} = \frac{3a^2 - x^2}{6y}. 
\]

To find the values of the constant quantities \( c \), \( c' \), we have

\[
\frac{c}{x} = \frac{\frac{1}{2} x^2 + c}{x} = x, 
\]

but as when \( x = c \), then \( X = c \), it is manifest that \( c \) and \( c' \) are each \( = c \), thus we have

\[
X = \frac{1}{2} x. 
\]

Ex. 4. Let us now suppose that it is required to find the centre of gravity of the solid generated by the revolution of AP an arch of a circle about the diameter. In this case, because \( y^2 = 2ax - x^3 \), we have from § 170,

\[
\int y^2 = \int (2ax - x^3) \frac{y}{y} = \frac{1}{2a} (a + \frac{1}{2} y^2 + c) 
\]

and reasoning as in the last example, we find \( c = c \), and \( c' = c \), and therefore

\[
X = \frac{8ax - 3x^3}{12a - 4y}. 
\]

If the segment be a hemisphere, in which case \( x = a \), then \( X = \frac{1}{2} a. \)

Sect. III. Of Fluxional Equations.

172. It has been shown (§ 49.), how, from an equation being given, expressing the relation between \( x \) a variable quantity, and \( y \) a function of that quantity, we may deduce the equation that expresses the relation of their fluxions. We are now to show how from the latter, or fluxional equation, we may return to the equation of the fluents, which, relatively to the other, may be called its primitive equation.

173. As any primitive equation and the fluxional equation derived from it both hold true at the same time, and as the constant quantities which enter into the former retain the same values in the latter, it follows that by means of the two equations we may exterminate any one of the constant quantities, and thus from any proposed primitive equation deduce a fluxional equation, in which one of the constant quantities contained in that primitive shall not at all be found.

For example, let the primitive equation be \( y + ax + b = 0 \), by taking the fluxions we have \( y + ax + b = 0 \), a fluxional equation in which \( b \) is not found; if, however, it be required to find an equation in which \( a \) shall be wanting, we have only to eliminate \( a \) by applying the common rules of Algebra (Algebra, Sect. vii.) to the two equations

\[
y + ax + b = 0, \quad y + ax + b = 0; 
\]

and hence we have \( y + ax + b = 0 \), thus it appears that from the primitive equation \( y + ax + b = 0 \) we may deduce a fluxional equation which may be expressed under either of these forms,

\[
y + ax + b = 0, \quad y + ax + b = 0; 
\]

these hold true at the same time as the primitive equation, they are alike related to, and any two of the three being given the other necessarily follows from them.

As a second example, suppose the primitive equation to be \( x^2 - 2ay - b = 0 \), by passing to the fluxions we immediately find \( x^2 - 2ay = 0 \), an equation in which \( b \) is not found. If, however, it be required that the fluxional equation shall want \( a \), we have only to apply the common rules of elimination to the two equations;

thus from the second we get \( a = -\frac{y}{x} \), and this being substituted in the first it becomes

\[
x^2. 
\]
from which we have

\[ (x^a - b) y^a = 2 a x y \frac{d}{dy} x - x^a = 0, \]

and taking the square root, having previously reduced the equation to a proper form,

\[ \sqrt{x^a + y^a - b} = y - \sqrt{x^a + y^a} = 0. \]

174. It is evident that by proceeding in this manner we shall, in some cases, arrive at a fluxional equation involving the second and higher powers of \( \frac{d}{dx} \), and when this happens we can only find the value of \( \frac{d}{dx} \) by the resolution of an equation; but this may be avoided by preparing the primitive equation in such a manner, that the constant quantity to be eliminated may be entirely separated from the variable quantities, so as to form one of the terms of the equation, then, upon taking the fluxions, this term being constant will vanish, and thus we shall obtain an equation entirely free from the constant quantity contained in that term. Thus the primitive equation \( y + ax + bx = 0 \) has already such a form that by taking the fluxions we get \( y + ax = 0 \), an equation in which \( b \) is not found. If it be required, that upon taking the fluxions, \( a \) shall vanish; we must put the equation under this form \( y + \frac{d}{dx} + ax = 0 \), and then taking the fluxions, we find immediately

\[ \frac{d}{dx} y + (y + b) \frac{d}{dx} + ax = 0, \]

an expression in which \( a \) is not found, and which by rejecting the divisor \( ax^a \) becomes \( y + ax + bx = 0 \), and these two forms of the fluxional equation are the very same as have been found in the last \( \S \). In the second example, viz. \( x^2 - 2 ax + a^2 = 0 \), the equation has already the form suited to the elimination of \( b \), for the fluxional equation is \( y + ax = 0 \), but in order that \( a \) may vanish, we must resolve the equation with respect to \( a \), so as to give it this form,

\[ y = \sqrt{(x^2 + y^2 - b)} + ax = 0; \]

passing now to the fluxional equation, \( a \) disappears, and we have

\[ \sqrt{(x^2 + y^2 - b)} + y \frac{d}{dx} = 0. \]

It is evident that we have only to reject the denominator to give the equation this form,

\[ y \sqrt{(x^2 + y^2 - b)} + y = x = 0, \]

the same as was found in the conclusion of last \( \S \).

175. From what has been now shewn we may infer, that as from any proposed primitive equation we can deduce a fluxional equation that shall contain one constant quantity less than the primitive contains, so on the contrary any fluxional equation being given, its primitive equation may contain one constant quantity more than the fluxional equation, but it can contain only one, for no more than one constant quantity can be made to disappear by returning from the primitive to its fluxional equation.

176. The fluxional equation expressing the value of \( \frac{d}{dx} \), which is derived from any primitive equation involving \( x \) and \( y \) a function of \( x \), may be called a fluxional equation of the first order; and as from this equation considered as a primitive, we may in like manner derive an equation that shall involve \( \frac{d}{dx} (\frac{50}{\xi}) \), this last may be called a fluxional equation of the second order, and the fluxional equation from which it is derived may be called its primitive equation of the first order, to distinguish it from the absolute primitive equation, from which all the others are conceived to be derived. A similar mode of definition is to be applied to the higher orders.

177. As any primitive equation and the fluxional equations of the first and second orders derived from it must all hold true at the same time, it is evident, that by means of the three equations, we may exterminate any two of the constant quantities contained in them, that we please, and thus produce a fluxional equation of the second order that contains two constant quantities less than the primitive equation. There are however two other ways by which we may arrive at the very same fluxional equation of the second order. For as from the given primitive equation we may deduce two different fluxional equations of the first order, one of which shall contain one only of the two quantities to be eliminated, and the other shall contain the other quantity only; we may consider each of these equations in its turn as a primitive, and, by proceeding in the manner explained in \( \S \) 173 and \( \S \) 174, derive from it a fluxional equation, in which that particular constant quantity which remained in its primitive, but which was to be finally eliminated, shall not be found; thus, from each of these primitives we shall deduce the very same fluxional equation of the second order, that shall be freed from two of the constant quantities contained in the absolute primitive equation.

Let us take for example the equation

\[ x^2 - 2 a y + b = 0; \]

by proceeding as explained in \( \S \) 173, or \( \S \) 174, we find these two fluxional equations of the first order,

\[ x - a y = 0, \quad (x^2 + b) \frac{d}{dy} = 2 a y + b = 0, \]

in the one of these the constant quantity \( a \) is wanting, and in the other \( b \) is wanting. Taking the first equation \( x = a y = 0 \), and proceeding as in \( \S \) 50 (observing that \( x \) is constant) we find \( y = a = 0 \); from this equation we now eliminate \( a \) by putting instead of it \( \frac{\frac{y}{y}}{y} \) (deduced from the equation \( x = a y = 0 \)) we find after proper reduction
a fluxional equation of the second order, in which both $a$ and $b$ are wanting, and having $a^2 - 2ay + b^2$ for its absolute primitive equation.

Let us now take the other fluxional equation of the first order which involves both $b$, viz. $(a^2 + b^2) y - 2axy = 0$; by proceeding with this as with the former we find $(a^2 + b^2) y - 2y \cdot ay = 0$; from the first of these equations we find $a^2 + b^2 = \frac{2ay}{y}$, and from the second $a^2 + b^2 = \frac{2ay^2}{y}$, therefore $\frac{2ay}{y} = \frac{2ay^2}{y}$, and hence we have

$$y \cdot x - ay = 0,$$

the same equation as before; and as we have arrived at the very same conclusion by considering each of these equations

$$a^2 - ay = 0, \quad (a^2 + b^2) y - 2axy = 0$$

as a primitive, it follows that both these are to be considered as primitive equations of the first order of the fluxional equation $y \rightarrow x \cdot y = 0$.

178. In general, every fluxional equation of the second order has two primitive equations of the first order, and all three may be considered as originating from one and the same absolute primitive equation; and as a fluxional equation of the second order may contain two constant quantities less than its absolute primitive equation, and one less than either of its primitive equations of the first order; so, on the contrary, a primitive equation of the first order may contain one constant quantity more than the fluxional equation of the second order derived from it, and the absolute primitive may contain two constant quantities which are not found in the fluxional equation of the second order derived from it; and similar conclusions may be drawn relating to fluxional equations of the third or any higher order.

Of Fluxional Equations of the first order.

179. When it is required to find the primitive equation corresponding to a proposed fluxional equation of the first order, we may endeavour to separate the variable quantities, that is, to bring the equation to such a form, that it may be composed of two parts, one of which consists of $x$ multiplied or divided by a function of $x$ only, and the other of $y$ multiplied or divided by a function of $y$ only. When this separation of the variable quantities can be effected, we have only to take the fluxents according to the methods explained in Sect. I. and put their sum $= 0$, and we immediately have the primitive equation required.

Ex. Suppose the fluxional equation to be

$$axy + nxy = 0;$$

divide the terms of the equation by $xy$, and it becomes

$$\frac{m}{x} + \frac{n}{y} = 0.$$

Now the fluent of $\frac{m}{x}$ is $m \cdot x + c'$ ($\S$ 103.), and in like manner the fluent of $\frac{n}{y}$ is $n \cdot y + c''$, therefore

$$m \cdot x + n \cdot y + c' + c'' = 0,$$

or, transposing $c' + c''$, and putting a single constant quantity for their sum, which, to be homogeneous with the logarithmic quantities, may be $- \log. c$, or $- 1. c$

$$m \cdot x + n \cdot y = 1. c,$$

or $1. (x^n)$, or $1. c$, and hence $a^2 \cdot y^2 = c,$

which last is the primitive equation required.

180. When a primitive equation is homogeneous, that is, when the sum of the exponents of the variable quantities $x$ and $y$ is the same in each term, as in this example,

$$ax + bxy + dxy + ey = 0,$$

or $(ax + by) x + (dx + ey) y = 0,$

in which the variable part of each term is of the first degree, as also in this equation

$$\begin{cases} (ax + by + cy + dy) x + \left(\frac{ax}{x} + \frac{by}{y} + \frac{cy}{y} + \frac{dy}{y}\right) y = 0, \\
+ \left(\frac{ax}{x} + \frac{by}{y} + \frac{cy}{y} + \frac{dy}{y}\right) y = 0,
\end{cases}$$

in which the variable part of each term is of the second degree, such an equation may be always transformed into another which will admit of the variable quantities being separated. To take a particular example, let us suppose the equation to be $x + y = nx + or (x - ny) x + y = 0$. We assume $y = nx$ (and the same assumption is to be made for any other homogeneous equation), then $y = nx + x$, thus the equation becomes transformed to

$$(n - nx) x + x = (x - nx + nx) = 0,$$

but as the terms of this equation have a common factor $x$, by leaving out that factor, it becomes

$$(1 - n) x + x = (x - nx + nx) = 0,$$

which also admits of being expressed thus

$$(1 - n) x + x = x = 0,$$

and, by division,

$$\frac{x}{n} + \frac{x}{1 - n} = 0,$$

and taking the fluxents

$$\int \frac{x}{n} + \int \frac{x}{1 - n} = C,$$

where $C$ denotes a constant quantity, or, since $\int \frac{x}{n}$

$$= l. x,$$

$$l. x + \int \frac{x}{1 - n} + l. x = C,$$
now the particular form of \( \int \frac{a}{1 - na + s^2} \) depends upon
the value of the number \( n \); for if \( n = \frac{m}{2} \), it will be a
logarithmic function, and if \( \frac{m}{2} < n \), it will be expressible
by means of a circle, but if \( \frac{m}{2} = n \), then it is an algebroic function, and in each case it may be found by
the methods delivered in Sect. I. for finding the Fluent of a rational fraction. It may however be simplified in
its form, by observing, that since
\[
\frac{\frac{m}{2}}{1 - na + s^2} = \frac{\frac{m}{2}a - n}{1 - na + s^2} + \frac{\frac{m}{2} - n}{1 - na + s^2},
\]
therefore (§ 103.) \( \int \frac{\frac{m}{2}}{1 - na + s^2} \) =
\[
\frac{1}{2} \ln (1 - na + s^2) = \frac{1}{2} \int \frac{n s}{1 - na + s^2}.
\]
If we limit our enquiry to the case of \( n = 2 \), we have
\[
\int \frac{n s}{1 - 2na + s^2} = \int \frac{2}{(1 - s)^3} = \frac{2}{1 - s^2},
\]
let the terms be now collected into one expression, then observing that \( \ln (1 - n + s^2) = \ln (1 - n^2) = \ln (1 - s) \), we have
\[
l(s + 1) (1 - n) = \frac{1}{1 - s} = C;
\]
and, substituting \( \frac{y}{n} \) instead of \( n \),
\[
l(s + 1) \left( \frac{x + y}{x} \right) + \frac{y}{x} = C;
\]
or, substituting \( l \cdot c \) instead of \( C \), and collecting the logarithmic functions into one,
\[
\ln \frac{x + y}{c} = \frac{y}{x - y};
\]
therefore, passing from logarithms to numbers, by observing that, as when \( n = 1, \mu \), we have by the nature of
logarithms \( c = \mu \), where \( c \) denotes the number of which
the Napierian logarithm is \( x \), so in the present case we
have \( \frac{s - y}{c} = c \), and hence the primitive equation
is found to be
\[
x - y = x - y = 0.
\]
As a second example let the fluxional equation be
\[
y - x = x \sqrt{(x^2 + y^2)}
\]
which is also homogeneous. Assume as before \( y = nx \),
then \( x = mx + nx \), and substituting these values of \( y \)
and \( x \) in the proposed equation, it becomes
\[
x \sqrt{(1 + x^2) - x^2} = 0,
\]
and the terms of the equation, observing that each
being a logarithmic function, their sum may be got equal
to a constant logarithm,
\[
l(x - c + 1) \left( \frac{y + \sqrt{x^2 + y^2}}{x} \right) = 0.
\]
If we now consider that
\[
(y + \sqrt{x^2 + y^2}) (y - \sqrt{x^2 + y^2}) = -x^2,
\]
and therefore that
\[
\frac{y + \sqrt{x^2 + y^2}}{x} = \frac{-x}{y - \sqrt{x^2 + y^2}},
\]
it will appear, that the above equation may be otherwise expressed thus:
\[
l(x - c + 1) \left( \frac{y}{y - \sqrt{x^2 + y^2}} \right) = 0.
\]
from which, by passing from logarithms to their numbers, we find \( y - \sqrt{x^2 + y^2} = -x \), and hence, by so
ordering the equation that the radical may disappear, we get \( x^2 = x^2 + 2 c y \), which is the primitive equation
required.

181. An equation which is not homogeneous, may in
some cases, by proper transformations, be rendered homo-


Part II.

Infinite. In this case we have \( y = \frac{P}{m} \), and therefore
\[
p + y = \frac{P}{m} (m + s y),
\]
therefore the original equation may be expressed thus,
\[
\frac{a x + b y}{(m x + s y) (a + P)} = 0.
\]
Assume now \( m x + s y \), then \( y = \frac{s}{m} \); the values of \( m x + s y \) and \( y \) being now substituted in the equation, and the whole reduced to a proper form, it becomes
\[
\frac{(b m + p x)}{a m n - b m^2 + (m n + p m)} = 0.
\]
The fluent of the second term of this expression will involve logarithms, except that \( m n \rightarrow p m \rightarrow c \), in which case the primitive equation is
\[
\frac{a x}{a m n - b m^2 + (m n + p m)} = C.
\]

182. When a fluxional equation has this form
\[
y + P y = Q x,
\]
where \( P \) and \( Q \) denote any functions of \( x \), the variable quantities may be separated in the following manner. Assume \( y = x \), then, taking the fluxiones, we have \( y = x \), and by substitution, the proposed equation becomes
\[
x x + P x = Q x,
\]
now as in this equation \( x \) and \( x \) may be supposed to denote indeterminate functions of \( x \), we may divide it into two others, such, that the variable quantities in each may be separable; to effect this we assume
\[
x x + P x = Q x,
\]
hence, dividing the first equation by \( x \), we have
\[
x + P = Q x,
\]
and, taking the fluciones, we have
\[
x = x - P = c,
\]
and hence, by passing from logarithms to their numbers,
\[
x = e^{-P},
\]
here no constant quantity is introduced, it being sufficient to add it at the end of the operation; let this value of \( x \) be substituted in the second equation, then by deducing from it the value of \( x \), we have
\[
x = \int P x = Q x + c;
\]
and since \( y = x \), therefore
\[
y = e^{-P} \left\{ \int P x = Q x + c \right\}.
\]
Let us take a particular case, and suppose the equation to be \( y + P x = x \), then we have \( P = x \), \( Q = x \), and \( x = x \), hence in this case the general formula becomes
\[
y = e^{-P} \left\{ \int e^{x} x + c \right\}.
\]
The fluent \( \int e^{x} x \) may be found by \( \S \) 143; let us suppose for example that \( n = 2 \), then we have
\[
\int e^{x} x = e^{x} (x + 1),
\]
so that the fluxional equation being
\[
y + P = x \frac{d}{dx} x = x \frac{d}{dx} x,
\]
the primitive equation is
\[
y = x - 2 x + 2 e^{x}.
\]
The general equation \( y + P y = Q x \), which involves the simple power only of the variable quantity \( y \), and its fluxion, has been called a linear equation of the first order; it has also, with more propriety, been called a fluxional equation of the first degree, and of the first order.

183. The equation
\[
y + P y = Q y + \frac{d}{dx} x,
\]
where \( P \) and \( Q \) as before denote any functions of \( x \), is easily reduced to the form we have been considering; for assume \( y = (1 - x) y \), then \( y = \frac{d}{dx} x \), \( y = x y \), and \( y = (1 - x) x y \); if we now substitute the values of \( y \) and \( y \) in the equation, it becomes
\[
y + P y = Q y + \frac{d}{dx} x = Q y + \frac{d}{dx} x;
\]
let the terms of this equation be divided by \( y \); then, including the factor \( (1 - x) \) in the indeterminate function \( P \), the result is
\[
x + P x = Q x,
\]
an equation of the very same form as that which has been considered in last \( \S \).

184. The most general form that can be given to a fluxional equation of the first order, and consisting of three terms only, is
\[
y + P x = Q x + \frac{d}{dx} x = x y + \frac{d}{dx} x;
\]
to give this equation a more simple form, let all its terms be divided by \( y \), \( \frac{d}{dx} x \), it then becomes
\[
x + P x = Q x + \frac{d}{dx} x = x - \frac{d}{dx} x.
\]
Suppose now
\[
x + P x = Q x + \frac{d}{dx} x = x - \frac{d}{dx} x,
\]
then
\[
x + P x = y, \frac{d}{dx} x + \frac{d}{dx} x = x,
\]
and
FLUXIONS.

Part II.

Inverse Method.

and

\[ y^f \frac{k-f+1}{(g-i+1)^{y^f}} = \frac{c-g}{(g-i+1)^{y^f}}; \]

Let us in order to abridge put

\[ \frac{k-f+1}{(g-i+1)^{y^f}} = b, \quad \frac{k-f+1}{(g-i+1)^{y^f}} = a, \]

then the equation becomes

\[ y^f + b = a \cdot x^m; \]

If we suppose \( m = 1 \), the resulting equation \( y^f + b = a \cdot x \)

may have its variable quantities separated by the method explained in § 183; but if we go only one step farther, and suppose \( m = 2 \), so that the equation is

\[ y^f + b \cdot y^s = a \cdot x^m, \]

the difficulty of separating the variable quantities generally is so great as to have hitherto baffled the utmost efforts of the most expert analysts. This equation is commonly called Riccati's equation, on account of its having been first treated of by an Italian mathematician of that name, who succeeded in separating the variable quantities in some particular cases, namely, when \( m \) is equal to \( \frac{-4p}{2p \pm 1} \), where \( p \) denotes any whole positive number.

185. If the separating of the variable quantities generally be a problem of insurmountable difficulty when the equation consists of only three terms, its solution can much less be expected, when the equation consists of four, or any greater number. There are, however, particular cases in which some of the most skilful analysts have, by employing happy and peculiar artifices, succeeded in resolving the problem, but the methods of proceeding are, generally speaking, not reducible to any determinate rules.

186. When the expression which constitutes a fluxional equation is such as would be produced by taking the fluxion of some function of \( x \) and \( y \), in which case it may be said to be a complete fluxion, then, without attempting to separate the variable quantities, we have only to add a constant quantity to that function, and the result put \( = c \), will evidently be the primitive equation required.

If, for example, the equation be \( x \cdot y^f + y \cdot x^f = 0 \), it is obvious that the expression \( x \cdot y^f + y \cdot x^f \) is immediately produced by taking the fluxion of the function \( x \cdot y \), \( y \) being also considered as a function of \( x \), therefore the primitive equation is \( x \cdot y^f + x \cdot x = 0 \).

From the view which has been given in § 174 of the origin of fluxional equations it appears, that in passing from a primitive equation to its fluxional equation, the terms of the latter in many cases will not constitute a complete fluxion, by reason of some multipliers, or divisors, which was common to them all, having disappeared. In such cases, however, if we can by any means discover that factor, by restoring it we shall immediately have a complete fluxion, the fluent of which, with the addition of a constant quantity, when put \( = c \), will be the primitive equation.

For example, if the equation be \( x \cdot y + y \cdot x = 0 \), here \( x \cdot y + y \cdot x \) cannot be immediately produced by taking the fluxion of a function of \( x \) and \( y \); but, if we divide the equation by \( x \) so as to give it this form \( y \cdot \frac{x}{x} = 0 \), we obtain the expression \( y \cdot \frac{x}{x} = 0 \) which is a complete fluxion, viz. that of the fraction \( y \), therefore \( y + c = 0 \), or \( y = c = 0 \), is the primitive equation.

In like manner, the equation \( x \cdot y + x \cdot y = 0 \), which does not in its present form express a complete fluxion, yet becomes so when multiplied by \( x^m \cdot y^m \), for then it is

\[ m \cdot x^m \cdot y^m \cdot y + n \cdot x^m \cdot y^m \cdot x^m = 0, \]

from which it appears that the primitive equation in this case must be \( x \cdot y + x = 0 \).

187. That we may be able to discover whether the terms of any proposed fluxional equation constitute a complete fluxion, and also from what expression such a fluxion has been derived, we must attend to the process, by which we find the fluxion of an expression composed of two variable quantities, one of which is a function of the other.

To avoid very general reasoning, we shall take for granted what is evidently possible, that any function of \( x \) and \( y \) may be generally expressed by a formula of this nature,

\[ A \cdot x^m \cdot y^n + B \cdot x^p \cdot y^q + C \cdot x^r \cdot y^s + \text{etc.} \]

where \( A, B, C, \text{etc.} \) denote constant quantities, and the exponents \( m, n, \text{etc.} \) given numbers, the number of terms being supposed either finite or infinite. Now the fluxion of the whole expression is the sum of the fluxions of its terms, but in taking the fluxion of each term, beginning with the first \( A \cdot x^m \cdot y^n \), the fluxion of which is

\[ m \cdot A \cdot x^{m-1} \cdot y^n + A \cdot x^m \cdot y^n \cdot y, \]

it is evident that the result is composed of two parts, one of which is the expression we would find for its fluxion, if \( x \) only were considered as variable, and \( y \) as constant, and the other is the expression for its fluxion, if \( y \) only were considered as variable and \( x \) as constant; hence it follows, that the sum of the fluxions of all the terms will have the same property; so that, if \( x \) be put for the whole expression, we shall in every case have

\[ \frac{d}{dx} \left( M \cdot \frac{d}{dx} \right) \cdot N \cdot y, \]

where \( M \cdot \frac{d}{dx} \) denotes the result that will be found if the fluxion of \( x \) be taken upon the hypothesis that \( x \) alone is
is variable, and $N_y$ is the fluxion of $u$, supposing $y$ alone to be variable.

188. Resuming the consideration of the general expression

$$Ax^m y^n + Bx^p y^q + Cx^r y^s + \ldots$$

let the fluxion of any one of its terms, for example, $Ax^m y^n$, be taken, supposing $x$ alone variable, and the result is $mAx^{m-1} y^n$. Again, let the fluxion of this result be taken, supposing $y$ alone variable, and we find it to be $nAx^{m} y^{n-1}$. Now, if we first take the fluxion of $Ax^m y^n$, supposing $y$ variable, we get $nAx^{m} y^{n-1}$. Then, the fluxion of this result, considering $x$ alone as variable, we get $mAx^{m-1} y^n$, which is the very same expression as was found by proceeding in a contrary order; and as the same must hold true of all the terms, we may conclude, that if the fluxion of $w$ is any function of $x$ and $y$ be taken, considering $x$ only as variable, and then the fluxion of that result, considering $y$ only as variable, the very same final result will be obtained as if we were first to take the fluxion of $w$ supposing $y$ only variable, and then the fluxion of that result, supposing $x$ variable; but the fluxion of $w$ being expressed thus, $Mx + N_y$, it has been shown that $Mx$ is the fluxion of $w$, if $u$ only is supposed variable and $N_y$ is its fluxion, if $y$ only is variable, therefore, if we take the fluxion of $Mx$ upon the supposition that $y$ only is variable, also the fluxion of $N_y$ upon the supposition that $x$ only is variable, the results must be identical. This property affords the following rule, by which we may always determine whether any proposed expression constitutes an exact fluxion or not. Let the expression be put under this form, $Mx + N_y$; let $M'x + N'_y$ be the fluxion of $M$, supposing $y$ alone variable, and $N'_x$ the fluxion of $N$, supposing $x$ alone variable, then, if $M'$ and $N'$ are identical, $Mx + N_y$ is a complete fluxion; and if they are not, $Mx + N_y$ is not a complete fluxion.

189. It is easy to see, bow, from a complete fluxion $w = Mx + N_y$ we may determine $w$ its fluent; for as $Mx$ has been deduced from $w$ by considering $x$ as variable, and $y$ as constant, on which account all the terms of $w$ that involved $y$ only must have vanished, it follows on the contrary, that if we put $y$ to denote those terms, we shall have

$$w = \int Mx + N_y,$$

the fluent of $Mx$ being taken, regarding $y$ only as variable. The function $X$ may be determined, by comparing the fluxion of the expression thus obtained with the given fluxion $Mx + N_y$.

Ex. 1. Let the fluxion be $\frac{2x + y}{2\sqrt{(ay + x^2)}},$ this expression when reduced to the form $w = Mx + N_y$ is

$$w = \frac{(a + y)\sqrt{(ay + x^2)}}{2\sqrt{(ay + x^2)}},$$

hence $M = \frac{2x + y}{2\sqrt{(ay + x^2)}},$ and in like manner the fluxion of $N$, supposing $x$ only variable, gives us

$$N = \frac{a + y}{2\sqrt{(ay + x^2)}},$$

and in like manner the fluxion of $M$, supposing $y$ only variable, gives us

$$M' = \frac{(ay + x^2)\sqrt{(ay + x^2)}}{4(ay + x^2)}.$$
190. It may be demonstrated, that as often as a fluxional equation does not constitute a complete fluxion, there is always an infinite number of factors, such that if the equation were multiplied by any one of them, the result would be a complete fluxion. A general method of determining some one of these factors, however, seems to be a problem of such difficulty, that its solution, except in some particular cases, is not to be expected.

191. When a fluxional equation involves the second or higher powers of $x$ and $y$, as in this example,

$$\frac{dy}{dx} = a^2 + x,$$

which may be put under this form,

$$\frac{dy}{dx} = a^2 + x,$$

we may, by the theory of algebraic equations, deduce from it the values of $\frac{dy}{dx}$, considering this quantity as a root of the equation; thus, in the present example, by resolving the quadratic equation $\frac{dy}{dx} = a^2 + x$, we have

$$\frac{dy}{dx} = \pm a,$$

so that $y - ax = 0$, and $y + ax = 0$, hence $x = \frac{y}{a}$.

are two primitive equations, from either of which the fluxional equation $\frac{dy}{dx} = a^2 + x = 0$ may be derived, and it may also be deduced from their product

$$(y - ax + c)(y + ax + c) = 0.$$  

192. As often as the equation contains only one of the two variable quantities, for example $x$, by the resolution of the equation we may obtain $\frac{dy}{dx} = \chi(x)$ (where $\chi(x)$ denotes some function of $x$), and hence $y = \int \chi(x) dx$, but if it be more easy to resolve the equation with respect to $x$ than to $\frac{dy}{dx}$, which we shall denote by $p$, then, instead of seeking the values of $p$ from the equation, we may find that of $x$, thus we shall have $x = \Phi(p)$, some function of $p$, and hence $x = \Phi(p)$, and since $y = p \int p$, therefore, $y = p \int p - \int p \int p$. The relation between $x$ and $y$ is now to be found by eliminating $p$ by means of the two equations

$$x = \Phi(p), \quad y = p \int p - \int p \int p.$$  

As a particular example, let us suppose the equation to be $nx + a y = b \sqrt{(x^2 + y^2)}$, from which, by putting

$$x = b \sqrt{(1 + p^2)} - a p = P,$$

$$y = b p \sqrt{(1 + p^2)} - a p - b \int_p \sqrt{(1 + p^2)}$$

the fluent of $p \sqrt{(1 + p^2)}$ may be found by the formulas given in § 130, and § 131.

193. When we cannot by any means find an expression for the relation between $x$ and $y$ in finite terms, then we must, as a last resource, have recourse to approximation, that is, we must express the values of $y$ in terms of $x$ by means of a series.

When the form of the series is known, we may determine the coefficients of its terms, by substituting the series and its fluxion instead of $y$ and $y$ in the proposed equation.

Suppose, for example, that the equation is

$$y + x = m x^2 + c,$$

we may assume

$$y = A x^a + B x^{a+1} + C x^{a+2} + \&c.$$  

then $\dot{y} = B x^{a+1} + (a+1) B x^a \dot{x} + (a+2) C x^{a+2} + \&c.$

Substituting now the values of $y$ and $\dot{y}$ in the equation, and dividing the whole by $x$, it becomes

$$A x^a + (a+1) B x^{a+1} + (a+2) C x^{a+2} + \&c.$$  

This equation becomes identical, if we assume $a = n$, or $a = n + 1$, and

$$A = \frac{m}{a}, \quad B = \frac{-m}{a(a+1)}, \quad C = \frac{m}{a(a+1)(a+2)},$$

$$D = \frac{-m}{a(a+1)(a+2)(a+3)}, \&c.$$  

Hence we have

$$y = m \left\{ \frac{x^{n+1}}{n+1} - \frac{x^{n+2}}{(n+1)(n+2)} \right\} + \frac{x^{n+3}}{(n+1)(n+2)(n+3)} - \&c.$$  

In order that a primitive equation may be general, it ought to contain an indeterminate constant quantity more than is found in the fluxional equation, therefore, this series which contains no such quantity, must be considered as incomplete, or as exhibiting the value of $y$, upon the supposition, that, when $x = 0$, then $y = 0$. However, we may obtain a value of $y$ that shall be general,
FLUXIONS.

\[ y = \int P' \, dx + c + c' \]

where \( c' \) denotes a second indeterminate constant quantity.

\[ \int P \, dx = \int P' \, dx + c + c' \]

we have also

\[ y = \int P \, dx = \int \int P \, dx + c + c' \]

Suppose, for example, that the equation is \( \frac{d^2 y}{dx^2} = \mu \), hence \( \mu = \mu \), and therefore

\[ y = \int \int P \, dx + c + c' \]

\[ = \int \int P \, dx + c + c' \]

In the very same manner we may deduce from the equation of the third order

\[ \frac{d^2 y}{dx^2} = \mu \]

its primitive equation; thus we have

\[ \frac{d^2 y}{dx^2} = \int \int P \, dx + c + c' \]

where \( P \) denotes such a function of \( x \), that its fluxion is \( X \), and \( c \) represents a constant quantity. Again

\[ \int \int P \, dx + c + c' = Q + c + c' \]

and as \( P \) and \( Q \) are functions of \( x \), the fluents of \( \frac{d}{dx} \) \( Q \) and \( \frac{d}{dx} \) \( Q \) may be found by the methods formerly explained.

195. Let us next consider such equations as involve only \( \frac{d}{dx} \), \( \frac{d^2}{dx^2} \) and constant quantities. In order to abridge let us put \( \int \frac{dy}{dx} = P \), then such an equation may be generally expressed thus

\[ \frac{dy}{dx} = P \]

known
known function of $p$; now as $\frac{y}{a} = p$, by taking the
fluxions, and observing that $a$ is constant, we have
$\frac{y}{a} = \frac{y}{a}$, hence $\frac{y}{a} = P$, and $x = \frac{y}{a}$, and $x = \int \frac{p}{P}$; let
the value of $a$ be substituted instead of it in the equa-
tion $y = p \cdot x$, and it becomes $y = \frac{p}{P} \cdot x$, hence
$y = \int \frac{p}{P} \cdot x$; thus it appears that if we can find the
integrand $\int \frac{p}{P}$ and $\int \frac{p}{P}$, we shall have the primitive
equation when we eliminate $p$ by means of these two
equations

$$a = c + \int \frac{p}{P}, \quad y = c + \int \frac{p}{P},$$

where $c$ and $c'$ denote the two indeterminate constant
quantities that ought to enter into the primitive equa-
tion.

Suppose for example that the equation is

$$\left(\frac{x+y}{a} \right)^{\frac{1}{2}} = \frac{y}{a} \cdot \frac{y}{a},$$

which, by putting $p$ for $\frac{y}{a}$ and $\frac{p}{a}$ for $\frac{y}{a}$, becomes
transformed to

$$\left(\frac{x+y}{a} \right)^{\frac{1}{2}} = \frac{y}{a} \cdot \frac{y}{a};$$

hence we have

$$x = \frac{y}{(x+y)^{\frac{1}{2}}} \cdot \frac{y}{a}, \quad y = \frac{p}{\left(1 + \frac{y}{a}\right)^{\frac{1}{2}}},$$

$$\frac{x}{a} = \frac{y}{\sqrt{1 + \frac{y}{a}}} \cdot \frac{y}{a}, \quad \frac{y}{a} = \frac{y}{\sqrt{1 + \frac{y}{a}}} \cdot \frac{y}{a};$$

when by means of these equations we eliminate $p$, we get

$$(x-c)^{\frac{1}{2}} + (y-c')^{\frac{1}{2}} = a^{\frac{1}{2}}.$$

The fluxional equation is evidently formed by putting
the general expression for the radius of curvature
(given in § 97.) equal to a constant quantity, and the
primitive equation is accordingly an equation to a circle
having that constant quantity for its radius, as it ought
to be.

196. Suppose now that the equation has this form

$$\frac{y}{a} = Y,$$

where $Y$ denotes a function of $y$, then putting as before
$\frac{y}{a} = p$, we have $\frac{y}{a} = \frac{y}{a} = \frac{p}{y}$, hence the equation
$\frac{y}{a} = Y$ becomes $\frac{p}{y} = Y$, and $\frac{p}{y} = Y \cdot \frac{y}{a}$, and $p = \frac{y}{a}$

197. When the equation contains $\frac{y}{a} \cdot \frac{y}{a}$
may be transformed to a fluxional equation of
order, by substituting in it $p \cdot x$ and $p \cdot x$, and
and $y'$; if we can find the primitive of that
and the value of $p$ in terms
shall have the value of $y$ from the formula $x$.
if we have the value of $x$ in terms of $p$, then,
$\int p = p - \int x \cdot p$, we shall have

$$y = p - \int X \cdot p.$$
FLUXIONS.

\[ \frac{\ddot{y}}{\ddot{x}} = \frac{P}{\dot{x}} = \frac{\dot{y}}{\ddot{x}} = \frac{P}{\dot{P}} \]

and the result will be an equation of the first order containing only \( p, \dot{p}, \) and \( y \); when its primitive equation be found, and hence the value of \( p \), in terms of \( y \), we may find \( x \) by the formula \( x = \int \frac{\ddot{y}}{P} \), and by the formula \( y = \frac{P}{\ddot{P}} \), when \( y \) is expressed by means of \( P \).

199. As an example of the manner in which fluxional equations of the second order are to be resolved by approximation, we shall take the particular equation

\[ \dddot{y} + ax^2 \ddot{y} x^2 = 0. \]

If the value of \( y \) which satisfies the equation be supposed to have this form

\[ A x^m + B x^{m+2} + C x^{m+4} + \&c. \]

It will not be possible to give to \( m \) such a value that the two exponents \( m-2 \) and \( m+4 \) shall become equal except in the particular case of \( m = -2 \); but if we suppose \( x \) very small, the equation may be satisfied in two ways, namely, by taking \( m = 0 \), and \( m = 1 \), because upon this supposition the term \( m (m-1) A x^{m-2} \), which is the greatest, vanishes, and therefore \( A \) is left indeterminate; thus we have two series, one beginning with \( A x \) and the other with \( A x^2 \). Assuming therefore successively

\[ y = A x^2 + B x^2 + C x^4 + \&c. \]

\[ y = A x + B x^{m+2} + C x^{m+4} + \&c. \]

Substituting these values as well as their corresponding values of \( \dot{y} \) in the proposed equation, we shall find arranging the terms, that \( \ddot{y} \) ought to be \( = 2 \); after all by determining the coefficients \( A, B, C, \&c. \) in the usual manner (ALGEBRA, § 265.), we obtain two cases, one of these is

\[ \frac{a A x^{m+2}}{(n+1)(n+2)} + \frac{a^2 A x^{m+4}}{(n+2)(n+3)(2n+4)} + \&c. \]

\[ \frac{1}{(n+2)(2n+4)(3n+6)(3n+8)} + \&c. \]

And the other

\[ \frac{a^2 A x^{m+4}}{(n+2)(n+3)(2n+4)(3n+6)(3n+8)} + \&c. \]

As a primitive equation in its general form ought to contain two constant quantities which do not appear in the fluxional equation of the second order derived from it (§ 777.), the value of \( y \) to be complete ought to contain two arbitrary constant quantities, but as each of these series contains only one such quantity, namely \( A \), it must be considered as expressing only a particular value of \( y \). The fluxional equation \( y + ax^2 \ddot{y} x^2 = 0 \) is however of such a nature that from two particular values of \( y \) we may deduce its general value; for let us denote these values by \( \dot{y} \) and \( Z \), then, as each of them must satisfy the fluxional equation, we have

\[ \dddot{y} + ax^2 \ddot{y} x^2 = 0, \quad \dot{y} + ax^2 = 0, \quad Z + ax^2 = 0; \]

let \( c \) and \( C \) denote two arbitrary constant quantities, then we have also

\[ c x^2 + ax^2 = 0, \quad C Z + ax^2 = 0; \]

and as each of these equations is identical, their sum must also be identical, that is

\[ c x^2 + C Z + ax^2 (c + C Z) x^2 = 0; \]

but the very same result will be obtained if we substitute \( c x + C Z \) instead of \( y \) in the proposed fluxional equation, therefore \( c x + C Z \) is also a value of \( y \), and as it involves two arbitrary constant quantities, \( c \) and \( C \), it possesses all the generality of which the value of \( y \) is susceptible. Hence it follows that if \( c \) be put instead of \( A \) in one of the two series which we have found for the value of \( y \), and \( C \) instead of \( A \) in the other series, the sum of the two results will be a general expression for the value of \( y \).

200. Having now explained the theory of fluxional equations at as great length as we conceive to be compatible with the nature of this work, we shall conclude this treatise by resolving a few problems which produce fluxional equations.

Prob. 1. Having given any hyperbolic, or, as it may more properly be called, Napierian logarithm, it is required to find a general expression for its corresponding natural number.

Let the number be denoted by \( 1 + n \), and its logarithm by \( y \), then \( y = \log (1 + n) \) (§ 57.), or

\[ y + n = 2, \quad 1 + n = 0, \quad y + n = 0, \quad n = 0. \]

and the problem requires that from this equation we deduce an expression for \( n \).

As when \( y = 0 \), then \( n = 0 \), we may assume

\[ n = A y + B y^2 + C y^3 + \&c. \]

\[ n = A y + 2 B y^2 + 3 C y^3 + \&c. \]

and our equation becomes

\[ s F \]

\[ y + A y^2 \]
FLUXIONS.

Inverse Method.

\[ y + A g + B y + C y^2 + D y^3 + &c. \]

Hence, by comparing the coefficients of the like terms, it appears that \( A = 1, \) \( 2B = A, \) \( 3C = B, \) \( 4D = C, \) &c. so that

\[ a = 1, \quad B = \frac{1}{2}, \quad C = \frac{1}{3}, \quad D = \frac{1}{4}, \quad &c. \]

therefore \( n = y + \frac{y^2}{2} + \frac{y^3}{3} + \frac{y^4}{4} + \&c. \)

\[ 1 + n = 1 + y + \frac{y^2}{2} + \frac{y^3}{3} + \frac{y^4}{4} + \&c. \]

Fig. 39. Prob. 2. Let \( AB, \) \( AC, \) be two straight lines given by position meeting each other at right angles in \( A, \) let \( C \) be a given point in \( AC \) one of the lines, and let a straight line \( PQ \) meet them in \( P \) and \( Q, \) and cut off from them equal segments \( AP, \) \( QC \) adjacent to the given points \( A, \) \( C, \) it is required to find the nature of the curve to which \( PQ \) is a tangent.

Let \( D \) be the point in which the tangent \( PQ \) meets the curve, draw \( DE \) perpendicular to \( AC, \) and \( DF \) to \( AP, \) put \( CA = a, \) \( CE = x, \) \( ED = y, \) then \( AE \) or \( DF = a - x, \) and since \( EQ = \frac{y}{y}, \) and \( EQ : ED \cdot DF : FP, \) therefore \( FP = \frac{(a - x) y}{x}; \) hence \( PA = \frac{(PF + FA) y}{a} = \frac{y}{y} \) and \( CQ = (CE - EQ) = \frac{x - y}{a}, \) and as by hypothesis \( AP = CQ, \) therefore

\[ y + \frac{(a - x) y}{a} = -x + \frac{x}{y}, \]

This expression belongs to a class of fluxional equations which have the singular property of being more easily resolved by first taking their fluxion, considering the fluxion of one of the variable quantities as constant; thus, in the present case, making \( x \) constant, we find

\[ y + \frac{y}{y} = n = \frac{x}{y}, \]

or \( \frac{y}{x} = \frac{y}{y} \)

hence dividing by \( y, \) the equation is easily reduced to

\[ \frac{y}{y} = \frac{x}{y}, \]

and taking the fluxions

\[ \sqrt{y} = \sqrt{(a - x)}, \]

best when \( a = x, \) then \( y = \infty, \) therefore \( a = \infty, \) and

\[ \sqrt{y} = \sqrt{a - \sqrt{(a - x)}}, \] or \( x = 2a\sqrt{y} - y, \)

which equation belongs to the common parabola.

Prob. 3. Let \( APQ \) be one of any number of curves of the parabolic kind, having the same vertex \( A, \) and axis \( AE, \) and the nature of which is defined by the equation \( p x^2 = y^2, \) where \( p \) denotes the focus and \( y \) the ordinate \( PB, \) and \( p \) as indeterminate quantity which is the same for the whole of \( \infty \) parabolas, but different for different parabolas; it is required to find the nature of a curve that shall have them all in a given angle.

Let the curve whose nature is required move of the parabolas in \( P, \) let \( PT, \) \( P' T' \) tangent lines

curves meet the axis in \( T \) and \( T', \) then, knowing of the problem, the lines \( PT, \) \( P' T' \) must make a given angle; let \( a \) denote its numerical tangent.

Because \( PT \) touches the parabola, the tangent angle \( PTB \) will be equal to \( \frac{a}{a} \) (fig. 19), the expression being supposed deduced from this equation \( p x^2 = y^2, \) but taking the fluxions of \( p x \) and eliminating the indeterminate quantity \( y, \) of the two equations, we find \( \frac{y}{x} = \frac{p}{a} \) and

\[ T = \frac{m y}{n x}. \]

Again, by considering \( x \) and \( y \) as the initial ordinates of the curve whose equation is given which \( P T \) is a tangent, we have the tangent angle \( T \) equal to \( \frac{a}{a} \) (fig. 15). Now the angle existing the difference of the two angles \( PTB, \) \( P'T'B', \) follows from the formula for finding the tangent of the difference of two angles, (Algebra, § 58),

\[ \frac{y}{x} = \frac{m y}{n x}, \]

hence we have

\[ a (m x + m y) + m y - a y = 0, \]

a fluxional equation expressing the nature of the curve which being homogeneous may be treated according the method explained in § 180.

If the curves be supposed to cut each other at right angles, then, \( a \) being infinite, the part of the curve which is not multiplied by \( a \) vanishes in respect of the other, which is multiplied by \( a; \) hence we have

\[ n x^2 + m y^2 = 0, \]

and taking the fluxions

\[ n x + m y = 0, \]

where \( c \) is put for a constant quantity. This shows that the curve is an ellipse, the center of which is at \( A \) the common vertex of all the parabolas.

The problem which we have here resolved is a particular case of one more general, and which has its object To determine the nature of the curve that intersects all other curves of a given kind in a given angle. The problem thus generalized is known by the name of the Problem of Trajectories; it was first proposed by Leibnitz as a challenge to the mathematicians, and resolved by Newton, who received it. See PLANE CURVES, SUPPLEMENT.
FLY, in Zoology, a large order of insects, the distinguishing characteristic of which is that their wings are transparent. By this they are distinguished from beetles, butterflies, grasshoppers, &c. Flies are subdivided into those which have four, and those which have no wings. Of those with four wings there are several genera or kinds; as the ant, the bee, the ichneumon, &c. Of those with two wings, there are likewise several kinds, as the gad-fly, gnat, house-fly, &c. For their classification and natural history, see Entomology.

House Fly. See Musca.

Pestilential Fly. See Abyssinia.

FLY, in mechanics, a cross with leaden weights at its ends; or rather, a heavy wheel at right angles to the axis of a windlass, jack, or the like; by means of which the force of the power, whatever it is, is not only preserved, but equally distributed in all parts of the revolution of the machine. See Mechanics.

FLY for Fishing. See Fishing Fly.

Vegetable Fly, a curious natural production chiefly found in the West Indies. "Excepting that it has no wings, it resembles the drone both in size and colour more than any other British insect. In the month of May it buries itself in the earth, and begins to vegetate. By the latter end of July, the tree is arrived at its full growth, and resembles a coral branch; and is about three inches high, and bears several little pods, which dropping off become worms, and from thence flies, like his British caterpillar."

Such was the account originally given of this extraordinary production. But several boxes of these flies having been sent to Dr. HIll for examination, his report was this: "There is in Martinique a fungus of the clavaria kind, different in species from those hitherto known. It produces substances from its sides; I call it therefore clavaria sobolifera. It grows on putrid animal bodies, as our fungus ex pede equino from the dead horse's hoof. The seeds are common in Martinique; and in its nympha state, in which the old authors call it tettigomotera, it buries itself under dead leaves to wait for change; and when the season is unfavourable, many perish. The seeds of the clavaria find a proper bed on his dead insect, and grow. The tettigomotera is among the cicadea in the British museum; the clavaria is just now known. This is the fact, and all the fact; though he untutored inhabitants suppose a fly to vegetate, and though there is a Spanish drawing of the plant's growing into a trifoliate tree, and it has been figured with the creature flying with this tree upon its back." See Edwards's Cenations of Natural History.

FLY-Boat, or Flight, a large flat-bottomed Dutch vessel, whose burden is generally from 600 to 1200 tons. It is distinguished by a very high stern, resembling a Gothic turret, and by very broad buttocks below.

FLY-Catcher, in Zoology. See Musciaca.

Venus's FLY-Trap, a kind of sensitive plant. See Dionaea Muscipula, Botany Index.

FLY-Tree, in Natural History, a name given by the common people of America to a tree, whose leaves they say, at a certain time of the year produce flies. On examining these leaves about the middle of summer, the time at which the flies use to be produced, here are found on them a sort of bags of a tough matter, of about the size of a filbert, and of a dusky greenish colour. On opening one of these bags with a knife, there is usually found a single full-grown fly, of the gnat kind, and a number of small worms, which in a day or two more have wings, and fly away in the form of their parent. The tree is of the mulberry kind, and its seeds are usually very largely stocked with these insect bags; and the generality of them are found to contain the insects in their worm state; when they become winged, they soon make their way out. The bags begin to appear when the leaves are young, and afterwards grow with them; but they never rupture the leaf or injure its shape. They are of the kind of leaf-galls, and partake in all respects, except size, of a species we have frequent on the large maple, or, as it is called, the spagyrum.

FLYERS, in architecture, such stairs as go straight, and do not wind round, or have the steps made tapering; but the fore and back part of each stair and the ends respectively parallel to one another: So that if one flight do not carry you to your designed height, there is a broad half space; and then you fly again, with steps everywhere of the same breadth and length as before.

FLYERS, the performers in a celebrated exhibition among the Mexicans, which was made on certain great festivals, and is thus described by Clavigero in his History of that people. "They sought in the woods for an extremely lofty tree, which, after stripping it of its branches and bark, they brought to the city, and fixed in the centre of some large square. They cased the point of the tree in a wooden cylinder, which, on account of some resemblance in its shape, the Spaniards called a mortar. From this cylinder hung four strong ropes, which served to support a square frame. In the space between the cylinder and the frame, they fixed four other thick ropes, which they twisted as many times round the tree as there were revolutions to be made by the flyers. These ropes were drawn through four holes, made in the middle of the four planks of which the frame consisted. The four principal flyers, disguised like eagles, herons, and other birds, mounted the tree with great agility, by means of a rope which was laced about it from the ground up to the frame; from the frame they mounted one at a time successively upon the cylinder, and after having danced there a little, they tied themselves round with the ends of the ropes, which were drawn through the holes of the frame, and launching with a spring from it, began their flight with their wings expanded. The action of their bodies put the frame and the cylinder in motion; the frame by its revolutions gradually untwisted the cords by which the flyers swung; so that as the ropes lengthened, they made so much the greater circles in their flight. Whilst these four were flying, a fifth danced upon the cylinder, beating a little drum, or waving a flag, without the smallest apprehension of the danger he was in of being precipitated from such a height. The others who were upon the frame (10 or 12 persons generally mounted), as soon as they saw the flyers in their last revolution, precipitated themselves by the same ropes, in order to reach the ground at the same time amidst the acclamations of the populace. Those who precipitated themselves in this manner by the ropes, that they might make a still greater display of their agility,
FLY

[780]

FLY

Agility, frequently passed from one rope to another, at that part where, on account of the little distance between them, it was possible for them to do so. The most essential point of this performance consisted in proportioning so justly the height of the tree with the length of the rope that the flyers should reach the ground with 13 revolutions, to represent by such number their century of 32 years, composed in the manner we have already mentioned. This celebrated diversion is still in use in that kingdom; but no particular attention is paid to the number of the revolutions of the flyers; as the frame is commonly hexagonal or octagonal, and the flyers six or eight in number. In some places they put a rail round the frame, to prevent accidents, which were frequent after the conquest; as the Indians became much given to drinking, and used to mount the trees when intoxicated with wine or brandy, and were unable to keep their station on so great a height, which was usually 60 feet.

FLYING, the progressive motion of a bird, or other winged animal, in the air.

The parts of birds chiefly concerned in flying are the wings and tail; by the first, the bird sustains and wafts himself along; and by the second, he is assisted, in ascending and descending, to keep his body poised and upright, and to obviate the vacillations thereof.

It is by the size and strength of the pectoral muscles, that birds are so well disposed for quick, strong, and continued flying. These muscles, which in men are scarcely a 70th part of the muscles of the body, in birds exceed and outweigh all the other muscles taken together; upon which Mr Willoughby makes this reflection, that if it be possible for a man to fly, his wings must be so contrived and adapted, that he may make use of his legs, and not his arms, in managing them.

The tail, Mesers Willoughby, Ray, and many others, imagine to be principally employed in steering and turning the body in the air, as a rudder; but Bogelli has put it beyond all doubt, that this is the least use of it, which is chiefly to assist the bird in its ascent and descent in the air, and to obviate the vacillations of the body and wings; for as to turning to this or that side, it is performed by the wings and inclination of the body, and but very little by the help of the tail. The flying of a bird, in effect, is quite a different thing from the rowing of a vessel. Birds do not vibrate their wings towards the tail, as oars are struck towards the stern, but waft them downwards; nor does the tail of the bird cut the air at right angles as the rudder does the water; but is disposed horizontally, and preserves the same situation that it always was in the bird turning in effect, as a vessel is turned about on a centre of gravity to the right, by a brisk application of the oars to the left; so a bird, in beating the air with its right wing alone towards the tail, will turn its fore part to the left. Thus pigeons changing their course to the left, would labour it with their right wing, keeping the other almost at rest. Birds of a long neck alter their course by the inclination of their head and neck; which altering the course of gravity, the bird will proceed in a new direction.

The manner of FLYING is thus. The bird first bends his legs, and springs with a violent leap from the ground; then opens and expands the joints of his wings, so as to make a right line perpendicular to the sides of his body: thus the wings, with all the feathers therein, constitute one continued lamina. Being now raised a little above the horizon, and vibrating the wings with great force and velocity perpendicularly against the subject air, the fluid resists those successions, both from its natural inactivity and elasticity, by means of which the whole body of the bird is protruded. The resistance the air makes to the withdrawing of the wings, and consequently the progress of the bird, will be so much the greater, as the waft or stroke of the fan of the wing is longer; but as the force of the wing is continually diminished by this resistance, when the two forces continue to be in equilibrio, the bird will remain suspended in the same place; for the bird only ascends so long as the arch of air the wing describes makes a resistance equal to the excess of the specific gravity of the bird above the air. If the air, therefore, be so rare as to give way with the same velocity as it is struck withal, there will be no resistance, and consequently the bird can never mount. Birds never fly upwards in a perpendicular line, but always in a parabola. In a direct ascent, the natural and artificial tendency would oppose and destroy each other, so that the progress would be very slow. In a direct ascent they would aid one another, so that the fall would be too precipitate.

Artificial FLYING, that attempted by men, by the assistance of mechanics.

The art of flying has been attempted by several persons in all ages. The Leucadians, out of superstition, are reported to have had a custom of precipitating a man from a high cliff into the sea, first fixing feathers, variously expanded, round his body, in order to break the fall.

Friar Bacon, who lived near 500 years ago, but only affirms the art of flying possible, but assures us that he himself knew how to make an engine wherein a man sitting might be able to convey himself through the air like a bird; and further adds, that there was then one who had tried it with success. The secret consisted in a couple of large thin hollow copper globes, exhausted of air; which being much lighter than air, would sustain a chair whereon a person might sit. Father Francisco Lana, in his Prodrorno, proposes the same thing as his own thoughts. He computes, that a round vessel of plate brass, 14 feet in diameter, weighing three ounces the square foot, will only weigh 1480 ounces; whereas a quantity of air of the same bulk will weigh 2155 1/2 ounces; so that the globe will not only be sustained in the air, but will carry with it a weight of 775 1/2 ounces; and he increases the bulk of the globe, without increasing the thickness of the metal, he adds, a vessel might be made to carry a much greater weight.—But the fallacy is obvious: a globe of the dimensions he describes, Dr Hook shews, would not sustain the pressure of the air, but be crushed inwards. Besides, in whatever ratio the bulk of the globe were increased, in the same must the thickness of the metal, and consequently the weight be increased: so that there would be no advantage in such augmentation. See Aerostation.

The same author describes an engine for flying, invented by the Sieur Beannier, a smith of Sable, in the county of Maine. Vide Philosoph. Collect.
The philosophers of King Charles the second's reign were mightily busied about this art. The famous Bishop Wilkins was so confident of success in it, that he says, he does not question but in future ages it will be as usual to hear a man call for his wings, when he is going a journey, as it is now to call for his boots.

**Flying Bridge.** See Bridge.

**Flying Fish,** a name given to several species of fish, which, by means of long fins, can keep themselves out of water for some time. See Exocoetus, Ichthology Index.

**Flying Pinion,** is part of a clock, having a fly or fan whereby to gather air, and so bridle the rapidity of the clock's motion, when the weight descends in the striking part.

**F0.** See China, No. 104.

**F0-Kiri.** See Fokien.

**F0A0.** Or Colt and Filly; the young of the horse kind. The word colt, among dealers, is understood of the male, as filly is of the female. See Colt.

**Focus,** in Geometry and Conic Sections, is applied to certain points in the parabola, ellipsis, and hyperbola, where the rays reflected from all parts of these curves concave and meet. See Conic Sections.

**Focus,** in Optics, a point in which any number of rays, after being reflected or refracted, meet.

**Fodder,** any kind of meat for horses or other cattle. In some places, hay and straw, mingled together, is peculiarly denominated fodder.

**Fodder,** in the civil law, is used for a prerogative that the prince has, to be provided with corn and other meats for his horses, by the subjects, in his warlike expeditions.

**Fodder,** among miners, a measure containing 22 hundred and a half weight; in London the fodder is only 20 hundred weight.

**Foddering a ship.** See Fethering.

**Foenuugreek.** See Trigonella, Botany Index.

**Foenuus Nauticum.** Where money was sent to a merchant to be employed in a beneficial trade, with condition to be repaid with extraordinary interest, in case such voyage was safely performed, the agreement was sometimes called focus nauticum, sometimes usura maritima. But as this gave an opening for usurious and gaming contracts, 19, Geo. II. c. 37. enacted, that all money lent on bottomry, or at responsedentini, on vessels bound to, or from the East Indies, shall be expressly lent upon the ship or merchandise; the lender to have the benefit of salvage, &c. Blackst. Com. ii. 439. Mol. de Jour. Mar. 361.

**Foetor,** in Medicine, is a stench arising from the body or any part thereof.

**Foetus,** the young of all viviparous animals whilst in the womb, and of oviparous animals before being hatched; the name is transferred by botanists to the embryos of vegetables.

Strictly, the name is applied to the young after it is perfectly formed; previous to which it is usually called Embryo. See Anatomy Index.

In the human fetus are several peculiarities not to be found in the adult; some of them are as follows.

1. The arteries of the navel string, which are continuations of the hypogastriacs, are, after the birth, shrunk up, and form the ligamenta umbilical. infer.

2. The veins of the navel string are formed by the union of all the venous branches in the placenta, and passing into the abdomen become the threefold ligament of the liver.

3. The lungs, before being inflated with air, are compact and heavy, but after one inspiration they become light, and as it were spongy; and it may be noted here, that the notion of the lungs sinking in water before the child breathes, and of their swelling after the reception of air, are no certain proofs that the child had or had not breathed, much less that it was murdered: for the uninflated lungs become specifically lighter than water as soon as any degree of putrefaction takes place in them; and this soon happens after the death of the child; besides, where the utmost care hath been taken to preserve the child, it is breathed once or twice and then died.

4. The thymus gland is very large in the fetus, but dwindles away in proportion as years advance.

5. The foramen ovale in the heart of a fetus, is generally closed in an adult.

**Fog.** See Mist. A meteor, consisting of gaseous vapours, floating near the surface of the earth.

Mists, according to Lord Bacon, are imperfect condensed of the air, consisting of a large proportion of the air, and a small one of the aqueous vapour; and these happen in the winter, about the change of the weather from frost to thaw, or from thaw to frost; and in the summer, and in the spring, from the expansion of the dew.

If the vapours which are raised plentifully from the earth and waters, either by the solar or subterraneous heat, do at their first entrance into the atmosphere meet with cold enough to condense them to a considerable degree, their specific gravity is by that means increased, and so they will be stopped from ascending; and either return back in form of dew or of drizzling rain, or remain suspended some time in the form of a fog. Vapours may be seen on the high grounds as well as the low, but more especially about marshy places. They are easily dissipated by the wind, as also by the heat of the sun. They continue longest in the lowest grounds, because these places contain most moisture, and are least exposed to the action of the wind.

Hence we may easily conceive, that fogs are only low clouds, or clouds in the lowest region of the air; as clouds are no other than fogs raised on high. See Cloud.

When fogs stick, then the vapours are mixed with sulphurous exhalations, which smell so. Objects viewed through fogs appear larger and more remote than through the common air. Mr. Boyle observes, that upon the coast of Coromandel, and most maritime parts of the East Indies, there are, notwithstanding the heat of the climate, annual fogs so thick, as to occasion people of other nations who reside there, and even the more tender sort of the natives, to keep their houses close shut up.

Fogs are commonly strongly electrified, as appears...
FOK[782] FOL

from Mr Cavallo's observations upon them. See Electricity.\n
FOGAGE, in the forest law, is rank grass not eaten up in summer.

FOGO, or FUEGO. See Fuego.

FOIL. See FE; and CHINA, No 7.

FOIBLE, a French term, frequently used also in our language. It literally signifies weak; and in that sense is applied to the body of animals and the parts thereof, as foible reins, foible right, &c. being derived from the Italian fiocole, of the Latin fioebilitus, to be "lamented, pitied."

But it is chiefly used with us substantively, to denote a defect or flaw in a person or thing. Thus we say, Every person has his foible; and the great secret consists in hiding it artfully: Princes are gazed upon by flatterers, for that is their foible. The foible of young people is pleasure; the foible of old men is avarice; the foible of the great and learned is vanity; the foible of women and girls, coquetry, or an afection of having gallants. You should know the foible and the foible of a man before you employ him: We should not let people perceive that we know their foible.

FOIL, in fencing denotes a blunt sword, or one that has a button at the end covered with leather, used in learning the art of fencing.

FOIL, among glass-grinders, a sheet of tin, with quicksilver, or the like, laid on the backside of a looking-glass, to make it reflect. See Foliating.

FOIL, among jewelers, a thin leaf of metal placed under a precious stone, in order to make it look transparent, and give it an agreeable different colour, either deeper or paler: thus, if you want a stone to be of a pale colour, put a foil of that colour under it; or if you would have it deep, lay a dark one under it.

These foils are made either of copper, gold, or silver and silver together. The copper foils are commonly known by the name of Nuremberg or German foils; and are prepared as follows: Procure the thinnest copper plates you can get; beat these plates gently upon a well-polished anvil, with a polished hammer, as thin as possible; and placing them between two iron plates as thin as writing paper, heat them in the fire; then boil the foil in a pickin, with equal quantities of tartar and salt, constantly stirring them till by boiling they become white; after which, taking them out and drying them, give them another hammering, till they are made fit for your purpose: however, care must be taken not to give the foils too much heat, for fear of melting; nor must they be too long boiled, for fear of attracting too much salt.

The manner of polishing these foils is as follows: Take a plate of the best copper, one foot long and about five or six inches wide, polished to the greatest perfection; bend this to a long convex, fasten it upon a half roll, and fix it to a bench or table; then take some chalk washed as clean as possible, and filtered through a fine linen cloth, till it be as fine as you can make it; and having laid some thereof on the roll, and wetted the copper all over, lay your foils on it, and with a polishing stone and the chalk polish your foils till they are as bright as a looking-glass; after which they must be dried, and laid up secure from dust.

FOKIEN, a province of China in Asia, commodiously situated for navigation and commerce, part of it bordering on the sea, in which they catch large quantities of fish, which they send salted to other parts of the empire. Its shores are very uneven, by reason of the number and variety of its bays; and there are many forts built thereon to guard the coast. The air is hot, but pure and wholesome.

The mountains are almost everywhere disposed into a kind of amphitheatres, by the labour of the inhabitants, with terraces placed one above another. The fields are watered with rivers and springs, which issue out of the mountains, and which the husbandmen conduct in such a manner as to overflow the fields of rice when they please, because it thrives best in watery ground. They make use of pipes of bamboo for this purpose.

They have all commodities in common with the rest of China; but more particularly musk, precious stones, quicksilver, silk, hempen cloth, callico, iron, and all sorts of utensils wrought to the greatest perfection. From other countries they have cloves, cinnamon, pepper, sandal wood, amber, coral, and many other things. The capital city is Fou-teche Fou; or, as others would have it written, Fucherofo. But as for Fokien, which most geographers make the capital, Grosier informs us there is no such place.

FOLARD, CHARLES, an eminent Frenchman, famous for his skill and knowledge in the military art, was born at Avignon in 1669, of a noble family, but not a rich one. He discovered an early turn for the sciences, and a strong passion for arms; which last was so inflamed by reading Caesar's Commentaries, that he enlisted at 16 years of age. His father got him off, and shut him in a monastery; but he made his escape in about two years after, and entered himself a second time in quality of cadet. His inclination for military affairs, and the great pains he took to accomplish himself in that way, recommended him to notice; and he was admitted into the friendship of the first-rate officers. M. de Vendome, who commanded in Italy in 1702, made him his aid-de-camp, having conceived the highest regard for him; and soon after sent him with part of his forces into Lombardy. He was entirely trusted by the commander of that army; and no measures were concerted, or steps taken, without consulting him. By pursuing his plans, many places were taken, and advantages gained; and such, in short, were his services, that he had a pension of 500 livres settled upon him, and was honoured with the cross of St Louis. He distinguished himself greatly, August 15, 1705, at the battle of Cassano; where he received a wound upon his left hand, which deprived him of the use of it ever after. It was at this battle that he conceived the first idea of the system of columns, which he afterwards prefixed to his Commentaries upon Polybius. The duke of Orleans sending De Vendome again into Italy in 1706, Folard had orders to throw himself into Modena to defend it against Eugene; where, though he acquitted himself with his usual skill, he was very near being assassinated. The description he has given of the conduct and character of the governor of this town, may be found in his Treatise of the Defence of Places, and deserves to be read. He received a dangerous wound on the thigh at the battle of Malplaquet, and was some time after made prisoner by Prince Eugene. Being exchanged in 1711, he was
made governor of Bourbourg. In 1714, he went to Malta, to assist in defending that island against the Turks. Upon his return to France, he embarked for Sweden, having a passionate desire to see Charles XII. He acquired the esteem and confidence of that famous general, who sent him to France to negotiate the re-establishments of James III. upon the throne of England; but that project being dropped, he returned to Sweden, followed Charles XII. in his expedition to Norway, and served under him at the siege of Fredericksbark, where that prince was killed, Dec. 11, 1718. Folard then returned to France; and made his last campaign in 1719, under the duke of Berwick, in quality of colonel. From that time he applied himself intensely to the study of the military art as far as it could be studied at home; and built his theories upon the foundation of his experience and observations on facts. He contracted an intimacy with Count Saxe, who, as he then declared, would one day prove a very great general. He was chosen a fellow of the Royal Society of London in 1749; and, in 1751, made a journey to Avignon, where he died in 1752, aged 83 years. He was the author of several works, the principal of which are: 1. Commentaries upon Polybius, in six volumes, 4to. 2. A Book of New Discoveries in War. 3. A Treatise concerning the Defence of Places, &c. in French. Those who would know more of this eminent soldier, may consult a French piece, entitled, Memoires pour servir à l'Histoire de M. le Chevalier de Folard. Ratisbon, 1751. 12mo.

FOLC-MOTE (Sax). The feoffed lands so called in the time of the Saxons, as charter-lands were called boc-lands, Kitch. 174. Folkland was terra suelgi or popularis; the land of the vulgar people, who had no certain estate therein, but held the same, under the rents and services customary or agreed, at the will only of their lord the thane; and it was therefore not put in writing, but accounted priorium rusticum et ignobilem. Spelm. of Enga, c. 5.

FOLCMOTE, or FOLKMOTE (Sax. Polegemoite, i.e. convenitus populi), is compounded of folk, populus, and mote, or gemote, convenire; and signified originally, as Somner in his Saxo Dictionary informs us, a general assembly of the people, to consider of and order matters of the commonwealth. And Sir Henry Spelman says, the folc mote was a sort of annual parliament or convention of the bishops, thanes, aldermen, and freemen, upon every May-day yearly; where the laymen were sworn to defend one another and the king, and to preserve the laws of the kingdom; and then consulted of the common safety. But Dr. Brady infers from the laws of the Saxons of England, that it was an inferior court, held before the king's crewe or steward, every month, to do folk right, or compose smaller differences, from whence there lay appeal to the superior courts; Gloss. p. 48. Squire seems to think the folc mote not distinct from the shire mote, or common general meeting of the county. See his Angl. Sax. Gov. 155. n.

Manwood mentions folc mote as a court helden in London, wherein all the folk and people of the city did complain of the mayor and aldermen, for misgovernment within the said city; and this word is still in use among the Londoners, and denotes celebrem ex tota civitate conventum. Stow's Survey. According to Ken-
FOLIO. Take five ounces of quicksilver, and one ounce of bismuth; of lead and tin, half an ounce each: first put the lead and tin into fusion, then put in the bismuth; and when you perceive that in fusion too, let it stand till it is almost cold, and pour the quicksilver into it: after this take the glass globe, which must be very clean, and the inside free from dust: make a paper funnel, which put into the hole of the globe, as near the glass as you can, so that the amalgam, when you pour it in, may not splash and cause the glass to be full of spots; pour it in gently, and move it about, so that the amalgam may touch everywhere: if you find the amalgam begin to be curly and fixed, then hold it over a gentle fire, and it will easily flow again; and if you find the amalgam too thin, add a little more lead, tin, and bismuth to it. The finer and clearer your globe is, the better will the looking-glass be.

Dr Shaw observes, that this operation has considerable advantages, as being performed in the cold; and that it is not attended with the danger of poisonous fumes from arsenic, or other unwholesome matters usually employed for this purpose: besides, how far it is applicable to the more commodious foliating of the common looking-glasses and other speculums, he thinks, may deserve to be considered.

FOLIO, in merchants books, denotes a page, or rather both the right and left hand pages, these being expressed by the same figure, and corresponding to each other. See BOOK-KEEPING.

FOLIO, among printers and booksellers, the largest form of books, when each sheet is so printed that it may be bound up in two leaves only.

FOLIS. See FOLIS.

FOLIUM, or LEAF, in Botany. See LEAF.

FOLKES, MARTIN, a philosopher and antiquarian of considerable eminence, was born in Westminster in the year 1690. A Mr Cappell, once professor of Hebrew at Saumur, was his private tutor. When 17 years of age, he was sent to Clare-hall, Cambridge, where he successfully applied himself to the study of philosophy and the mathematics; and when only twenty-three years of age he was chosen a fellow of the Royal Society. His ingenious communications acquired him so much applause, that he was frequently chosen into its council. He was in habits of friendship with the illustrious Newton, at that time president, and by his influence was elected one of the vice-presidents in the year 1723. Mr Folkes became a candidate for the chair on the death of Sir Isaac Newton; but the superior interest of Sir Hans Sloane rendered his application ineffectual. In 1733 and the two subsequent years, his residence was for the most part in Italy, with the view of improving himself in the knowledge of classical antiquities. To ascertain the weight and value of ancient coins, he carefully consulted the cabinets of the curious; and on his return home he presented to the Antiquarian Society, of which he was a member, a dissertation on this subject. He read before the same learned body, a dissertation on the measurement of Trajan's and Antonine's pillar, together with other remains of antiquity. The fruits of his observations he presented to the Royal Society; and, in particular, "Remarks on the standard measure preserved in the Capitol of Rome," and the model of an ancient globe in the Farnesian palace. He visited Paris in 1739, where he was received with great respect, and honoured with the company of the most eminent literary characters in that metropolis. This respect indeed he was entitled to by his unwearied application to many branches of knowledge which were both curious and useful. His valuable work, entitled "A table of English silver coins, from the Norman Conquest to the present time, with their weights, intrinsic values, and some remarks upon the several pieces," was printed in the year 1745. Among the many honours conferred upon Mr Folkes, he was created doctor of laws by both universities, and chosen president of the Antiquarian Society. He continued to furnish the Philosophical Transactions with many learned papers, till his career was stopped by a paralytic stroke, which terminated his useful life in the year 1754. He was a man of very extensive knowledge and great accuracy; but the chief benefit to science which resulted from his labours, was his treatise on the intrinsic subject of coins, weights, and measures. His cabinet and library were large and valuable, and exposed to public sale after his death. His private character was distinguished for politeness, generosity, and friendship.

FOLKESTONE, a town of Kent, between Dover and Hythe, 72 miles from London, appears to have been a very ancient place, from the Roman coins and British bricke often found in it. Stillingfleet and Tanner take it for the Lapis Titiali of Nennius. It was burnt by Earl Godwin, and by the French in the reign of Edward III. It had five churches, now reduced to one. It is a member of the town and port of Dover; and has a weekly market and an annual fair. It is chiefly noted for the multitude of fishing boats that belong to its harbour, which are employed in the season in catching mackerel for London; to which they are carried by the mackerel boats of London and Barking. About Michaelmas, the Folkestone barks, with others for Sussex, go away to the Suffolk and Norfolk coasts to catch herrings for the merchants of Yarmouth and Lowestoft. Folkestone gives the title of Vicar Cant to William Henry Bouverie, whose grandfather, Jacob, was so created in 1747. It has been observed of some hills in this neighbourhood, that they have visibly sunk and grown lower within memory.

FOLKLAND, and FOLKMORE. See FOLCLAND.

FOLLICULUS, (from folia, "a bag") a species of seed-vessel first mentioned by Linnaeus in his "Delitio Plantae," generally consisting of one valve, which opens from bottom to top on one side, and has no suture for fastening or attaching the seeds within it.

FOLLICULI are likewise defined by the same author to be small glandular vessels distended with air, which appear on the surface of some plants; as at the foot of water-milfoil, and on the leaves of alderwood. In the former the leaves in question are roundish, and furnished with an appearance like two horns; in the latter, pot-shaped, and semicircular.

FOLLIS, or FOLIS, anciently signified a little bag or purse; whence it came to be used for a sum of money, and very different sums were called by that name: thus the scholiast on the Basilides mentions a fellis of copper which was worth but the 24th part of the miliarium; the glosses nominate, quoted by Cronovius and others, one of 125 miliarium, and another of 250 denarii, which was the ancient sextertium; and three different sums of eight, four, and two pounds of gold, were each
each called follis. According to the account of the
scholiast, the ounce of silver, which contained five mi-
lionaires of 60 in the pound, was worth 120 follis of
copper. The glossographer, describing a follis of 350
denarii, says it was equal to 312 pounds 6 ounces of
copper; and as the denarius of that age was the 8th
part of an ounce, an ounce of silver must have been
worth 120 ounces of copper; and therefore the schol-
list's follis was an ounce of copper, and equal to the
glossographer's nummus. But as Constantine's copper
money weighed a quarter of a Roman ounce, the schol-
list's follis and the glossographer's nummus contained
each four of them, as the ancient nummus contained four
asses.

FOLLY, according to Mr. Locke, consists in the
drawing of false conclusions from just principles; by
which it is distinguished from madness, which draws
just conclusions from false principles.

But this seems to confound a definition; folly, in its
most general acceptation, denoting a weakness of intel-
lect or apprehension, or some partial absurdity in sen-
timent or conduct.

FOMAHAUT, in Astronomy, a star of the first
magnitude in the constellation AQUARIUS.

FOMENTATION, in Medicine, is a fluid exter-
nally applied, usually as warm as the patient can bear
it, and in the following manner. Two flannel cloths
are dipped into the heated liquor, one of which is
washed as dry as the necessary speed will admit, then
immediately applied to the part affected: it lies on un-
til the heat begins to go off, and the other is in readi-
ness to apply at the instant in which the first is remov-
ed: thus these flannels are alternately applied, so as to
keep the affected part constantly supplied with them
warm. This is continued 15 minutes or half an hour,
and repeated as occasion may require.

Every intention of relaxing and soothing by fomenta-
tions may be answered as well by warm water alone
as when the flannel cloths are boiled in it; but when
disinfectants or antiseptics are required, such ingredi-
ents must be called in as are adapted to that end.

The degree of heat should never exceed that of pro-
ducing a pleasant sensation; great heat produces effects
very opposite to that intended by the use of fomenta-
tion.

FONG-YANG, a city of China, in the province of
KIANG-NANG. It is situated on a mountain, which hangs
over the Yellow river, and encloses with its walls sev-
eral fertile little hills. Its jurisdiction is very extensive:
for it comprehends 18 cities; five of which are of the
second, and 13 of the third class. As this was the
birthplace of the emperor Hong-vo, chief of the pre-
ceding dynasty, this prince formed a design of rendering
it a famous and magnificent city, in order to make it
the seat of empire. After having expelled the Western
Tartars, who had taken possession of China, he trans-
ferred his court hither, and named the city Fong-yang;
that is to say, "The Place of the Eagle's Splendour." His
intention, as we have said, was to beautify and en-
large it; but the inequality of the ground, the scarcity
of fresh water, and above all the vicinity of his father's
tomb, made him change his design. By the unanimous
advice of his principal officers, this prince established
his court at Nan-King, a more beautiful and com-
modious place. When he had formed this resolution, a
Fong-Yang stop was put to the intended works: the imperial
palace which was to have been enclosed by a triple wall,
the walls of the city to which a circumference of a
league were assigned, and the canals that were begun,
all were abandoned; and nothing was finished, but three
monuments that still remain. The extent and magnifi-
cence of these sufficiently show what the beauty of this
city would have been, had the emperor pursued his or-
iginal design. The first is the tomb of the father of
Hong-vo, to decorate which no expense was spared;
it is called Hoan-lin, or the Royal Tomb. The second
is a tower built in the middle of the city, which is of
an oblong form, and 100 feet high. The third is a
magnificent temple erected to the god Fo. At first it
was only a pagod, to which Hong-vo retired after hav-
ing lost his parents, and where he was admitted as an
inferior domestic; but having soon become weary of
that kind of life, he enlisted with the chief of a band of
banditti, who had revolted from the Tartars, and was
bold and enterprising, the general made choice of
him for his son-in-law: soon after he was declared his
successor by the unanimous voice of the troops. The
new chief seeing himself at the head of a large party,
had the presumption to carry his views to the throne.
The Tartars, informed of the progress of his arms, sent
a numerous army into the field; but surprised and
attacked them with so much impetuousity, that they were
obliged to fly; and, though they several times returned
in the charge, they were still defeated, and at length
driven entirely out of China. As soon as he mounted
the throne, he caused the superb temple which we have
mentioned to be raised out of gratitude to the Bonzes,
who had received him in his distress, and assigned them
a revenue sufficient for the maintenance of 300 persons,
under a chief of their own sect, whom he constituted a
mandarin, with power of governing them, independent
of the officers of the city. This pagod was supported
longer as the preceding dynasty lasted; but that of
the Eastern Tartars, which succeeded, suffered it to fall
to ruin.

FONG-CHOW, the name of a ridiculous superstiti-
on among the Chinese. See CHINA, No. 105.

FONT, among ecclesiastical writers, a large bason
in which water is kept for the baptizing of infants or
other persons.

FONT, in the art of printing, denotes a complete as-
sortment of letters, accents, &c. used in printing. See
FOUNT.

FONTAINE, JOHN, a celebrated French poet,
and one of the first-rate geniuses of his age, was born
at Chateau-Thierry in Champagne, the 8th of July
1621, of a good family. At the age of 19 he en-
tered amongst the Oratorians, but quitted that order
18 months after. He was 22 years of age before he
knew his own talents for poetry; but hearing an ode
of Malherbe read, upon the assassination of Henry IV.
he was so taken with admiration of it, that the poeti-
cal fire, which had before been dormant within him,
seemed to be enkindled from that of the other great
poet. He applied himself to read, to meditate, to re-
peat, in fine to imitate, the works of Malherbe. The
first essays of his pen he confined to one of his rela-
tions who made him read the best Latin authors, Ha-
race, Virgil, Terence, Quintilian, &c. and then the
Fontaine's best composition in French and Italian. He applied himself likewise to the study of the Greek authors, particularly Plato and Plutarch. Some time afterwards his parents made him marry a daughter of a lieutenant-general, a relation of the great Racine. This young lady, besides her very great beauty, was remarkable for the delicacy of her wit, and Fontaine never composed any work without consulting her. But as her temper was none of the best, to avoid dissension, he separated himself from her company as often as he well could. The famous duchess of Bouillon, niece to Cardinal Mazarine, being exiled to Château-Thierry, took particular notice of Fontaine. Upon her recall, he followed her to Paris; where by the interest of one of his relations, he got a pension settled upon him. He met with great friends and protectors amongst the most distinguished persons of the court, but Madame de la Sablière was the most particular. She took him to live at her house, and it was then that Fontaine, divested of domestic concerns, led a life conformable to his disposition, and cultivated an acquaintance with all the great men of the age. It was his custom, after he was fixed at Paris, to go every year during the month of September, his native place, of Château-Thierry, and pay a visit to his wife, carrying with him Racine, Despréaux, Chapelier, or some other celebrated writers. When he has sometimes gone thither alone by himself, he has come away without remembering even to call upon her; but seldom omitted sending some part of his lands, by which means he squandered away a considerable fortune. After the death of Madame de la Sablière, he was invited into England, particularly by Madame Mazarine, and by St Evremond, who promised him all the sweets and comforts of life; but the difficulty of learning the English language, and the liberty of the duke of Burgundy, prevented his voyage.

About the end of the year 1692 he fell dangerously ill; and, as is customary upon these occasions in the French church, he made a general confession of his whole life to F. Moguet, an Oratorian; and, before he received the sacrament, he sent for the gentlemen of the French Academy, and in their presence made his sincere composition for having composed his Tales; a work he could not reflect upon without the greatest repentance and detestation; promising that if it should please God to restore his health, he would employ his talents only in writing upon matters of morality or piety. He survived this illness two years, living in the most exemplary and edifying manner, and died the 13th of March 1695, being 74 years of age. When they stripped his body, they found next his skin a hair shirt; which gave room for the following expression of the younger Racine:

Et l'Auteur de Jacobst est oré d'un Citrice.

Fontaine's character is remarkable for a simplicity, candour, and probity seldom to be met with. He was of an obliging disposition; cultivating a real friendship with his brother poets and authors; and what is very rare, beloved and esteemed by them all. His conversation was neither gay nor brilliant, especially when he was not amongst his intimate friends. One day being invited to a dinner at a farmer general's, he ate a great deal, but did not speak. Rising up from table very early, under pretence of going to the theatre, the company represented to him that it was not proper time; "Well, (says he), if it is not, then let me a little longer." He stayed one hour by his wife's year 1660. At the age of 12, he was in the hands of M. de Harley, the first president, removing to him his education and fortune. It had been having been a long time without seeing him, he opened to meet him one day visiting, without telling him again, and mentioned to the company that young man had a good deal of the understanding. When they told him it was him he answered in the most tranquil manner, "But I am glad on't." An indifference, or rather absence of mind, influenced his whole conduct, rendering him often insensible to the inculcations of the other. Madame de Bouillon going one example of silence, saw him, abstracted in thought, sitting at a table; returning at night, she found him at his place, and in the same attitude, although it was cold, and had rained almost the whole day. Hence this simplicity so far, that he was scarcely amongst the bad reading of his writings night and particularly his Tales. Madame de Bouillon was in such esteem for exhorting him to prayer and alms deeds; "his alms deeds (replied Fontaine), I am sure, have nothing to give; but they are about publishing an edition of my Tales, and the bookseller owns seven hundred copies; you shall have them to sell, and double their amount amongst the poor." Another time his guest exhorting him to repent of his faults, "I have committed any (cried the nurse), I am sure it is from ignorance than malice, for he has as much civility as an infant." One time having composed wherein he made a profane application of those words of the Gospel, "Lord, five talents thou didst deliver me," he dedicated it, by a most ingenious prayer to the celebrated Arnauld, telling him, it was to show posterity the great esteem he had for that learned man. He was not sensible of the indecency of the defect and the profane application of the text, till Boisse Racine represented it to him. He addressed new by a dedication in the same manner, to the author of Paris. His Fables are in the same work, contain every thing in that kind, both ancient and modern, the opinion of the learned. People of taste, the finer they read them, will find continually new beauties and charms, not to be met with elsewhere. The descendants of this great poet were long exempted from all taxes and impositions; a privilege which the intendants of Soisson thought it an honour to snare to them.

FONTAINEBLEAU, a town in the Isle of France, and in the Gâtinois, remarkable for its baron, which has been the place where the kings of France used to lodge when they went a hunting. It was embellished by Francis I. and every successive king added something to it; so that it may now be considered one of the finest pleasure houses in the world. It stood in midst of a forest, consisting of 26,424 acres of each containing 100 square perches, and each proceed. E. Long. 2. 33. M. Lat. 40. 22.
quitted it, for the sake of returning to the world. He was a priest, and had a cure in Normandy: but left it, and was, as a man of wit and letters, some time with the cardinal d'Avrigne. Having excited some attention at Paris by certain critical productions, the Abbé Bignon in 1724 committed to him the Journal des Spavans. He acquitted himself well in this department, and was pleasantly enjoying the applause of the public, when his enemies, whom by critical strictures in his Journal he had made such, formed an accusation against him of a most abominable crime, and procured him to be imprisoned. By the credit of powerful friends, he was set at liberty in 17 days; the magistrature of the police took upon himself the trouble of justifying him in a letter to the Abbé Bignon; and this letter having been read amidst his fellow sufferers in the Journal, he was unanimously re-established in his former credit. This happened in 1725. But with whatever reputé he might acquit himself in this Journal, frequent disgusts made him frequently abandon it. He laboured meanwhile in some new periodical works, from which he derived his greatest fame. In 1731, he began one under the title of Nouvelliste du Parnasse, ou Réflexions sur les Ouvrages nouveaux: but only proceeded to two volumes; the work having been suppressed by authority, from the incessant complaints of authors ridiculed therein. About three years after, in 1733, he obtained a new privilege for a periodical production, entitled: Observations sur les Écrits Modernes; which, after continuing to 33 volumes, was suppressed again in 1743. Yet the year following, 1744, he published another weekly paper, called, Jugemens sur les Ouvrages nouveaux, and proceeded to 11 volumes: the two last being done by other hands. In 1745, he was attacked with a disorder in the breast, which ended in a dropsey that proved fatal in five weeks. "He was (says M. Freron) born a sentimental person; a philosopher in conduct as well as in principle; exempt from ambition; and of a noble firm spirit, which would not submit to sue for preferments or titles. In common conversation he appeared only a common man: but when subjects of literature, or any thing out of the ordinary way, were agitated, he discovered great force of imagination and wit." Besides the periodical works mentioned above, he was the author of many others: his biographer gives us no less than 17 articles; many of them critical, some historical, and some translations from English writers, chiefly from Pope, Swift, Fielding, &c. The Abbé de la Porte, published, in 1757, L'Esprit de l'Abbe des Fontaines, in 4 vols. 12mo.

FONTEANA, FELIX, a celebrated Italian physiologist. See SUPPLEMENT.

FONTEANA, GREGORY, an eminent Italian mathematician. See SUPPLEMENT.

FONTANELLA, in Anatomy, imports the quadrangular aperture found betwixt the os frontis and osa sincipitis, in children just born; which is also called fons pulsatoris.

FONTABRIA, a sea port town of Spain, in Biscay, and in the territory of Guipuscoa, seated on a peninsula on the sea shore, and on the river Bidasso. It is small, but well fortified both by nature and art; and has a good harbour, though dry at low water. It is built in the form of an amphitheatre, on the declivity of a hill, and surrounded on the land side by the lofty Pyrenean mountains. It is a very important place, being accounted the key of Spain on that side.

W. Long. i. 43. N. Lat. 43.

FONTEMELLE, BERNARD LE BOVIER DE, was a man of letters, born at Rouen in 1657, the most universal genius of the age of Louis XIV. in the estimation of Voltaire. He received his education in the college of Jesuits at Rouen, where the quickness of his parts became conspicuous at a very early period. He was capable of writing Latin verses when only 13, which were deemed worthy of being published. He studied the law at the desire of his father; but as he lost the very first cause in which he was employed as an advocate, he became disgusted with his profession, and devoted himself entirely to literature and philosophy. He composed a considerable part of the odes of Psyche and Bellerophon, which were printed under the name of his uncle Thomas Corneille. He wrote a tragedy called Aspar; but as it did not succeed, he consigned the manuscript to the flames, and never afterwards attempted that species of composition. His Dialogues of the dead were published in the year 1683, which were well received, as a specimen of elegant composition, combining morality with the charms of literature. His "Lettres du Chevalier d’Her," published in 1685, under his name, discovered much wit and ingenuity, but at the same time, no small share of affectation. His "Entretiens sur la Pluralité des Mondes," has been regarded as one of his ablest performances, combining science and philosophy with vivacity and humour, a talent which may be said to belong almost exclusively to the French. It was praised by all, and translated into several foreign languages.

In his "History of Oracles," he supported the opinion that oracles were forgeries, in opposition to those who contended that they were supernatural operations of evil spirits, put to silence by the appearing of Christ, and of consequence he exposed himself to clerical animadversion. His "Pastoral Poems" appeared in the year 1688, with a discourse on the nature of the eclogue, which were very much admired for their delicacy of sentiment, as was also his opera of "Thetis and Peleus;" but his "Æneas and Lavinia" was not so successful. In the year 1699, Fontenelle was chosen secretary of the Academy of Sciences, which office he held during the long period of 42 years. He published a volume annually of the history of that learned body, filled with analyses of memoirs, and eulogiums on deceased members.

As a poet, he did not rise above elegance and ingenuity; as a man of science, he rather excelled in throwing light on the inventions of others, than in discovering any new truth himself, and as a general writer, he united solid sense with the delicacy and refinement of a man of wit. He studied his own happiness as much as most men, but he never sacrificed to the promotion of it, the duties of a man of honour and virtue. He had many friends, and towards the close of life, scarcely a single enemy. He was never married, and for a man of letters he acquired considerable affluence. Although of a delicate constitution, he reached the great age of 90 without any complaint but dulness of hearing. He died on the 9th of January 1757, being almost a hundred years of age. When asked by a certain person...
by virtue of these two axioms; All is possible, and every one is in the right.”

FONTENOUX, a town or village of the Netherlands, in the province of Hainault, and on the borders of Flanders; remarkable for a battle fought between the allies and the French on the first of May 1745. The French were commanded by Mareschal Saxe, and the allies by the Duke of Cumberland. On account of the superior numbers of the French army, and the superior generalship of their commander, the allies were defeated with great slaughter. The British troops behaved with great intrepidity, as their enemies themselves acknowledged. It has been said, that the battle was lost through the cowardice of the Dutch, who failed in their attack on the village of Fontenoy, on the which the event of the day depended. E. Long. 2. 20. N. Lat. 50. 35.

FONTENOUX, a village of France, in the duchy of Burgundy. remarkable for a bloody battle fought there in 841, between the Germans and the French, in which were killed above 100,000 men; and the Germans were defeated. E. Long. 3. 48. N. Lat. 47. 28.

FONTEVRAUD, or FONTEVAUX, Order of, in ecclesiastical history, a religious order instituted about the latter end of the 11th century, and under the protection of the Holy see by Pope Pascal II. in 1106, confirmed by a bull in 1113, and invested by his successors with very extraordinary privileges. The chief of this order is a female, who is appointed to inspect both the monks and nuns. The order was divided into four provinces, which were those of France, Aquitaine, Auvergne, and Bretagne, in each of which they had formerly several priories.

FONTICULUS, or FONTANELLA, in Surgery, an issue, seetion, or small ulcer, made in several parts of the body, in order to excite irritation, or to produce the discharge of matter.

FONTINALLA, or FONTANALLA, in antiquity, a religious feast held among the Romans in honour of the deities who presided over fountains or springs. Varro observes, that it was the custom to visit the wells on those days, and to cast coins into fountains. Scaliger, in his conjectures on Varro, takes this not to be a feast of fountains in general, as Festus insinuates, but of the fountain which had a temple at Rome, near the Porta Capena, called also Porta Fontinalis: he adds, that it is of this fountain Cicero speaks in his second book De Legibus. The Fontinallas were held on the 13th of October.

FONTINALLIS, WATER-MOSS, a genus of plants belonging to the cryptogamic class, and to the order of nucci. See Botany Index.

FOOD, in the most extensive signification of the word implies whatever alimentes are taken into the body, whether solid or fluid; but in common language, it is generally used to signify only the solid part of our aliment.

We are told, that in the first ages men lived upon acorns, berries, and such fruits as the earth spontaneously produces; then they proceeded to eat the flesh of wild animals taken in hunting: But their numbers decreasing and mankind multiplying, necessity taught them the art of cultivating the ground, to sow corn,

&c. By and by they began to assign to each other, by general consent, portions of land to produce them their supply of vegetables; after this, reason suggested the expedient of domesticating certain animals, both to assist them in their labours and supply them with food. Hogs were the first animals of the domestic kind that appeared upon their tables; they held it to be ungrateful to devour the beasts that assisted them in their labours.—When they began to make a free use of domestic animals, they roasted them only: boiling was a refinement in cookery which for ages they were strangers to; and fish living in an element men were unused to, were not eaten, till they grew somewhat civilized. Menelaus complains, in the Odyssey, that they had been constrained to feed upon them.

The most remarkable distinction of foods, in a medical view, is into those which are already assimilated into the animal nature, and such as are not. Of the first kind are animal substances in general; which if not entirely similar, are nearly so, to our nature. The second comprehends vegetables, which are much more difficultly assimilated. But as the nourishment of all animals, even those which live on other animals, can be traced originally to the vegetable kingdom, it is plain, that the principle of all nourishment is in vegetables.

Though there is perhaps no vegetable which does not afford nourishment to some species of animals or the Mamm.

...
FOOD

Food. Animal food of all kinds rather tends to alkalescence and putrefaction. Some animal foods, indeed, turn manifestly acid before they putrify; and it has been asserted, that some degree of alkalescence takes place in every kind of animal food before digestion. This alkalescence of animal food, however, never comes to any morbid degree, but the disease is always on the side of putrefaction. The alkalescence of vegetables is more frequent, and ought to be more attended to, than the alkalescence of animal food; which last, even in weak stomachs, is seldom felt; while alkalescence greatly affects both the stomach and system.

With regard to their difference of solution:—Heavyness, as it is called, is seldom felt from vegetables, except from tough farinaceous paste, or the most viscid substances; while the heavi ness of animal food is more frequently noticed, especially when in any great quantity. Difficulty of solution does not depend so much on fineness of texture (as a man, from fish of all kinds, is more oppressed than from firmer substances), as on viscosity; and hence it is more frequent in animal food, especially in the younger animals.

With regard to mixture:—There is no instance of difficult mixture in vegetables, except in vegetable oils; while animal foods, from both viscosity and oiliness, especially the fatter meats, are refractory in this respect. Perhaps the difference of animal and vegetable foods might be referred to this head of mixture. For vegetable food continues long in the stomach, giving little stimulus: Now the system is affected in proportion to the extent of this stimulus, which is incomparably greater from the animal viscid oily food, than from the vegetable, firmer, and more aqueous. However, there are certain applications to the stomach, which have a tendency to bring on the cold fit of fever, independent of stimulus, merely by their refrigeration: and this often arises from vegetables; especially in those hot countries where intermitents prevail, they are often induced from a surfeit of vegetable than of animal food. A proof of this is, that when one is recovering of an intermitent, there is nothing more apt to cause a relapse than cold food, especially if taken on those days when the fit should return, and particularly ascescent, fermentable vegetables, as salads, melons, cucumbers, &c. acido-dulces, &c. which, according to Dr. Cullen, are the most frequent causes of epidemics; therefore, when an intermitent is to be avoided, we shun vegetable diet, and give animal foods, although their stimulus be greater.

II. In the Intestines. When the putrescence of animal food has gone too far, it produces an active stimulus, causing diarrhrea, dysentery, &c. But these effects are but rare; whereas from vegetable food and its acid, which, united with the bile, proves a pretty strong stimulus, they more frequently occur; but luckily are of less consequence, if the refrigeration is not very great. In the autumnal season, there is a tendency to dysentery, if it is observed that eating of fruits brings it on, it is rather to be ascribed to their cooling than stimulating the intestines.

As to stool:—Whenever neither putrefaction nor acidity has gone a great length, animal food keeps the belly more regular. Vegetable food gives a greater proportion of succulent matter; and, when exsiccated by the stomach and intestines, is more apt to stagnate, and produce slow belly and constiveness, than animal stimulating food; which, before it comes to the great gut, where stoppage is made, has obtained a putrefactive tendency, and gives a proper stimulus; and thus those who are castive from the use of vegetables; when they have recourse to animal food are in this respect better.

III. In the blood-vessels. They both give a blood of the same kind, but of different quality. Animal food gives it in great quantity, being in great part, as the expression is, convertible in succum et sanguinem, and of easy digestion; whereas vegetable is more watery, and contains a portion of unconquerable saline matter, which causes it to be thrown out of the body by some excretion. Animal food affords a more dense stimulating elastic blood than vegetable; stretching and causing a great resistance in the solids, and again exciting their stronger action. It has been supposed that alkalescence of vegetable food is carried into the blood-vessels, and there exerts its effects; but the tendency of animal fluids is so strong to alkalescence, that the existence of an acid acidimony in the blood seems very improbable. Animal food alone will soon produce an alkalescent acidimony; and if a person who lives entirely on vegetables were to take no food for a few days, his acidimony would be alkalescent.

IV. We are next to take notice of the quantity of nutriment these different foods afford. Nutriment is of two kinds: the first repairs the waste of the solid fibres; the other supplies certain fluids, the chief of which is oil. Now, as animal food is easier converted, and also retained longer in the system, and as it contains a greater proportion of oil, it will afford both kinds of nutriment more copiously than vegetables.

V. Lastly, as to the different degrees of perspiration of these foods. This is not yet properly determined. Sanctorius constantly speaks of motion as the most perspirable of all food, and of vegetables as the least perspirable. This is a consequence of the different stimulus those foods give to the stomach, so that persons who live on vegetables have not their perspiration so suddenly excited. In time of digestion, perspiration is stopped from whatever food, much more so from cooling vegetables. Another reason why vegetables are less perspirable is, because their aquo-saline juices determine them to go off by urine, while the more perfectly mixed animal food is more equally diffused over the system, and so goes off by perspiration. Hence Sanctorius’s accounts may be understood; for vegetable aliment is not longer retained in the body, but mostly takes the course of the kidneys. Both are equally perspirable in this respect, viz.: that a person living on either returns once a day to his usual weight; and if we consider the little nourishment of vegetables, and the great tendency of animal food to corpulence, we must allow that vegetable is more quickly perspired than animal food.

As to the question, Whether man was originally designed for animal or vegetable food, see the article CARNIVOROUS.

With regard to the effects of these foods on men, it must be observed, that there are no persons who live entirely on vegetables. The Pythagoreans themselves ate milk; and those who do so mostly, as these Pythagoreans, are weakly, sickly, and meagre, labouring...
FOO [ 790 ]

Food.

ing under a constant diarrhoea and several other diseases. None of the hardy, robust, live on these; but chiefly such as gain a livelihood by the exertion of their mental faculties, as (in the East Indies) factors and brokers; and this method of life is now confined to the hot climates, where vegetable diet, without inconvenience, may be carried to great excess. Though it be granted, therefore, that man is intended to live on these different foods promiscuously, yet the vegetable should be in very great proportion. Thus the Laplanders are said to live entirely on animal food: but this is contradicted by the best accounts; for Linnaeus says, that besides milk, which they take sour, to obviate the bad effects of animal food, they use also calsenyanthes, and many other plants, copiously. So there is no instance of any nation living entirely either on vegetable or animal food, though there are indeed some who live particularly on one or other in the greatest proportion. In the cold countries, e.g. the inhabitants live chiefly on animal food, on account of the rigour of the season, their smaller perspiration, and little tendency to putrefaction.

Of more importance, however, is the following than the former question, viz. In what proportion animal and vegetable food ought to be mixed? 1. Animal food certainly gives most strength to the system. It is a known axiom of Sanctorius, that pondus addit robur; which may be explained from the impletion of the blood-vessels, and giving a proper degree of tension for the performance of strong oscillations. Now animal food not only goes a greater way in supplying fluid, but also gives the fluid more dense and elastic. The art of giving the utmost strength to the system is best understood by those who breed fighting cocks. These people raise the cocks to a certain weight, which must bear a certain proportion to the other parts of the system, and which at the same time is so nicely proportioned, as that, on losing a few ounces of it, their strength is very considerably impaired. Dr Robinson of Dublin has observed, that the force and weight of the system ought to be determined by the largeness of the heart, and its proportion to the system: for a large heart will give large blood-vessels, while at the same time the viscera are less, particularly the liver; which last being increased in size, a greater quantity of fluid is determined into the cellular texture, and less into the sanguineous system. Hence we see how animal food gives strength, by filling the sanguineous vessels. What pains we now bestowed on cocks, the ancients did on the athletes, by proper nourishment bringing them to a great degree of strength and agility. It is said that men were at first fed on figs, a proof of which we have from their nutritious quality: however, in this respect they were soon found to fall short of animal food; and thus we see, that men, in some measure, will work in proportion to the quality of their food. The English labour more than the Scots; and wherever men are exposed to hard labour, their food should be animal. — Animal food, although it gives strength, yet loads the body; and Hippocrates long ago observed, that the athletic habit, by a small increase, was exposed to the greatest hazards. Hence it is only proper for bodily labours, and entirely improper for mental exercises; for whoever would keep his mind acute and penetrating, will exceed rather on the side of vegetable food. Even the body is oppressed with animal food; a full meal always produces drowsiness, laziness, and yawning; and hence the feeding of gamblers, whose mind must be ready to take advantage, is always performed by avoiding a large quantity of animal food. Further, With regard to the strength of the body, animal food, in the first stage of life, is hardly necessary to give strength: in manhood, when we are exposed to active scenes, it is more allowable; and even in the decline of life, some proportion of it is necessary to keep the body in vigour. There are some diseases which come on in the decay of life, at least are aggravated by it; among these the most remarkable is the gout. This, when it is in the system, and does not appear with inflammation in the extremities, has pernicious effects there, attacking the lungs, stomach, head, &c. Now, to determine this to the extremities, a large proportion of animal food is necessary, especially as the person is commonly incapable of much exercise.

Animal food, although it gives strength, is yet of many hazards to the system, as it produces plethora and all its consequences. As a stimulus to the stomach and to the whole system, it excites fever, urges the circulation, and promotes the perspiration. The system, however, by the repetition of these stimulants, is soon worn out; and a man who has eaten too much the athletic diet, is either early carried off by inflammatory diseases, or, if he takes exercise sufficient to render that diet salutary, such an accumulation is made of putrescent fluids, as in his after life lays a foundation for the most iner- terate chronic distempers. Therefore it is to be questioned, whether we should desire this high degree of bodily strength, with all the inconveniences and dangers attending it. Those who are chiefly employed in mental researches, and not exposed to too much bodily labour, should always avoid an excess of animal food. There is a disease which seems to require animal food, viz. the hysterical or hypochondridic; and which appears to be very much a-kin to the gout, affecting the alimentary canal. All people affected with this disease are much disposed to ascension: which sometimes goes so far, that no other vegetable but bread can be taken in, without occasioning the worst consequences. Here then we are obliged to prescribe an animal diet, even to those of very weak organs; for it generally obviates the symptoms. However, severe instances of ascency in excess have been produced by a long-continued use of this diet, which it is always unlucky to be obliged to prescribe; and when it is absolutely necessary to prescribe, it should be joined with as much of the vegetable as possible, and when a cure is performed we should gradually recur to that again.

2. Next, let us consider the vegetable diet. The chief inconvenience of this is difficulty of assimilation; which, however, in the vigorous and exercised, will not be liable to occur. In warm climates, the assimilation of vegetable aliment is more easy, so that there it may be more used, and when joined to exercise gives a pretty tolerable degree of strength and vigour; and though the general rule be in favour of animal diet, for giving strength, yet there are many instances of its being remarkably produced from vegetable. Vegetable diet has this advantage, that it whets the appetite, and that we can hardly suffer from a full meal of it. Besides
the disorders it is liable to produce in the 
prime 
xix,
and its falling short to give strength, there seem to be
no bad consequences it can produce to the blood ves-
sels; for there is no instance where its peculiar acri-
momny was ever carried there, and it is certainly less 
putrefiable than animal food; nor, without the utmost 
indolence, and a sharp appetite, does it give plethora,
or any of its consequences: so that we cannot here but 
conclude, that a large proportion of vegetable food is 
useful for the generality of mankind.

There is no error in this country more dangerous, 
or more common, than the neglect of bread: for it is 
the safest of vegetable alimenta, and the best corrector 
of animal food; and, by a large proportion of this 
alone, its bad consequences, when used in a hypochon-
driac state, have been obviated. The French appar-
ently have as much animal food on their tables as the 
British; and yet, by a greater use of bread, and the 
dried acid fruits, its bad effects are prevented; and 
therefore bread should be particularly used by the 
English, as they are so voracious of animal food. Ve-
getable food is not only necessary to secure health, but 
long life: and, as we have said, in infancy and youth 
we should be confined to it mostly: in manhood, and 
decay of life, use animal food; and near the end, ve-
teable again.

There is another question much agitated, viz. What 
are the effects of variet in food? Is it necessary and 
allowable, or universally hurtful? Variety of a certain 
kind seems necessary; as vegetable and animal foods 
have their mutual advantages, tending to correct each 
other. Another variety, which is very proper, is that 
of liquid and solid food, which should be so managed 
as to temper each other; and liquid food, especially 
of the vegetable kind, is too ready to pass off before it 
is properly assimilated, while solid food Fres of a long 
stay. But this does not properly belong to the question, 
whether variety of the same kind is necessary or pro-
per, as in animal foods, beef, fish, fowl, &c. It doth 
not appear that there is any inconvenience arising from 
this mixture, or difficulty of assimilation, provided a 
moderate quantity be taken. When any inconvenience 
does arise, it probably proceeds from this, that one of 
the particular substances in the mixture, when taken 
by itself, would produce the same effects; and indeed it 
would appear that this effect is not heightened by the 
mixture, but properly abated by it. There are few 
exceptions to this, if any, e.g. taking a large propor-
tion of ascenscent substances with milk. The coldness, 
&c. aci1ditiy, flatulency, &c. may appear; and it is pos-
sible that the coagulum, from the ascenscent of the 
vegetables, being somewhat stronger induced, may give 
occasion to too long retention in the stomach, and to 
acidity in too great degree. Again, the mixture of fish 
and milk often occasions incivences. The theory of 
this is difficult, though, from universal consent, it 
must certainly be just. Can we suppose that fish, give 
occasion to any coagulum as runnet? If it does so, it 
may produce bad effects. Besides, fishes approach 
somewhat to vegetables, in giving little stimulus; and 
are accused of the same bad effects as these, viz. bring-
ing on the cold fit of fever.

Thus much may be said for variety. But it also 
has its disadvantages, provoking to gluttony; this, 
and the art of cookery, making men take in more than 
they properly can digest: and hence, perhaps very 
justly, physicians have universally almost preferred sim-
plicity of diet; for, in spite of rules, man's eating will 
only be measured by his appetite, and satiety is sooner 
produced by one than by many substances. But this 
is so far from being an argument against variety, that 
it is one for it, as the only way of avoiding a full meal 
of animal food, and its bad effects, is by presenting a 
quantity of vegetables. Another mean of preventing 
the bad effects of animal food, is to take a large pro-
portion of liquid; and hence the bad effects of animal 
food are less felt in Scotland, on account of their drink-
ing much with it, and using broths, which are at once 
excellent correctors of animal food and prevents of 
glutony.

With regard to the difference between animal 
foods, properly so called, the first regards their solubi-
ity, depending on a lax or firm texture of their different 

cinds.

I. SOLUBILITY of animal food seems to deserve less 
attention than is commonly imagined; for there are 
many instances of persons of a weak stomach, incapable 
of breaking down the texture of vegetables, or even of 
dissolving a light pudding, to whom hung beef, or a 
piece of ham, was very grateful and easily digested.
None of the theories given for the solution of 
animal food in the human stomach seem to have explained 
the process sufficiently. Long ago has been discarded 
the supposition of an active corrosive menstruum there; 
and also the doctrine of trituration, for which, indeed 
there seems no mechanism in the human body; and, 
till lately, physicians commonly agreed with Boerhaave 
in supposing nothing more to be necessary than a wa-
tery menstruum, moderate heat, and frequent agita-
tion. This will account for solution in some cases, but 
ot entirely. Let us try to imitate it out of the body 
with the same circumstances, and in ten times the time 
in which the food is dissolved in the stomach we shall 
not be able to bring about the same changes. Take 
the coagulated white of an egg, which almost every 
body can easily digest, and yet no artifice shall be able 

to dissolve it. Hence, then, we are led to seek another 
cause for solution, viz. fermentation; a notion, indeed, 
formerly embraced, but on the introduction of me-
chnical philosophy, industriously banished, with every 
other supposition of that process taking place at all in 
the animal economy.

Many of the ancients imagined this fermentation to 
be putrefactive. But this we deny, as an acid is pro-
duced; though hence the fermentation might be reck-
oned the vinous; which, however, seems always to be 

morbide. Neither indeed is the fermentation purely 
acetic, but modified by putrefcence; for Pringle has 
observed, that animal matters raise and even expedite the 
acetic process. The fermentation, then, in the stom-
ach is of a mixed nature, between the acetic and the 
putrefactive, mutually modifying each other; though, 
indeed, in the intestines, somewhat of the putrefactive 
seems to take place, as may be observed from the state 
of the feces broke down, and from the little disposition 
of such substances to be so, which are not liable to the 
putrefactive process, as the firmer parts of vegetables, 
&c. Upon this view solution seems to be extremely 


easy, and those substances to be most easily broken down 
which
Food. which are most subject to putrefaction. See Anatomy, and Gastric Juice.

1. There is a difference of solubility with respect to the manuclation of animal food, for which bread is extremely necessary, in order to keep the more slippery parts in the mouth till they be properly comminuted. From want of proper manuculation persons are subject to eructations; and this more frequently from the firm vegetable foods, as apples, almonds, &c. than from the animal, though, indeed, even from animal food, very tendinous, or swallowed in unbroken masses, such sometimes occur. Manuculation is so much connected with solution, that some, from imperfectly performing that, are obliged to belch up their food, remanuculate it, and swallow it again before the stomach may dissolve it, or proper nourishment be extracted. Another proof of our regard to solubility, is our rejecting the firmer parts of animal food, as bull beef, and generally carnivorous animals.

2. In effect, with regard to solubility seem also to be the foundation of our choice between fat and lean, young and old meats. In the lean although perhaps a single fibre might be sufficiently tender, yet these, when collected in fasciculae, are very firm and compact, and of difficult solution; whereas in the fat there is a greater number of vessels, a greater quantity of juice, more interposition of cellular substance, and consequently more solubility. Again, in young animals, there is probably the same number of fibres as in the older, but these more connected: whereas, in the older, the growth depending on the separation of these, and the increase of vessels and cellular substance, the texture is less firm and more solubile; which qualities, with regard to the stomach, are at that time too increased, by the increased alkalescence of the animal. To this also may be referred our choice of castrated animals, viz., on account of their disposition to fatten after the operation.

3. It is with a view to the solubility, that we make a choice between meats recently killed, and those which have been kept for some time. As soon as meat is killed, the putrefactive process begins; which commonly we allow to proceed for a little, as that process is the most effectual breaker down of animal matters, and a great assistance to solution. The length of time during which meat ought to be kept, is proportioned to the meat's tendency to undergo the putrid fermentation, and the degree of those circumstances which favour it: Thus, in the torrid zone, where meat cannot be kept above four or five hours, it is used much more recent than in these northern climates.

4. Boiled or roasted meats create a difference of solution. By boiling we extract the juices interposed between the fibres, approximate them more to each other, and render them of more difficult solubility; which is increased too by the extraction of the juices, which are much more alkalescent than the fibres: but when we want to avoid the stimulus of alkalescent food, and the quick solution, as in some cases of disease, the roasted is not to be chosen. Of roasted meats it may be asked, which are more proper, those which are most or least roasted? That which is least done is certainly the most soluble: even raw meat is more soluble than dressed, as Dr. Cullen was the person who from necessity was obliged to eat such. But at the same time they are very soluble, they are very liable to that, wherever we want to avoid alkalescence; primum vit, the most roasted meats should be.

Those who throw away the broths of kindly very improperly; for, besides their supplying from their greater alkalescence they incresce quantity of the meat. Here we shall observe, blood has been thought insoluble. Undoubtedly very nutritious; and though out of the body, white of eggs, it seems very insoluble; yet too, in the body it is commonly easily digested very properly forbids it the.israelites, in some countries it is highly alkalescent; and when it was used in great quantity, its more frequent: but to a moderate use it, in climates, no such objection takes place.

5. Solubility is varied from another seeming, the juice of animal bodies. Young animal appears more solubile than old, not only is the composition and firmness of texture is, but also their greater viscosity of juice. And is more common, than to be longer operate full meal of meat, than from the same quantity &c. Upon account, too, of their greater juice, are the tendinous and ligamentous animals longer retained than the purely muscular; as on account of their firmness of texture. In whose muscular parts are exceedingly tender, account of their juicy viscosity, longer is the stomach. And eggs, too, which are so nourishing, have the same effect, and cannot in great quantity: For the stomach is sensitive to gelatinous substances; and by this nature perhaps taught us, as it were by instinct, to limit ourselves in the quantity of edible substances.

6. With regard to solution, we must take an of animal food; which, when tolerably per, least putrid, acts as a sort of preservative, and, by diminishing the number of the fibres, render them more soluble; last account is the lean of fat meat more solved than other lean. But when the added to much heat, this oil is separated, leaving the solid parts less easily soluble, and becoming the astringent, raisenost, and of difficult mixture in the stomach. Fried meats, from the reasons now of baked meats, for the same, as well as for the of the paste, are preparations which diminish the solubility of the food. From what has been said, paration of food by fattening it, and keeping some time after being killed, although it may to glutony, will yet, it must be confessed, be solution of the food.

II. The second difference of animal food is regard to alkalescence.

Of this we have taken a little notice above the head of Solubility.

1. From their too great alkalescence we all avoid the carnivorous animals, and the which live on insects, are admitted into our table.
no man, without exposure, can live upon these alone for any length of time. Fishes, too, are an exception to this rule, living almost universally on each other. But in these the alkalescence does not proceed so far; whether from the viscosity of their juice, their want of heat, or some peculiarity in their economy, is not easy to determine.

2. Alkalescence is determined by difference of age. The older animals are always more alkalescent than the young, from their continual progress to putrefaction. Homburg always found in his endeavours to extract an acid from human blood, that more was obtained from the young than from the old animals.

3. A third circumstance which varies the alkalescence of the food, is the wildness or tameness of the animal; and this again seems to depend on its exercise. Dr Cullen knew a gentleman who was fond of cats for food; but he always used to feed them on vegetable food, and kept them from exercise; and in the same manner did the Romans rear up their rats, when intended for food. In this way the flesh of the partridge and the hen seems to be much the same; only, from its being more on the wing, the one is more alkalescent than the other. Again, tame animals are commonly used without their blood; whereas the wild are commonly killed in their blood, and upon that account, as well as their greater exercise, are more alkalescent.

4. The alkalescence of food may be determined from the quantity of volatile salt it affords. The older the meat is, it is found to give the greater proportion of volatile salt.

5. The alkalescence of aliment may also, in some measure, be determined from its colour; the younger animals being white and less alkalescent. We also take a mark from the colour of the gravy poured out, according to the redness of the juices judging of the animal's alkalescence.

6. The relish of food is found to depend much on its alkalescence, as does also the stimulus it gives and the fever it produces in the system. These effects are also complicated with the viscosity of the food, by which means it is longer detained in the stomach, and the want of alkalescence supplied.

Having mentioned animal food as differing in solubility and alkalescence, which often go together in the same subject, we come to the third difference, viz.

III. QUANTITY of Nutriment. Which is either absolute or relative: absolute with respect to the quantity it really contains, sufficient powers being given to extract it; relative, with respect to the assimilatory powers of those who use it. The absolute nutriment is of some consequence: but the relative, in the robust and healthy, and except in cases of extraordinary weakness, may, without much inconvenience, be disregarded. In another case is the quantity of nourishment relative, viz. with regard to its perspirability; for if the food is soon carried off by the excretions, it is the same thing as if it contained a less proportion of nourishment. For, giving more fluid, that which is longer retained affords most; and, for the repair of the solids, that retention also is of advantage. Now, gelatinous substances are long retained; and, besides, are themselves animal substances dissolved; so that, both absolutely and relatively, such substances are nutritious. Of this kind are eggs, shell fish, &c. In adults, though it is disputed whether their solids need any repair, yet at any rate, at this period, fluid is more required; for this purpose the alkalescent foods are most proper, being most easily dissolved. They are, at the same time, the most perspirable; on one hand that alkalescence leading to disease, while on the other their perspirability obviates it. Adults, therefore, as writers justly observe, are better nourished on the alkalescent; the young and growing, on gelatinous foods. All this leads to a comparison of young and old meats; the first being more gelatinous, and the last more alkalescent. This, however, by experience, is not yet properly ascertained. Mr Geoffroy is the only person who has been taken up with the analysis of foods. See Memoires de l'Academie, 1731 & 1732. His attempt was certainly laudable, and in some respects useful performed; but, in general, his experiments were not sufficiently repeated, nor are indeed sufficiently accurate. He has not been on his guard against the various circumstances which affect meats; the cow-kind liking a moist succulent herbage, which is not to be got in warm climates; while the sheep are fond of dry food, and thrive best there. Again, some of his experiments seem contradictory. He says, that veal gives more solution than beef, while lamb gives less than mutton, which is much to be doubted. If both he Sanctorius had examined English beef, the result probably would have been very different as to its perspirability, &c. Besides, Mr Geoffroy has only analyzed beef and veal when raw; has made no proper circumstantial comparisons between quadrupeds and birds; and has examined these last along with their bones, and not their muscles, &c. by themselves, as he ought to have done, &c. If a set of experiments of this kind were properly and accurately performed, they might be of great use; but at present, for the purpose of determining our present object, we must have recourse to our alkalescence, solubility, &c.

IV. The fourth difference of animal food is, The Nature of the Fluids they afford. The whole of this will be understood from what has been said on alkalescence; the fluid produced being more or less dense and stimulating, in proportion as that prevails.

V. The fifth difference of animal foods is with respect to their Perspirability. The sum of what can be said on this matter is this, that such foods as promote an accumulation of fluid in our vessels and dispose to phlethora, are the least perspirable, and commonly give most strength; that the more alkalescent foods are the most perspirable, though the viscous and alkalescent may attain the same property by long retention in the system. The authors on perspirability have determined the perspiration of foods as imperfectly as Mr Geoffroy has done the solubility, and in a few cases only. We must not lay hold on what Sanctorius has said on the perspirability of mutton, because he has not examined in the same way other meats in their perfect state; far less on what Kail says of oysters, as he himself was a valetudinarian, and consequently an unfit subject for such experiments, and probably of a peculiar temperament.

As to the effects of Food on the Mind, we have already hinted at them above. It is plain, that deli-
FOOD

Food

FOOOTH, an island in the Red sea; situated, according to the observations of Mr Bruce, in N. Lat. 13° 59' 43". It is described by him as about five miles in length from north to south, though only nine in circumference. It is low and sandy in the southern part, but the north rises in a black hill of considereable height. It is covered with a kind of bent grass, which never arises at any great length by reason of want of rain and the constant browsing of the goats. There are great appearances of the black hill having once been a volcano; and near the north cape the ground sounds hollow like the Solfatara in Italy.

There are a vast number of beautiful fish met with upon the coasts, but few fit for eating; and our traveller observed, that the most beautiful were the most noxious when eaten; none indeed being satisfactory excepting those which resembled the fish of the northern seas.

There are many beautiful shell-fish, as the concha veras, of several colours and sizes; sea urchins, &c. Sponges are likewise found all along the coast. There are also pearls, but neither large nor of good water; in consequence of which they sell at no great price. They are produced by a species of bivalve shells. Several large shells, from the fish named bisset, are met with upon stones of ten or twelve tons weight along the coast. They are turned upon their faces and sunk into the stones, as into a paste, the stone being raised all about them in such a manner as to cover the edge of the shell; "a proof (says Mr Bruce) that this stone must some time lately have been soft or liquefied; for had it been long age, the sun and air would have worn the surface of the shell; but it seems perfectly entire, and is set in that hard brown rock as the stone of a ring is in a golden chasing."—The water in this island is very good.

The inhabitants of Foootht are poor fishermen of a swarthy colour; going naked, excepting only a ring about their waist. They have no bread but what they procure in exchange for the fish they catch. What they eat in this manner is called segan. But besides this they catch another species, which is flat, with a long tail, and the skin made use of for shagreen, of which the handles of knives and swords are made. There is a small town on the island, consisting of about 30 huts, built with faggots of bent grass or spartum, supported by a few sticks, and thatched with grass of the same kind of which they are built.

FOOT, a part of the body of most animals wherein they stand, walk, &c. See ANATOMY.

Foot, in the Latin and Greek poetry, a metre or measure, composed of a certain number of long and short syllables.

These feet are commonly reckoned 28: of which some are simple, as consisting of two or three syllables, and therefore called dissyllabic or trisyllabic feet; others are compound, consisting of four syllables, and are therefore called tetrasyllabic feet.

The dissyllabic feet are four in number, viz. the pyrrichius, spondeus, iambus, and trocheus. See PYRRHICIUS, &c.

The trimetrical feet are eight in number, viz. the dactylus, anapestus, tribrachys, molossus, amphibrachys, amphimacer, bacchius, and antibacchius. See DACTYL, &c.

The tetrasyllabic feet are in number 16, viz. the proceleusmaticus, dispondeus, choriambus, antiaspasus, diambus, diehoreus, ionicus a major, ionicus a minor, epistrius pristus, epistrius secundus, epistrius tertius, epistrius
FOOT is also a long measure consisting of 52 inches. Geometricians divide the foot into 10 digits, and the digit into 10 lines.

Foot-Holt, the name of a disorder peculiar to sheep. It is occasioned by an insect, which when it comes to a certain maturity, resembles a worm of two, three, or four inches in length. See FARRAR Index.

Foot-Square, is the same measure both in breadth and length, containing 144 square or superficial inches.

Cubic or Solid Foot, is the same measure in all the three dimensions, length, breadth, and depth or thickness, containing 1728 cubic inches.

Foot of a Horse, in the manage, the extremity of the leg, from the coronet to the lower part of the hoof.

Foot Level, among artificers, an instrument that serves as a foot rule, a square, and a level. See Level, Rule, and Square.

Foote, Samuel, Esq., the modern Aristophanes, was born at Truro, in Cornwall; and was descended from a very ancient family. His father was member of parliament for Tiverton, in Devonshire, and enjoyed the post of commissioner of the prize office and fine-contract. His mother was heiress of the Dinely and Gooder family. In consequence of a fatal misunderstanding between his two brothers, Sir John Dinely Gooder, Bart., and Samuel Gooder, Esq., captain of his majesty's ship the Ruby, which ended in the death of both, a considerable part of the Gooder estate, which was better that 5000l. per annum, descended to Mr. Foote.

He was educated at Worcester College, Oxford, which owed its foundation to Sir Thomas Cokes Windred, Bart., a second cousin of our author's. On leaving the university, he commenced student of law in the Temple; but as the dryness of this study did not suit the liveliness of his genius, he soon relinquished it. He married a young lady of a good family and some fortune; but their tempers not agreeing, a perfect harmony did not long subsist between them. He now launched into all the fashionable foibles of the age, gaming not excepted, and in a few years spent his whole fortune. His necessities led him to the stage, and he made his first appearance in the character of Othello. He next performed Fowell of with much more applause; and this, indeed, was ever after one of his capital parts. He attempted Lord Foppington likewise, but professingly gave it up. But as Mr. Foote was never a capital actor in the plays of others, his salary was very unequal to his gay and extravagant turn; and he contracted debts which forced him to take refuge within the verge of the town. But at this occasion, he relieved his necessities by the following stratagem. Sir Fr., a.D.—1 had long been his intimate friend, and had dissipated his fortune by similar extravagance. Lady N.—a.—P.—let, who was likewise an intimate acquaintance of Foote's, and who was exceedingly rich, was fortunately at that time bom upon a matrimonial scheme. Foote strongly recommended to her to consult upon this momentous affair the conjurer in the Old Bailey, whom she represented as a man of surprising skill and penetration. He employed an acquaintance of his own to persuade the conjurer; who depicted Sir Fr., a.D.—1 at full length; described the time when, the place where, and the dress in which she would see him. The lady was so struck with the coincidence of every circumstance, that she married D.—1 in a few days. For this service Sir Francis settled an annuity upon Foote; and this enabled him once more to emerge from obscurity.

In 1747 he opened the little theatre in the Haymarket, taking upon himself the double character of author and performer; and appeared in a dramatic piece of his own composing, called the Diversion of the Morning. The piece consisted of nothing more than the exhibition of several characters well known in real life; whose manner of conversation and expression this author very happily hit off in the diction of his drama, and still more happily represented on the stage, by an exact and most amusing imitation, not only of the manner and tone of voice, but even of the very persons, of those whom he intended to take off. In this performance, a certain physician, Dr L.—a, well known for the oddity and singularity of his appearance and conversation, and the celebrated Chevalier Taylor, who was at that time in the height of his popularity, were made objects of Foote's ridicule; the latter, indeed very deservedly: and, in the concluding part of his speech, under the character of a theatrical director, Mr. Foote took off, with great humour and accuracy, the several styles of acting of every principal performer on the English stage. The performance at first met with some opposition from the civil magistrates of Westminster, under the sanction of the act of parliament for limiting the number of playhouses, as well as from the jealousy of one of the managers of Drury-lane playhouse; but the author being patronized by many of the principal nobility, and other persons of distinction, this opposition was overruled: and having altered the title of his performance, Mr. Foote proceeded, without further molestation, to give Tea in a Morning to his friends, and represented it through a run of 40 mornings to crowded and splendid audiences.

The ensuing season he produced another piece of the same kind, which he called An Auction of Pictures. In this performance he introduced several new and popular characters; particularly Sir Thomas de Veil, then the sitting justice of peace for Westminster, Mr. Cock the celebrated auctioneer, and the equally famous Orator Henley. This piece also had a very great run.

His Knights, which was the production of the ensuing season, was a performance of somewhat more dramatic regularity; but still, although his plot and characters seemed less immediately personal, it was apparent that he kept some particular real persons strongly in his eye in the performance, and the town took upon themselves to fix them where the performance appeared to be the most striking. Thus Mr. Foote continued from time to time to select, for the entertainment of the public, such characters, as well general as individual, as seemed most likely to engage their attention. His dramatic pieces, exclusive of the interlude called Party in Patience, are as follows: Taste, the Knights, the Author, the Englishman in Paris, the Englishman returned from Paris, the Mayor of Garret, the Lion, the Patron, the Miner, the Orator and the Commissary.
Commissary, The Devil upon two Sticks, The Lame Lover, The Maid of Bath, The Nabob, the Conservers, The Capuchin, the Bankrupt, and an unfinished comedy called The Slanderer. All these works are only to be ranked among the petits pieces of the theatre. In the execution they are somewhat loose, negligent, and unfinished; the plots are often irregular, and the catastrophes not always conclusive; but with all these deficiencies, they contain more strength of character, more strokes of keen satire, and more touches of temporary humour, than are to be found in the writings of any other modern dramatist. Even the language spoken by his characters, incorrect as it may sometimes seem, will on a closer examination be found entirely dramatic; as it abounds with those natural minuitions of expression which frequently form the very basis of character, and which render it the truest mirror of the conversation of the times in which he wrote.

In the year 1766, being on a party of pleasure with the late duke of York, Lord Maccorvarough, and Sir Francis Delaval, Mr Foote had the misfortune to break his leg, by a fall from his horse; in consequence of which he was compelled to undergo an amputation. This accident so sensibly affected the duke, that he made a point of obtaining for Mr Foote a patent for life; whereby he allowed to perform, at the little theatre in the Haymarket, from the 15th of May to the 15th of September every year.

He now became a greater favourite of the town than ever: his very laughable pieces, with his more laughable performance, constantly filled his house; and his receipts were sometimes almost incredible. Parnassus was enriched by his characters; incorrect as it may sometimes seem; he was visited by the first nobility, and he was sometimes honoured even by royal guests.

The attack made upon his character by one of his domestics, whom he had dismissed for misbehaviour, is too well known to be particularized here. Suffice it to say, he was honourably acquitted of that charge: but it is believed by some, that the shock which he received from it accelerated his death; others pretend, that his literary altercation with a certain duchess, or rather her agents, much affected him, and that from that time his health declined. It is probable, however, that his natural volatility of spirits could scarcely fail to support him against all impressions from either of these quarters.

Mr Foote, finding his health decline, entered into an agreement with Mr Colman for his patent of the theatre; according to which, he was to receive from Mr Colman, 260l. per annum, besides a stipulated sum whenever he chose to perform. Mr Foote was to have two or three times in some of the most admired characters; but being suddenly affected with a paralytic stroke one night whilst upon the stage, he was compelled to retire. He was advised to bathe; and accordingly retired to Brighthelmstone, where he apparently recovered his former health and spirits, and was what is called the fiddler of the company who resorted to that agreeable place of amusement. A few weeks before his death, he returned to London; but, by the advice of his physicians, set out with an intention to spend the winter at Paris and in the south of France. He had got no farther than Dover, when he was suddenly attacked by another stroke of the palsy, which in a few hours terminated his existence. He died the 21st of October 1777, in the 56th year of his age, and was privately interred in the cloisters of Westminster abbey.

FOP, probably derived from the cuppa of Ha, applied in the first satire of his first book to the extravagant Nervius, is used among us to denote that person who cultivates a regard to adventurous enterprise and beauty to excess.

FORAMEN, in Anatomy, a name given to a small aperture or perforation in diverse parts of the body: as, 1. The external and internal foramens of the ovum or skull. 2. The foramens in the upper jaw. 3. Foramen lachrymale. 4. Foramen mastoideum.

Foramen Ovalis, an oval aperture or passage in the heart of a foetus, which closes up after birth arises from the coronal vein, near the right union, and passes directly into the left auricle of the heart, for the circulation of the blood in the foetus in the same manner as the infant breathes, and the lungs are exercised as in this the foetus differs from the adult; it is almost all anatomists, Mr Cheselden excepted, agree, that the foramen ovale has sometimes been found in adults. See Pouls.

Forbes, Duncan, Esq. of Calcluden, ied a complaint of the court of session in Scotland, was in the year 1685. In his early life, he was known in a family remarkable for hospitality; which, led him afterwards to a frugal indulgence in social amusements. His natural disposition inclined him to that art, but the accidental discovery of various gardens, the advice of his friends he supplied himself to. He directed his studies particularly to the civil law, which he made a quick progress, and in 1709 was called to the bar. From 1722 to 1737, he was a member of the commons for Nairn, and Forres. In 1725, he was made king's counsel; and in 1737 lord president of the court of sessions. In the rebellion which broke out in Scotland in 1745, and 1745 he espoused the royal cause; but with the prudence and moderation did he conduct himself with delicate conjuncture, that not a whisper was ever heard to his prejudice. The glory he acquired in advancing the prosperity of his country, and in continuing to re-establish peace and order, was the only return of his services. He had been an admirer of his public service, and in a private capacity, he had a lively sense of religion, without the least taint of superstition; and his charity was extended to every sect and denomination of religionists indiscriminately. He was well versed in the Hebrew language; and wrote in a flowing and elegant style, concerning religious and moral subjects, some important discoveries in theology and philosophy, and concerning the sources of incorruptibility. He died in 1747, in the 62d year of his age; and his works have since been published in two volumes octavo.

Force, in Philosophy, denotes the cause.
change in the state of a body, when, being at rest, it begins to move, or has a motion which is either not uniform or not direct. While a body remains in the same state, either of rest or of uniform and rectilinear motion, the cause of its remaining in such a state is in the nature of the body, and it cannot be said that any extrinsic force has acted on it. This internal cause or principle is called inertia.

Mechanical forces may be reduced to two sorts: one of a body at rest, the other of a body in motion. The force of a body at rest is the cause where we conceive to be the body lying still on a table, or hanging by a rope, or supported by a spring, &c. and this is called by the names of pressure, tension, force, or vis aberrans, societatis, contusus movendi, comamen, &c. To this class also of forces we must refer centripetal and centrifugal forces, though they reside in a body in motion; because these forces are homogeneous to weights, pressures, or tensions of any kind.

The force of a body in motion is a power residing in that body so long as it continues its motion; by means of which it is able to remove obstacles lying in its way; to lesson, destroy, or overcome the force of any other moving body which meets it in an opposite direction; or to surmount any dead pressure or resistance, as tenacity, gravity, friction, &c. for some time; but which will be lessened or destroyed by such resistance as lessens or destroys the motion of the body. This is called moving force, vis motrix, and by some late writers vis viva, to distinguish it from the vis aberrans spoken of before; and by these apppellations: hence a different name is understood by all mathematicians; namely, that power of displacing, of overcoming opposite moving forces, or of overcoming any dead resistance, which resides in a moving body, and which, in whole or in part, continues to accompany it, so long as the body moves. See MECHANICS.

We have several curious as well as useful observations in Desaguilers's Experimental Philosophy, concerning the comparative forces of men and horses, and the best way of applying them. A horse draws with the greatest advantage when the line of direction is level with his breast; in such a situation, he is able to draw 200 lb. eight hours a-day, walking about two miles and a half an hour. And if the same horse is made to draw 240 lb. he can work but six hours a-day, and cannot go quite so fast. On a carriage, indeed, where friction alone is to be overcome, a middling horse will draw 200 lb. But the best way to try a horse's force, is by making him draw up out of a well, over a single pulley or roller; and, in such a case, one horse with another will draw 300 lb. as already observed.

Five men are found to be equal in strength to one horse, and can, with as much ease, push round the horizontal beam of a mill, in a walk 40 feet wide; whereas three men will do it in a walk only 10 feet wide.

The worst way of applying the force of a horse, is to make him carry or draw up hill; for if the hill be steep, three men will do more than a horse, each man climbing up faster with a burden of 100 lb. weight, than a horse that is loaded with 300 lb.; a difference which is owing to the position of the parts of the human body being better adapted to climb than those of a horse.

On the other hand, the best way of applying the force of a horse, is in a horizontal direction, whereas a man can exert least force; thus a man weighing 140 lb. and drawing a boat along by means of a rope coming over his shoulders, cannot draw above 27 lb. or exert above one-seventh of the part of the force of a horse employed to the same purpose.

The very best and most effectual posture in a man, in the art of rowing, in which he not only acts with more muscles at once for overcoming the resistance, than in any other position; but as he pulls backward, the weight of his body assists by way of lever. See Desaguilers, Exp. Phil. vol. i. p. 241, where we have several other observations relative to force acquired by certain positions of the body, from which that account for most feats of strength and activity. See also a Memoire on this subject by M. de la Hire, in Mem. Roy. Acad. Sc. 1629; or in Desaguilers, Exp. Sc. 267, &c. who has published a translation of part of it, with remarks.

Citizen Bognerz has invented an instrument for ascertaining the relative strength of men and animals, for an account of which, see Dynamometer; and for a fuller description of the apparatus, the reader may consult the original paper on the subject in Jour. de l'Ecole Polytech. vol. ii. or the translation in Phil. Mag. vol. i.

FORCE, in Law, signifies any unlawful violence offered to things or persons, and is divided into simple and compound. Simple force is what is so committed, that it has no other crime attending it, as where a person by force enters another's possession, without committing any other unlawful act. Compound force, is where some other violence is committed, with such an act which of itself alone is criminal; as if one enters by force into another's house, and there kills a person, or ravishes a woman. There is likewise a force implied in law, as in every trespass, rescue, or misdemeanor, and an actual force with weapons, number of persons, &c.—Any person may lawfully enter a tavern, inn, or victualling-house; so may a landlord his tenant's house to view repairs, &c. But if, in these cases, the person that enters commits any violence or force the law will intend that he entered for that purpose.

FORCEPS, in Surgery, &c. a pair of scissors for cutting-off, or dividing, the fleshly membranous parts of the body, as occasion requires. See SURGERY.

FORCER, in Mechanics, is properly a piston, without a valve. For by drawing up such a piston, the air is drawn up, and the water follows; when pushing the piston down again, the water, being prevented from descending by the lower valve, is forced up to any height above, by means of a side branch between the two.

FORCIBLE ENTRY, is a violent and actual entry into houses or lands; and a forcible detainer, is where one by violence withholds the possession of lands, &c. so that the person who has a right of entry is barred, or hindered, therefrom.

At common law, any person that had a right to enter into lands, &c. might retain possession of it by force. But this liberty being abused, to the breach of the peace, it was therefore found necessary that the same should be restrained: Though, at this day, he who
FOR a woman of estate, is felony. For by the statute 3 H. VII. c. 2. it is enacted, "That if any persons shall take away any woman having lands or goods, or that be heir apparent to her ancestor, by force and against her will, and marry or defile her; the takers, procurers, abettors, and receivers, of the woman taken away against her will, and knowing the same, shall be deemed principal felons; but as to procurers and accesiories before the fact, they are to be excluded the benefit of clergy, by 39 Elizabeth, c. 9. The indictment on the statute Hen. VII. is expressly to set forth, that the woman taken away had lands or goods, or was heir apparent; and also that she was married or defiled, because no other case is within the statute; and it ought to allege that the taking was for lese. It is no excuse that the woman at first was taken away with her consent; for if she afterwards refuse to continue with the offender, and be forced against her will, she may from that time properly be said to be taken against her will; and it is not material whether a woman so taken away be at last married or defiled with her own consent or not, if she was under force at the time; the offenders being in both cases equally within the words of the act.

Those persons who, after the fact, receive the offender, are but accessories after the offence, according to the rules of common law; and those that are only privy to the damage, but not parties to the forcible taking away, are not within the act H. P. C. 119. A man may be indicted for taking away a woman by force in another country; for the continuance of the force in any country, amounts to a forcible taking there. Ibid. Taking away any woman child under the age of 16 years and unmarried, out of the custody and without the consent of the father or guardian, &c., the offender shall suffer fine and imprisonment; and if the woman agrees to any contract of matrimony with such person, she shall forfeit her estate during life, to the next of kin, to whom the inheritance should descend, &c. stat. 4 & 5 P. & M. c. 8. This is a force against the parents; and an information will lie for inducing a young man or woman from their parents, against their consents, in order to marry them, &c. See MARRIAGE.

FORCING, in Gardening, a method of producing ripe fruits from trees before their natural season. See Gardening Index.

FORCING, in the wine trade, a term used by the wine coopers, for the fining down wines, and rendering them fit for immediate draught. The principal inconvenience of the common way of fining down the white wines with isinglass, and the red with whites of eggs, is the slowness of the operation; these ingredients not performing their office in less than a week, or sometimes a fortnight, according as the weather proves favourable, cloudy or clear, windy or calm: this appears to be matter of constant observation. But the wine merchant frequently requires a method that shall, with certainty, make the wines fit for tasting in a few hours. A method of this kind there is; but it is kept in a few hands a valuable secret. Perhaps it depends upon a prudent use of a tartarised spirit of wine, and the common forcing, as occasion is, along with gypsum, as the principal; all which are to be well stirred about in the wine, for half an hour before it is suffered to rest.

FORDOUN, JOHN OF, the father of Scottish history, flourished in the reign of Alexander III. towards the end of the 13th century. But of his life there is nothing known with certainty, though there was not a monastery that possessed not copies of his work. The first five books of the history which bears his name were written by him: the rest were fabricated from materials left by him, and from new collections by different persons. There is a manuscript in vellum of Fordoun's History, in the library of the university of Edinburgh.

FORDWICH, a town of Kent, called in Doomsday Book "the little borough of Fordwich," is a member of the port of Sandwich, and was anciently incorporated by the style of the barons of the town of Fordwich, but more lately by the name of the mayor, jurats, and commonalty, who enjoy the same privileges as the cinque ports. This place is famous for excellent trout in its river Stour.

END OF THE EIGHTH VOLUME.
DIRECTIONS FOR PLACING THE PLATES OF VOL. VIII.

**PART I.**

<table>
<thead>
<tr>
<th>Plate CC. CCL. to face</th>
<th></th>
<th></th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>CCIL</td>
<td></td>
<td></td>
<td>122</td>
</tr>
<tr>
<td>CCIII—CCVI</td>
<td></td>
<td></td>
<td>258</td>
</tr>
<tr>
<td>CCVII—CCIX</td>
<td></td>
<td></td>
<td>332</td>
</tr>
<tr>
<td>CCX</td>
<td></td>
<td></td>
<td>350</td>
</tr>
</tbody>
</table>

**PART II.**

| CCXI—CCXVI            |  |  | 568  |
| CCXVII                |  |  | 628  |
| CCXVIII               |  |  | 674  |
| CCXIX, CCXX           |  |  | 778  |