THE INTELLECTUAL OBSERVER.

APRIL, 1863.

THE NEW BRITISH SNAKE (CORONELLA LÆVIS), SMALL CROWNED SMOOTH SNAKE.

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(*With a Coloured Plate.*)

A MINUTE description of the size and colour of this snake would fail to distinguish it from the viper, as both these species vary greatly in size and colour. The markings, the general appearance, and form and size of the head are the best characters to attend to; in general appearance it much more closely resembles the viper than the common ringed snake (*Natrix torquata*), but may at once be known from the viper by the imperfect **V** on the top of the head, and instead of a single dark zig-zag line down the centre of the back, as in the viper, there are two rows of dark spots down the back; the head is also much shorter, smaller, and rounder than the head of the viper.

It was on the morning of the 24th of August, 1862, I saw, for the first time, one of these animals, Mr. Fenton having stopped me as I was driving along the road in the Regent's Park, and, taking from his pocket what I then thought was a viper, asked me if I would accept it for the Zoological Gardens. I confess I felt in fear of its bite, until Mr. Fenton held it in his hand, and allowed it to bite his finger several times. I then examined its mouth, and saw that its teeth were like the teeth of the harmless snakes, the poison fangs not being present. Having perfectly satisfied myself upon this point, I handled it, but could not help observing that this snake was much more fierce than any common snake; it bit me several times, but without any injury to the skin, in consequence of the shortness of its teeth. Mr. Fenton's opinion of the origin of this snake was at that time stated to me; he said he believed it to be a *hybrid* between a *viper* and a *common snake.* This led me to call the attention of Dr. Gunther, Mr. Buckland, and others, to the subject, which soon proved our new animal to be a well-known continental species, and Mr. Buckland at once set to work to learn all that was known, or could be ascertained, respecting its occurrence in England. The result of Mr. Buckland's energetic action has brought to light no less than fourteen individuals of this animal that may fairly be considered British specimens. And, doubtless, many more will follow, now that the subject has been brought to notice. It is by no means surprising that this snake has so long passed unnoticed, considering its near resemblance to the viper, and considering also how few persons are inclined closely to examine such creatures.

To say that serpents, large and small, have at all times, and in all countries, been regarded with fear, is not sufficient to account for the almost universal dislike and abhorrence in which they are held. The true cause of this instinctive dread doubtless arises from the real danger that attends the too near approach to these animals, many of them being provided with the most deadly of poisons. And the knowledge required to distinguish these from those which are harmless, will at all times prevent their becoming commonly or universally understood. To distinguish the poisonous species from the innoxious is not so easy a matter as sometimes stated, and considerable danger attends examinations to determine to which they belong; the poisonous snakes of Australia fully bear out this point, as their external form and general appearance would indicate that they belong to the snakes that are without poison. In the early-recorded history of our species, the serpent is held up as the symbol of evil; in the hands of the cunning and skilful they become powerful agents to deceive, and impose upon the credulous. Snake-charming, as it is called, is still practised in many countries, and it is quite impossible to remove the superstition that exists in the minds of many intelligent persons upon this subject; the artful and crafty manner in which these designing persons have studied the habits and nature of these animals almost exceeds belief. The opportunities I have had of testing the power of some of them (the so-called snake-charmers), convince me that they do not dare handle a freshly-caught cobra, or other poisonous serpent, except in their own peculiar way, and they fear the poisonous bite as much as other people. The rapid action of the poison, in many cases, must satisfy any one who may have the opportunity or desire to investigate the subject, of the danger attending the experiments. It frequently happens that an animal, struck and wounded by the poisonous fangs of a serpent, say, a *puff adder, cobra,* or *rattlesnake,* will die in six or seven seconds; with a knowledge of this power, it cannot be a matter of surprise that these animals are regarded with feelings of horror and disgust; the dread of death from such a cause would call forth a natural repugnance towards the whole race: the larger ones are feared on account of their great strength and power; the smaller, from the danger of their poison fangs. Again, the habits of these creatures are not likely to decrease our fear. Many of the most deadly lie concealed just below the surface of the sand, ready to strike a death-blow to the incautious traveller; others lurk and hide in the branches of trees and bushes, from which they dart upon the unwary. The wonderful resemblance in colour they bear to the places in which they are found, render them difficult to be seen by the unpractised eye. Many species are aquatic, and among these there is reason to believe many are highly poisonous. This point has been warmly disputed, but doubtless the best authorities assert such to be the case. The power of fascination attributed to these creatures appears quite unfounded; having for many years paid considerable attention to this subject, and having almost unequalled opportunities of forming a correct opinion, I have arrived at this conclusion, not hastily, but with, I trust, a fair and impartial consideration.

FLOWER SPOTS OF THE DESERT.*

BY WILLIAM BOLLAERT, F.R.G.S.

For weeks, ay for months, had the young people of Iquique, Huantajaya, and Santa Rosa been on the look-out for the misty clouds of winter, settling over the lomas or summits of the

* Names of some of the plants found on the Lomas of Iquique. Latitude 21° S. Examined by Mr. Miers :—

Cleome chilensis, var. pubescens.
Talinum.
Bryonia convolvulifolia.
Argylia Feuillei (Begonia radiata).
Gilia ?
Convolvulus.
Verbena.
Lycium fragosum.
Nolana atriplicifolia.
Dolia vermiculata.
Tetersena amœna.
Sisyrinchium ?
Leucocoryne ixiodes.
Notholœna remota.
Usnea.
Oxalis.
Peperomia.
Chenopodiacea.

Some of the plants found on the Lomas about Lima in latitude 12° S. Examined by Raymondi :—

Ismene Amacæs, the beautiful bulbous Amancay.
Begonia geraniifolia.
Quamoclit coccinea.
Valeriana off. and pinnata.
Bomarea ovata.
Oxalis.
Solanum.
Commelina fasciculata.
Piper crystallinum, etc.

mountains of the coast, and which were to be sprinkled soon afterwards with pretty flowers and curious plants.

What is the cause of this bounteous effect of Nature's hand? It is not easy to understand or explain it.

During the day of the long and hot months of summer in these latitudes, southerly winds, inclining to the east, blow along and rather off shore, so that the diurnal evaporation from the surface of the South Pacific is blown seaward and away from the land. At night the wind gets more easterly, forming a land breeze; this is but of short duration, and it is probable that the sandy coast has been left too hot from the sun's heat of the day to allow of any moisture being deposited from these limited land-breezes, even if there were any moisture of consequence in them.

Then the great S.E. trade winds, after they have left the South Atlantic charged with vapour, have deposited what was held in solution in the shape of rain in Brazil, and, ere they arrive in the frozen region of the Andes, have been deprived of the greater portion of moisture, the small remainder being left in the upper portions of the Andes and Cordilleras. I was surprised to see so little glacier and snow when at heights in the Cordillera of South Peru from 15,000 to over 17,000 feet, and could only explain it by this view—that there was so little moisture for the winds to deposit. The winds coming from the eastward must become bone-dry in traversing nearly the whole of the longitude of this portion of Peru, and from the two prime facts, namely, that the southerly winds blow off the land, and the easterly are destitute of moisture, originate the deserts of Peru.

However, during the short winter months light winds come from N.N.W. and N.W.; these being somewhat charged with vapour yielded by the Pacific Ocean, and the land not so heated as in summer, deposit dews and cause mists, to which many names are given, as *cerason*, *camanchaca*, and *garua*; the last may be called a very slight drizzle, which is only observed on the mountains of the coast at certain elevations in the various latitudes.

With what joy this season used to be, and is still hailed, even by the charming and fastidious Limeñas. A writer in the *Mercurio Pernano* (I. 30, 1791) says, "About the period of St. John commences the *paseos* or rambles to the ravines of the Amancaes (blue, yellow, and white bulbous plants); these rambles end the latter part of September. At this same period are the *paseos* also to the *lomas* (summits of the hills). The soft *garua* of that time of the year nourishes the land, and produces pretty little flowers. The diversions here are of a sweet and rural character, they delight and cheer the inhabitants of this desert portion of the country, leaving no ill consequences, even should they over-feast or over-dance themselves, or sleep on the sand with a bright moon staring on them." Ulloa tells us that these *lomas* are clothed with verdure, and enamelled with flowers of the most radiant colours, to the great joy of the people, who, as soon as the severity of the winter has abated, resort to these flower-capped hills, which exhibit so elegant an appearance. Then if it causes so much pleasure to the dwellers of beautiful Lima, where every luxury can be obtained, we will essay to give an idea of the annual *paseo* to the *lomas* in the Tiempo de Flores in South Peru.

Let us suppose that at last it has been arranged that the young folks of Iquique shall go by Molle to the faldas (steep sides) and lomas of the Morro de Tarapaca, then to enjoy hospitality at the mines of Santa Rosa and Huantajaya, and then onwards to the lomas above Iquique.

We are astonished to find how many young girls and young men can congregate for the trip from out of the few families resident at Iquique, including the amiable Don M. B., who it was well known would enliven the party on its route by recounting a good stock of amusing stories; there was also a very prince of Yaravi (Indian melody) singers, Don M. F., and lastly Don Jorge and myself.

For days previously, preparations had been going on as regarded the "provend" in the shape of bread, cakes, chickens, fish, hard-boiled eggs, and sweetmeats; not forgetting the drinkables, including the favourite French liqueur, "Parfait Amour," for the ladies. All these things are stowed away in *alforjas*, or saddle-bags, not being unmindful that each also contained a gourd full of water.

All are stirring at early dawn, for we are going to have a long day of it. The donkeys get an extra feed of maize and an extra drink of water; they are duly caparisoned with the comfortable saddles and pretty bridles, the manufacture of Arequipa; scarlet and blue *pellones* cover the saddles, bound on by a party-coloured *sincha*, or girth.

The sun-burnt beauties sally from their rude habitations, all joy and excitement, with their Panamá hats, ponchos, bright scarlet, orange, or blue pollera or petticoat, and their naturally small feet, made to go into still smaller shoes of spruce make and of all colours.

One of the señoritas was rather older than the rest, and had to look a little after the younger ones, and instead of the light and rather long pollera, she had on the somewhat antiquated "Faldellin," a very short crinoline, worn as a dress. However the bewitching *Saya y Manta*, a curiously close-fitting garment, was in use, the upper portion being narrow, and made to hide the head and face, excepting the eyes. This has since faded away, and now the frightful European bonnet and dense dresses are worn.

Well, it was a pretty sight to observe the cavalcade (donkeyade) start. Nimbly did we trip over the earthquake-elevated, shelly plain of Iquique, with the huge granite and porphyritic mountains to the left, the placid Pacific to the right, its waves rolling gently on the sandy shore, and the sea-air purity itself. The animals had rather a hard pull through a deep sandy track at the base of perhaps one of the highest *medanos* in the world, literally a mountain of sand, which we christened "La Ballena," or the "whale," from its resemblance to that monster of the deep when out of the water. Subsequently, a friend of ours, a Frenchman, attempted to explore this colossal heap of sand on mule-back, from opposite to where we were travelling, when having got midway up with great difficulty, he and animal began to sink in the sand. In a moment he threw himself out of the saddle, and the reins over the head of the mule. Keeping hold of the end of the rein, he did his best to roll downwards, tugging at the mule; now he sank in the loose sand almost out of sight, then the mule was well nigh submerged. It was terrible—a fierce, but at last a successful struggle for life.

We arrive at the elevated shelly plain above Molle; here are a number of Tumuli, the graves, most probably, of a coast race of Indians called Changos. Subsequently I opened some of these ancient tombs, and found the desiccated bodies, wrapped in coloured woollen and cotton mantles, in a sitting posture, with pottery, wooden combs, bones, pointed, used as awls, spines of the cactus, pierced at the end for needles, copper fish-hooks, stone arrow-heads, brown and red mineral pigments, and heads of maize. In one was the mummy of a dog; in another that of a bird.

We now descended to the ruins of the silver amalgamating works at Molle, said to be so called from a mullu or mastic tree once growing at the foot of the high and escarped porphyritic mountains. If a tree ever grew there, the climate must have been different from the present, yielding some water by rain, or there must have been filtration of comparatively fresh water from the interior, no signs of such a state of things now existing.

Here we make our first *pascana* or halting-place, and whilst a fire was lit to prepare chocolate, I wandered about the rocky and sandy shore. In clear, deep pools were myriads of *erisos* or sea-eggs, of various sorts, shells, and enormous quantities of sea-weed. On the rocks there were numberless bright-eyed and inquisitive-looking lizards, two or three species of them, and so tame in their wild state as almost to let me catch them. But what a stillness! The morning had now become perfectly calm, with not a ripple on the waters; not a vessel in sight. I was hidden among the dark rocks, and could scarcely believe I was so near to a merry party bent on pleasure, until I heard a shout, "Almuerzo"—breakfast. I returned to the ruins, and already was Don M. tinkling his guitar and singing a favourite ditty of those times.

Our meal is soon over. "Al camino" is the word. We tighten up the saddle girths preparatory to the ascent of the celebrated Morro, or Mountain of Tarapacá, the summit of which is about 6000 feet above the level of the sea.

On the shore we fell in with a solitary family of Changos; these are the aboriginal Indian fishermen of the coasts, and are probably a remnant of one of the ancient tribes of Atacama. They neither speak Aymará or Spanish, and are nearly in as miserable a condition as the savages of Tierra del Fuego. They roam about the coast from south of the valley of Copiapo, in Chili, to hereabouts, transporting themselves on their floats of seal-skin. We gave them some tobacco, for which they blessed us.

We began to "faldear," or creep slantingdicularly up the long base of the Morro, and when about 2000 feet above the level of the sea, came upon a little pasture—a thin, dryish grass, each stem an inch or so apart, at which our donkeys began to nibble, and some of them may not have had such a treat for years. Continuing upwards, we beheld an interesting sight in a hollow (where there was some grass), namely, a pure Indian family reposing there, whilst their donkeys were browsing in the desert pastures. Here were the three generations, the grandparents, parents, and grandchildren, on their way from the interior to the coast, to collect guano to manure their little farms. These were pure Aymará Indians, descendants from that stock, who may have built the Pre-Incarial masses of masonry of Tia-Huanacu, who were subdued by the Incas, and became worshippers of the sun according to Incarial formula; and they wore black garments, said to be in memory of the murder of their Incas by the Spaniards, and their still degraded position. One of the young Indian girls was really pretty, nicely dressed in flowing robes, with her necklaces, silver tupus, or spoons with pointed ends, serving as pins to keep her dress together, and her party-coloured faja or sash. We christened her at once "The Flower of the Desert," but her real name was "Quespi," or the "Bright one."

Bidding adieu to these children of the sun, who remained quietly *acullicando*, or chewing their beloved coca, our ascent began to be steep, over sand and sharp stones, often obliging us to dismount, which made rather a toil of pleasure. At last we struck some huanaco tracks, made by these animals when browsing, which assisted us in our climb. From the fresh footprints we observed, we anticipated a sight of these fleet-running animals; and on reaching an undulating plain about two-thirds up the Morro, sure enough we saw a small troop of them. But our object was not to have a huanaco hunt, and we were without our guns or dogs.

It was now past mid-day, the sun's rays told on us; there was no breath to be wasted in singing, or even chattering. The señoritas of the party would exclaim, "Ay que calor" (Oh! how hot it is). "Quando llegaremos a la Pascana" (When shall we get to our resting-place?); "Deme un poco de agua por el amor de Dios" (Give me a little water, for the love of God).

"Here we are," shouted one of the party, who was acting as *vaqueano* or guide. Our resting-place was in the shade of some huge broken rocks, looking as if they had been tumbled down from the peaks above us by earthquakes, and shivered in their descent. What a desolate scene it was! that mountain ravine we were in, running, as it were, across the Morro of Tarapacá.

Having come to a halt, we unsaddled the donkeys, giving them the length of their halters, so that they might nibble at the slight pasture. Our first refreshment was the *ulpo*, made of ground maize, baked with sugar and a little cinnamon in powder, mixed with water. A cigar followed, and we rested full length on the soft sand.

Now came the cry for the *fiambres*, or the cold provisions, produced out of the saddle-bags. This was our dinner; after which, our Apollo, Don M., tuned his guitar for one of his best songs. The song being ended, and the sun somewhat lower, and the air freshened with a breeze, we "saddled up," continuing our journey.

For some time we traversed the mountain plain; on our right rose the remaining portion of the Morro and its peaks, the whole a scene of the most utter desolation. We now came to a very steep incline without a track, so steep that we had to dismount, dragging the animals after us. Here we would often slip downwards, half imbedded in portions of dislodging paniso or disintegrated rock; indeed, at times we were in some danger of rolling down, or of loose stuff and broken rock falling upon us. Had either occurred, it might have been fatal.

Every one promised never to take this "short cut" again, but go round by the Indian track. Some thirty years afterwards, however, I accompanied Dr. B. to explore this Morro for mineral matters. We were on horseback, and got into a similar or rather worse position; with very great struggling I succeeded in making the descent, but my companion had to leave his horse and get to Molle on foot. Next morning the horse was rescued from some precipices on which it had managed to get.

Having arrived at better travelling ground, although much broken, where some rocks of an argillaceous limestone presented themselves, together with large patches of nodular common salt, we came to a rest, and stretched ourselves on the ground for a few minutes; and after a short halt continued our way.

I must here digress a moment to speak of the mines of El Carmen, which were discovered in 1778, about the same time as those of Santa Rosa; at the latter we were going to pass the night. The veins at El Carmen were found rich at the surface with native chlorides and sulphurets of silver; they were worked without any care or order, and when the pits were only moderately deep they were abandoned. But they are not worked out, the veins are only picked into here and there, and under other circumstances of management, and a cheaper rate of labour, this spot, as well as Santa Rosa, Huantajaya, and some other localities, will still yield abundance of treasure. I may here observe that at Huantajaya, in particular, the "desmontes," or rubbish of the mines, outside and inside of them, is in very large quantities, and could this be economically taken by tram or railroad, say to Iquique, and worked there, it would lead to a new and profitable branch of business. According to some recent assays of the Huantajaya "desmontes," it is said that they yielded about 40 ounces of silver per ton; picked heaps gave about 71 ounces per ton. However, my opinion is that the cajon of 6400 lbs., yielding 80 ounces of silver, is nearer the mark = 28 ounces the ton. In 1861 a railway was projected from Iquique to the interior, to the nitrate of soda quarries; should this be realized then there would be no great difficulty in transporting these "desmontes" to the coast, and there working them for the silver they contain.

A question was asked as to the cause of the mines of El Carmen being abandoned. The answer was, it was said that a white mule had been foaled there, which circumstance caused the mines to discontinue yielding!

We were now on the Santa Rosa knot of mountains, wending our way in "Indian file," or one behind the other, through deep desert ravines, the ridges of the mountains forming them towering from 1000 to 2000 feet above us. Then we wound along the shelving sides of mountains, at times covered with huge masses of rocks. It was on one of these mountains I first became acquainted with the "Pintados," or colossal sculptures, in their slopes. The "Pintados" are made by scraping away a portion of the loose *débris* of the mountain in such a way as to form a variety of figures of Indians, pumas, huanacos, suns, moons, circles, squares, etc.; and in one such locality a tomb was discovered, containing the body of a female completely desiccated, dressed in penguins' skins; at its side was a bow and a quiver full of arrows. The custom of forming these "Pintados" must be a very ancient one, for the present Indians say they know nothing about them, save that they must have been made by the "Pagan Indians," before the arrival of the Spaniards.

As we approached Santa Rosa, we heard the church bells ringing and small rockets cracking, and in a few minutes afterwards a number of our acquaintances came out to welcome our arrival, escorting us into the town. I say town. Reader, imagine the long slope of a desert mountain, the loose stuff on the surface irregularly broken out, the masses of which piled up, form, if possible, more irregular habitations. Some of this stuff contained so much common salt, that in time, by the help of slight and occasional dews, it had become agglutinated together, forming the walls, which were merely covered with matting. There was no arrangement of streets whatever; here a house, there the mouth of a mine, and heaps of "desmonte" everywhere. There were, however, some half dozen habitations built of boards brought from Chili, the dwellers of which looked upon themselves as somebodies, and at that period their mines were in "boya," or giving abundance of rich ores.

One family took charge of some of our party, another took others, so in a short time we were disposed of for the night; and after such a day's tramp, we slept soundly upon the *estrada*, or a part of the floor at the end of the apartment, raised like a broad step; for, as yet, bedsteads or many other articles of comparative civilization had not been introduced into that portion of South America.

The next morning we were shown over the place, and entered some of the mines. When first discovered they commenced their yield in native and chloride of silver. One mine produced much sulphuret, another very large quantities of sulphurets of silver and copper. I entered one, the "Paniso," which was then in "boya;" it had given since 1815 to 1826, £600,000. Another mine, the "Arcos," had just given a little "boya" of three yards long and twenty in height, valued at £20,000. They had been, and were working these mines in the most miserable manner, and the proprietors were told that if they continued their honey-comb and rule-of-thumb system, instead of by shaft and adit, the yield of the mines would soon be brought to a stand-still, which proved to be the case.

In 1853-4, the writer paid another visit to Santa Rosa, to look at the place, as one goes to see an old friend. The houses of wood were gone, the other habitations were in ruins, the church had tumbled down or had been overthrown by an earthquake, and not a soul was to be seen. At last, while prowling about, the mew of a cat was heard, and then the starved pussy was seen perched on a ruined wall; then the sound of the blows of the comba, or miner's hammer, was heard to come from the mouth of the once famous "Paniso" mine. A stone was rolled down the mine, which is one way of announcing oneself at the mouth of a pit, and two brothers (miners) made their appearance. They were merely doing a little experimental work, and the vein was giving a small portion of native silver; this, to them, was not a favourable sign; they would rather have been working in a poorer ore, for the chances then might have led them to abundance of it. The writer asked why the mines had not been properly worked. The answer was, that since the nitrate of soda quarries had been opened, the labouring population went to them; then the continual revolutions took the young men away to the army, and the President Castilla (a native of the province) seemed to require more soldiers than any of the previous "mandones," or rulers.

I will not pause to describe the ball and other festivities by which the evening of my first visit was passed; but on the following morning early, the whole party were again on their way, resting for awhile at the celebrated mines of Huantajaya, to the mountain-range of the coast, to the loved "lomas" of the flower spots in the desert.

As we were all connected with mines, we made a *détour* to "catear," or examine the country mineralogically. But with so joyous a party little was done, save a general admiration of the "Lindos Panisos," or beautiful indications of metallic matters. These Panisos are caused by the heads of the veins protruding to the surface, the copper, iron, and other metallic substances oxidising, and giving their colours to the desert mountains.

Onwards we go, mainly along the slopes of the hills, these and their bases often covered with salt, sand, and angular pieces of rock, some of the latter looking as if they had lain there undisturbed for ages, and that the fierce heat of the sun had half burnt them up.

At last we arrive at the upper base of the coast mountains (the lower base being below on the shores of the Pacific). We are about 2000 feet above the sea, and some of the summits are 1500 feet above us. They are of granite with porphyries reposing thereon.

Diminutive pasturage is fallen in with, then a small plant or two with green leaves, and in a short time we enter a dell in which this desert vegetation is seen to increase, and then come to a spot where there is a pretty abundant crop of blue and white flowers, called azucenas or lilies; so we named the dell the "valley of the lilies."

In accounting for the flower spots of the desert, the elements we have to deal with are:—1. Mountains from 2000 to 3000 feet above the level of the Pacific Ocean, and hereabouts formed of a very feldspathic granite. It is easily decomposed on account of the rather large quantity of soluble alkali in the feldspar, and thus a loose surface is produced. Seeds of plants can be brought here by the easterly winds from the interior, which blow generally at night, or conveyed in the ordure which the huanacos and vicuñas deposit in these localities. In close proximity with the granite a mighty formation of porphyry reposes. On the latter rock, as a rule, there is no vegetation, it being less prone to decomposition, and not affording holding ground to seed or plant. From the decomposed granite we have, however, obtained soil which is without a trace of humus; we have brought the germs of vegetable life hither, we will now look for their nourishment.

2. During the greater portion of the year the winds blow along, but somewhat off, the coast from the south, so that all moisture in the air formed by the sun's heat from the waters of the Pacific is blown off the land to the west, to be deposited again in another portion of the same sea. Did these winds blow on the shores of this land, the moisture held in solution in them would be deposited as heavy dews and rain, and tropical forests would appear, where now there is but a sandy and saline desert.

3. The short months of winter succeed, and then N.W. and N.N.W. winds blow on the land. The sun now being north of the equator, the atmosphere is cooler, cloudy days and misty nights occur, and in the height of this desert winter, the *garua*, or very slight drizzle, is occasionally deposited on the summits, in the dells and slopes of these mountains. These *garuas* do not extend any distance inland, for in this latitude, just past this mountain boundary, no vegetation is seen, until the base of the Andes is reached, and there it is scarce. The Cordilleras are barren; on descending to the table-lands, 12,000 to 13,000 feet above the sea, the vegetation is stunted and peculiar; but when the mighty masses of the Andes are passed, you come down upon magnificent tropical flora, extending, in some places, across the continent to the coast of Brazil.

4. The great S.E. trade winds have left the greater portion of their moisture in Brazil, and ere they reach the Andes have but very little to deposit on their peaks, after which they blow to the N.W., bone-dry, maintaining nearly the whole of the west coast of Peru in absolute sterility, excepting where a scanty stream

may find its way down the narrow valleys from the Cordilleras to the west.

It is the *garua*, or thick winter mist of the coast, that nourishes the seeds transported to the flower spots. First in the progress of organic life is a spare pasture; upon this a few wild huanaco and vicuña feed, having migrated from the Cordilleras. A stray fox may sometimes be met with, but what this animal finds to eat I cannot tell. The condor is seen to whirl about majestically, and a little slate-coloured bird may be heard to chirrup at times.

Whilst exploring, I came upon some of the party who had got into a growth of the small blue and white lilies. They were in great glee, and I could hear them joyfully exclaim, as I was botanically occupied, "Look, how pretty these flowers are; how beautiful, see, see! Why not remain here for ever, build a house, and always have a garden?" Yes, these periodical and stunted flower spots in the desert seemed then to my friends ever-blooming glades, and sylvan groves.

I collected specimens of the pasture, lilies, and oxalis; in all about twenty different species of plants, one of which, I think, must have been a Solanum, or member of the potato family,* and there was one plant I tried to persuade myself was a shrub. I came upon two or three species of small cacti, and then fell in with what I took for the gigantic cactus, with a yellow flower. Some of these were thirty to forty feet high, the girth at the base being ten to fifteen feet. I think it is the same species I have seen in abundance on the lower portions of the Cordilleras, where it is so tough as to be cut into narrow planks. These cacti are in comparative abundance, and on some occasions have been used as fuel at Iquique. I found the bright green leaf of one plant rolled up in such a manner as to enable it to hold a portion of water. This was handy, I thought, for the little slate-coloured birds to drink.

I found on the cacti the following Bulimi, named, I believe, by Mr. Cumming: Succinea Broderipii, Bulimus virgulatus, B. erosus, and at their roots little heaps of their dead shells. Laden with specimens of the plants, bulimi, and pieces of rock, I returned to our camp, where an excellent repast was set out, including a good salad made from the Vinagrillo, or Oxalis Acetosella. Here we remained for some time discussing our repast in this mountain solitude.

Of the flowers which had been collected, some were made into bouquets, others placed round our hats; even the head-gear of the donkeys came in for a share of floral ornamentation.

We now commenced our journey back to Iquique, bidding adieu to the Valley of the Lilies. We ascended to the pass of

* This collection I have presented to the Linnean Society.

Guantaca, from whence we had a glorious view of the Pacific and its iron-bound shores. Rapidly descending the mountain range, at times our animals had to slide down through the deep sandy track; arriving at the bottom, we trotted briskly over the plain to Iquique, which we reached whilst the vesper bell was ringing for the "Oracion," when all good Roman Catholics kneel to say the evening prayer.

We were now a goodly party, but got them all fairly accommodated. For some days afterwards our mountain friends enjoyed sea-bathing, fishing, paddling about on balsas, trips to the island, formerly covered with guano, and hunting for shells.

At this juncture a good friend to the poorer people of the whole coasts, Captain Bowers, came into the bay with his ship, the "Catalina." He did not require any pressing to give a dinner and dance on board his vessel, which was heartily enjoyed by all.

A few days afterwards our Santa Rosa and Huantajaya friends returned to their mountain homes, the abodes of the silver-fabricating gnomes of Tarapacá.

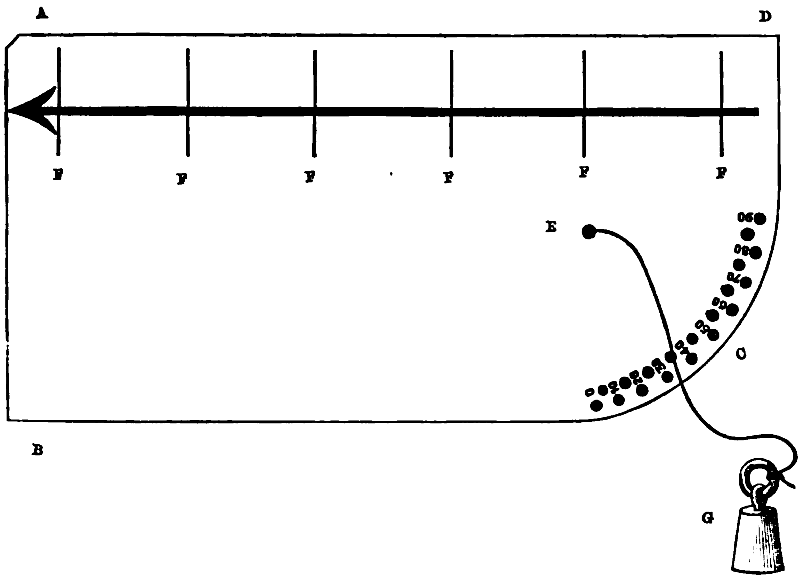
OBSERVATION OF BOLIDES.

BY ALEXANDER S. HERSCHEL, B.A.

The description of a large meteor's passage through the air has been a narrative homely and familiar to all since the ingenuity of man first combined the elements of earth and air and fire, to direct the flight of rockets and to please the eye with the gay discharges and the flashes and explosions of fireballs. Yet the spectacle is grand and awful when we revolve the real wonders of the sight. If it is seen by day, no bird is so high, no balloon, nor even a cloud; mountains and valleys are undistinguishable to this visitor as it swiftly approaches the dangerous circle of our globe. If seen at night moving beneath the stars, it is nearer to those than the whole height of our dull but lofty atmosphere!

Suppose it to be a small shooting-star only that is seen. Its distance and its trajectory are as great as those of a meteor. Philosophers are not yet agreed upon the true nature of these apparitions, but it appears not improbable that the shooting-star is an exceedingly small paring of metallic iron, or a grain of sand, piercing at twenty to thirty miles a second, the extreme fluid coverings of the earth. The brightest meteor, it is equally probable, may be no larger than a schoolboy's marble, or a hazelnut or walnut! Such a fragment may yet suffice, with great velocity, to strike the air with rolling thunder, just as the slender thong of a whiplash may be made, with velocity enough, to produce an astonishing report. As the floating fibres of the whipcord mark the spot at which the lash was drawn with detonation through the air, so these unearthly projectiles leave luminous clouds of unknown nature floating on the course to mark their track, and in the cause of this remarkable phosphorescence is undoubtedly to be sought the origin of the vivid light that the slender fragments are able to elicit from the air. By the blow of their intrusion through different regions of density, aided by the disruptive, liquefying, and calcining actions of the heat which probably accompanies the light, their slight substance is crushed and scattered or exhausted, the velocity, quickly yielding to resistance, is destroyed, and their subsequent descent to the earth in a few extremely small fragments is no longer matter of perception. Some larger bodies, however, occasionally encounter the earth's globe, and, piercing the fluid envelopes, penetrate, with unexhausted velocity, to the ground; but their occurrence is singular and rare. Such aerolites, or aerosiderites, as they are called (masses of stone or iron fallen from the air), are preserved in considerable numbers in our national museums, where they form collections yearly increasing in interest and extent. The stones possess a great resemblance or likeness of character among themselves. Scattered through the fragment of a greyish-looking sandstone are seen glittering particles, like filings, of metallic iron alloyed with nickel, bright particles of iron pyrites, or iron combined with sulphur, and particles of olivin, a yellow, gem-like crystal, or of felspar, the crystalline component of granite. Frequently oolitic or seed-like grains of all of these mixed substances together abound throughout the structure. The fragment is entirely clothed with a thin, black, polished or enamelled crust. The last is the same glass or slag to which the mineral is fused before the blowpipe, and on certain specimens it may be seen raised in wave-like lines, as if rippled in the molten condition by the force of a powerful wind. When on any side the crust is wanting, the fracture has, in some remarkable instances, been exactly covered by the similarly exposed faces of smaller stones, fallen at the same time many miles from the place of the principal descent. These accumulated fragments of the several falls give from a few pounds to many hundred weight, as the weight of foreign matter occasionally descending to the earth. The aerosiderites are of much greater weight, but of various sizes, little altered by their passage through the air. Like rude settings of valuable gems, the clear crystals of olivin are seen bedded in their sponge-like cavities. The metal contains invariably a portion of nickel in alloy, and its fibres are found by section and etching to have a constant crystalline structure. The character of these minerals, and the circumstances of their arrival, places their extratelluric origin apparently beyond a doubt. Professor Quetelet has, however, most recently doubted the existence of an unbroken analogy between these bodies and the smallest shooting-stars. Such an analogy can only be traced in the fugitive or ephemeral features of their apparition, and simultaneous observations at distant places of one and the same fugitive flight are indispensable to the study; but of the rarer aerolitic falls no precise observations of the kind are found; shooting-stars, and the associated class of bolides (fireballs or large meteors) and detonating meteors, have alone yielded trustworthy results to observation. The periodic recurrence of the first, in showers, renders the tribe of shooting-stars an old subject for concerted observation, and bolides no less would seem to appear in groups, but not expectedly. Unless it be that the brilliance of a single individual elicits by discussion the notices of others no less brilliant than itself, instances may be cited to show that the recurrence of this phenomenon twice upon the same evening is more probable than that a brilliant meteor should appear alone and singly in a day. Until a physical connection can be pointed out by reason of which a group of shooting-stars should have one, or the least, dimension in common, such a group of bolides a second dimension in common, and lastly by which the aerolites, perhaps too far apart to show themselves in groups, occupy a series of superior dimensions, three classes of phenomena apparently distinct present no hypothesis whereby they may be collected under a single head. Some recommendations which follow for the observation of large meteors, may possess points of interest for those who are not habitual gazers upon the heavenly vault.

When a large meteor attracts the gaze of a fortunate beholder, let him attend some minutes for the occurrence of a report. Throughout the flight of the meteor he may compare in numbers *the length of the head with its width*, and certain peculiarities of figure, light, and colour common to meteors will correctly impress themselves upon him as they arise, and afford ground for future remarks. Immediately on the meteor's disappearance the points of appearance and disappearance of its course should be compared with surrounding objects. All objects, whether the angles and roofs of houses or the boughs of trees, should be pressed into this service, to avoid the uncertainty which quickly arises when the light has disappeared. On a starlight night, if the constellations can be recognized, no better course can be pursued than to align or triangulate the points of apparition and extinction with the best-known neighbouring constellations; but, in default of these, the places of appearance and disappearance should be marked with deliberation by surrounding objects, and a visit to the spot may be made at some future time for measurement. Sentences, numerals, or the alphabet should be repeated in estimation of the meteor's duration or of the interval elapsed to the occurrence of a report. The first of these estimations, leading to a knowledge of the meteor's velocity, is of especial value to the theory of their origin.* To measure from landmarks the course of the flight, there should be cut from stiff cardboard an altitude card (six inches by three) of the following pattern:—



A B C D is an oblong card, twice as long as broad, one corner of which is cut away by the quadrant C of a circle, about the centre E, graduated with a protractor to ninety degrees of arc from the transverse to the longitudinal direction of the card, as shown by the figure. A plummet line, with small weight attached (as shown at G), is fastened at the centre, and hangs freely over the face of the graduations while the card is in use. A series of transverse incisions F F F . . . divide the back of the card into ribs, which admit the point of a straight rod or cane inserted between them to the whole length of the card in the direction of the arrow. This instrument has every

* The alphabet may be repeated distinctly fifteen times in a minute, and in small intervals of time the sixth part of a second becomes by its aid a quantity sufficiently easy to observe.

accuracy sufficient for the intended purpose, but if greater precision is desired, a wider card with longer incisions may conveniently be fastened upon the tube of a small hand telescope, and an observation of the horizon employed to secure the proper adjustment of the arrow-line to the axis of the telescope. Reaching the spot where the observation was made and marked, the observer will direct his pointer to the spot previously determined, where the meteor finally disappeared, the card and plummet vertically downwards, depending from the rod, until the plummet is at rest. Slightly twisting the rod towards the right, the plummet will be held fast by its own weight upon the edge of the card, until the card can be lowered, examined, and the *altitude* read off. The rod and card are now held at arm's length between the observer and the sky, the card and plummet depending as before vertically downwards from the point of the rod, between the observer and the place of disappearance of the meteor, but the handle of the rod directed onwards in the imaginary prolonged line of the meteor's apparent flight towards the horizon. The rod is thus directed, by the eye recovering the meteor's course from the landmarks of the previous evening; and being followed downwards to its intersection with the horizon, this point of intersection is marked by known objects of the view. Its *bearing* is to be afterwards found by compass, or by reference to an ordnance map of the locality. The card and plummet depending from the rod between the observer's eye and the place of the meteor's disappearance inform the observer at the same time of the *slope* downwards from horizontal at which the meteor passed from view. The card should again be tilted, by slightly turning the rod before the rod is lowered, to examine the card and read off the *slope of path*. A fourth observation, of the *altitude of the place of apparition*, completes the set of these observations, and suffices (with general remarks to prevent misapprehension) to render the description as accurate and valuable as any that can be expected at the present day to be obtained.

THE FEET OF ARACHNIDÆ.

BY L. LANE CLARKE.

(*With a Tinted Plate.*)

The feet of Arachnidæ are more varied than those of the Diptera, the family is larger, the individuals more gifted in every way, of higher organization, and with an instinct that raises them in position to a near kindred with the upper circles of creation.

In examining the feet, we cannot help going beyond the external form to question why such admirable tools are given to what, at first sight, is an ungainly and troublesome "creeping thing."

We will begin with the foot of the common house-spider (fig. 1), which requires to be well mounted in balsam, and a good half-inch lens to see it properly; then, indeed, we perceive the two claws, toothed like a comb, with from eight to fourteen teeth, and a third simple claw, acting like a thumb to the sensitive small hand, which twists, and spins, and weaves, and builds nests for its young and snares for its food.

If we now take another foot, that of the beautiful garden-spider, the *Epeira diadema*, we shall see, beside the two large toothed claws, five others, also toothed, branch forward from the heel of the foot, and must assist it greatly in the formation of its geometric web and pretty cocoon, slung under a green rose-leaf in a hammock of the softest silk (fig. 2). Unlike the fly, the spider has no pulvillus, and, therefore, if able to run up a wall, it is by the action of these sharp and toothed claws on the inequalities of its surface; also by the length of its legs, and in some species by the number of joints in its tarsi, giving such pliability that the feet are capable of every variety of inflexion, sometimes even of a spiral one, whilst, from their span and equal hold of eight equidistant spaces, the body is balanced and supported in every position. The species I refer to are the harvest-men, *Phalangium*, whose tarsi have upwards of forty joints, and resemble antennæ.

A house-spider seems to be incapable of walking upon glass, unless it throws up an invisible ladder of its own making, touching the glass here and there with its spinnarets, and giving its hind feet a resting-place, when it speedily escapes from a tumbler. The experiment is best made with *Clubiona atrox* in a champagne glass; but it happens sometimes that the spider will approve of its prison, and weave for observation both a snare and a den, and a little honey or treacle on the edge of the glass will attract its prey, and the action of this tiny foot may be closely observed.

I have spoken of the spider's foot as "a sensitive small hand," and certainly the pulmonary spiders, or aristocrats of the tribe, possess a nervous organization which lead us to believe in very acute senses.

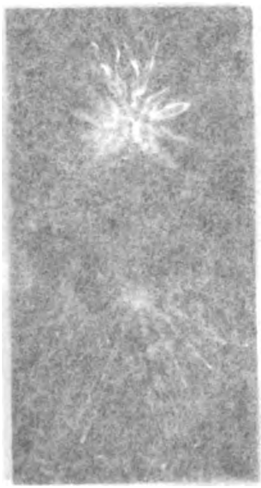
They have no antennæ or known organs of hearing, yet they are sensitive to sound, and even capable of pleasure in the vibrations which cause our own nerves to thrill under the harmonies of music. Several examples are upon record; but Michelet gives one that is less known, in the spider-friend of little Berthome, who was a musical prodigy, in the year 1800. The poor child, stimulated into unnatural development, was confined for many hours a-day to practise in solitude. The music attracted a house-spider (*Tegenaria domestica*), which at first left its web, and stationed itself on the music-stand, then crept daily on the child's arm, and as long as the music was heard, the spider rested there; when it ceased, it retreated to its web.

This continued for many months; at last a visitor, with the unloving heart of ignorance, seeing the little creature on the boy's music, struck it to death; the child fainted—was ill of grief for three months, for he had recognized in that small living thing a fellow-sufferer and a friend.

Besides the sense of hearing, do not the eyes of spiders follow with marvellous exactness the movements of their prey? The *Salticus*, tiger-like, springs with unerring certainty upon the restless fly, creeping, and sidling, and whirling round instantaneously for the fatal leap.

Does not this little foot *feel* delicately for the silken line, and test its strength before it trusts its body to a fall? Does it not coil up a floating filament, and join two broken cords? or, more wonderful still, carry in its toothed claws that cable of *six thousand strands* from corner to corner of the angled wall, with care avoiding contact, lest it stick in a wrong place? When a spider has dropped from the ceiling, how does it ascend again so quickly? The spinnarets do not suck in again the twisted line; no, the hinder feet, using the simple claw as a thumb, rolls up the thread into a ball, and holds it ready for further use, or throws it away if not needed. The same handy foot has been observed clearing the web of an *Epeira* when flakes of falling soot had sullied it, gathering the dirty and broken threads, rolling them into little pellets, and flinging them to some distance, and still the busy feet tapped and tried every mesh of the snare, never breaking any, but replacing a missing link with geometric precision, and in such positions that by *feeling* alone could this have been accomplished, as the work was out of sight of the spider's eyes.

Feet of Arachnidæ.



[illegible] walls. [illegible]

[illegible] that common [illegible]

[illegible] words:—

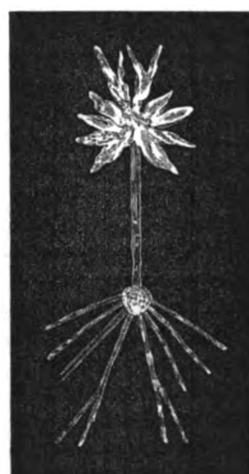
> "The spider's touch, how exq[illegible]
> [illegible] at each thread, and [illegible]

The [illegible] the wandering gnat, [illegible] touch these

Feet of Arachnidæ.

Can any one look at the nest of the *Mygale* or trap-door spider, without wishing to see the tools with which it was made? What could have enabled it to dig into solid argillaceous clay, impregnated with oxide of iron, six or seven inches deep, line it with a beautiful orange-coloured tapestry, and furnish a door so curiously, that it is the perfection of insect architecture? The door of this nest, though but three lines in thickness, has thirty layers of finest web, and a hinge so perfect, that it may be opened hundreds of times without injuring the spring; moreover, it has been measured for a living bolt that shall secure its inmate from outward violence — small holes are made, where the claw of this foot shall hook, and bar the spider's fortress and her home. I doubt not that in the work of all the Mygales the powerful foot-jaws or mandibles assist considerably, the short stout spines upon these claws being better adapted for hard work than the delicate combs of Epeira (fig. 3, foot; fig. 4, mandibles).

I might cite innumerable examples of the handiness of a spider's foot, but its *sensitiveness* leads us from the external crust to consider the cause of all its *sentient* power. The spiders of which I speak are remarkable for the concentration of the nervous mass or ganglia in the cephalo-thorax. There is a nearer approach to the brain of the vertebrate animal than in any of the insect tribe, and from that firm compact stellate ganglion, strong nerves pass into the thrilling legs. No wonder, then, that a spider, more than any creature, except man, feels change of weather, and measures its gossamer line by the current of electric fluid. Never does the little *Aranea* or *Clubiona* spin a long line in wet and windy weather. The *Epeira*, if beginning a new web, shortens the main lines considerably in doubtful weather.



It is this nervous susceptibility which is exercised by the little *Segestria*, a small spider which lurks in the crannies of our garden walls. Crouched in its silken tube, out of sight and power of seeing, it stretches out six of these feet, each holding a thread that communicates with the snare, and verifies the poet's words:—

> "The spider's touch, how exquisitely fine,
> Feels at each thread, and lives along the line."

The heedless fly, the wandering gnat, scarcely touch these lines without a spring and a fatal nip from the jaws of the concealed enemy.

Thus much for the pulmonary spiders; but the lower ranks of this large family, though greatly beneath them in organization and instinct, have yet, many of them, very pretty feet, worthy of our observation and a place in our microscopic cabinet.

(Fig. 5.) The foot of the common cheese mite (*Acarus domesticus*) has a single hook surrounded by a membrane called a *caruncle,* capable of inflation and retraction, for it is a double and purse-like organ, called by the Germans bursten or purse, and is analogous to the pulvillus of a fly.

(Figs. 9, 10.) The foot of *Xodes* or dog tick, an acarus which, for its curious rostrum, as well as for this appendage, should be carefully examined and mounted.

(Fig. 7.) The foot of *Uropoda vegetans,* a parasitic acarus, often found on coleopterous insects, attached to them by an anal peduncle, through which it derives its nourishment from the juices of the beetle.

(Figs. 6, 12). The tarsi of the pretty little water-mites, *Limnochares* and *Hydrachna,* ciliated for swimming, and armed with tiny hooks for clinging to water-plants and to the Nepa, upon whose body the Hydrachna lays its eggs.

(Fig. 8.) The tarsi of *Dermanyssus,* pest of our canary cages.

(Fig. 13.) The beautiful caruncle of *Gamasus coleoptorum,* the common parasite of the dung-beetle, which is said to indicate the early or late harvest, according as they cluster towards the thorax or the anus of the poor beetle they infest.

(Fig. 14.) Foot of *Pachygnatus,* a small mite found under stones in damp places.

(Fig. 11.) The examination of feet of *Trombidium* and others of this numerous family will amply reward the patient observer.

VARIATIONS IN PLUMAGE.

BY W. B. TEGETMEIER.

SOME years since, when conversing with one of the most eminent of living zoologists, I expressed an opinion that naturalists had overlooked many sources of information in neglecting the variations that were capable of being produced in our domesticated animals. The facts that extreme changes in form and colour can be produced almost at the will of the experimenter, and that dogs, pigeons, fowls, etc., can almost be bred to pattern, show that there are certain laws regulating the production of varieties which, being facts, cannot be otherwise than important.

The reply of the *savant* was very characteristic, and, as coming from one of the most profound systematic naturalists of the day, was the more emphatic:—"Do you know the reason," he replied, "why naturalists have neglected varieties and the laws which govern their production? It is simply because they do not know anything about them."

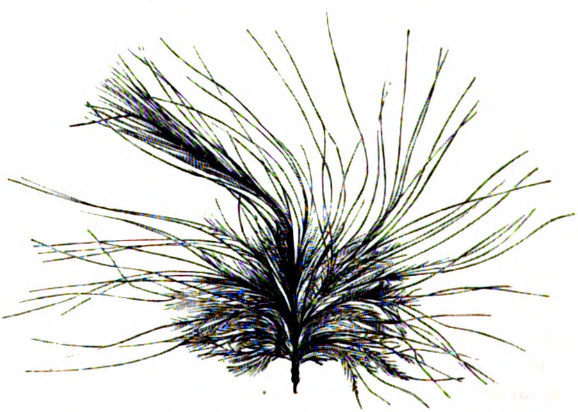
This reply confirmed me in the course I was then pursuing, and I continued, as far as was compatible with other engagements, the study of the changes capable of being produced by artificial selection.

At the present time it cannot be said that varieties have not received a considerable share of attention. Their production by artificial selection bears so strongly on the hypothesis which ascribes the origin of species to natural selection, that they have risen rapidly in the estimation of all scientific men, and this appreciation has extended even to those who, like myself, have endeavoured to trace out their origin, to study their structure, and to ascertain the limits to their variability. But a few years since, my special pursuit—the variation of poultry and pigeons—would have been regarded as rendering me a fit companion for Spitalfields' pigeon-fanciers and Nottingham cock-fighters. At the present time I find that the observations I have made on these subjects have obtained for me the acquaintance and friendship of some of the most eminent scientific men of the age. One of the most remarkable of these variations occurring in the plumage of birds, I propose describing in this communication.

In the January number of the INTELLECTUAL OBSERVER there appeared a notice of some fowls with black periosteum and skin; and I may state that under the title of "Coq à Duvet" (GALLUS LANATUS), Temminck, in his *Histoire Naturelle des Pigeons et des Gallinacés*, has described those birds which are now known at our poultry shows under the title of *Silk* *fowls*. These birds, of which I possess several specimens, are brought from many parts of eastern Asia and the Indian Archipelago. They are small in size, and are remarkable as having the skin and periosteum of a dark bluish-black. Their flesh, however, is perfectly white, and, as Temminck states, surpasses that of other poultry in its flavour. The plumage of these birds is most remarkable for its downy character. Every feather, even the large primaries and secondaries of the wings, has the barbs entirely disunited, giving rise to that silky appearance from which the fowl derives its English and French trivial names.

I have found that when these birds are mated with other varieties, the mongrel offspring are characterized by the dark skin and periosteum, but that the plumage takes the ordinary colour and character; and it is not perhaps until the fowl is killed for the table that its dark and repugnant-looking skin is noticed. Moreover, there is but little doubt that it is this mongrel so reared that Temminck describes under the title of *Coq Negre* or *Gallus Morio*.

In all the wild species of gallinaceous fowls there exists no example of this strange peculiarity of feather. The question to be solved at once presents itself, What is the origin of this peculiar breed? Whilst the subject of variation was regarded with the contemptuous ignorance to which I have before alluded, I do not think that any answer could have been given to the question. But at present some light can be thrown on the



FEATHER OF COCHIN CHINA HEN,—EXAMPLE OF VARIATION.

subject. I have now in my possession a Cochin hen in which the entire plumage of the body is broken up into a covering of a texture closely resembling in appearance the character of the fur of a rough tortoiseshell cat or fawn-coloured rabbit.

This peculiarity arises from the barbs of the feathers remaining perfectly distinct, the barbules being straight instead of curving and hooking into each other, as is usually the case. Some of these feathers have been very beautifully photographed by Mr. C. Walker, of Norwood, by means of the carbon process; the photographs being printed directly from the feathers without the employment of a camera. One of these has been carefully engraved, so that the exact structure of these singular feathers may be seen. From this specimen the peculiar appearance of the bird may be inferred. The fine filaments at the top of the feathers form the external layer of the covering, and produce the extraordinary hair-like appearance that is so very remarkable in the entire plumage. It is obvious that a bird so clothed can have not the slightest power of flight, being in this respect reduced to the condition of an Ostrich or an Apteryx.

Now, as to the origin of this singular animal: Some years since a single bird thus peculiarly clothed was hatched from an ordinary pair of Chinese fowls, the cause which determined the variation being, as is usually the case, utterly unknown. By hatching the eggs of this hen, and by a careful and long-continued selection of those offspring which showed most completely the tendency to develope the peculiarity of the feathers, the breed of silky Cochins was at length established. Here, then, is the production of a permanent and fixed variety by artificial selection.

Now, let us imagine such an occurrence as the production of this variation occurring in a state of nature, it is obvious that a bird of moderate size, destitute of any natural means of defence, and incapable of escape by flight, could scarcely by any possibility avoid being destroyed by its natural carnivorous enemies, hence there would be no possibility of the perpetuation of a small breed of silky fowls in a state of nature.

Nor, with the exception of the Apteryx or Kiwi Kiwi of New Zealand, which is being rapidly exterminated, does there exist any small sized land-bird with a plumage rendering it incapable of flight. On the other hand, many large birds, whose size and strength enable them to protect themselves from their natural foes, possess plumage of a loose and divided character, such are the Ostrich, Emeu, Rhea, and many others.

Those who agree with Mr. Darwin's views on the origin of species by means of natural selection, will see in this singular fact one which bears strongly on the theory they advocate. Unless we admit some such explanation, the existence of many large birds with loose plumage, and the non-existence in a natural condition of any small species so clothed, is rather puzzling, especially when we know that birds as small as pigeons not unfrequently produce this singular variation.

VEGETABLE TEXTILE FIBRES.

BY J. W. M'GAULEY.

THE wide-spread distress which at present exists in Lancashire and other places in consequence of the war now unhappily raging in America, having deprived our manufacturers of their usual supply of cotton, it becomes very important that we avail ourselves of every means to prevent a recurrence of the serious inconvenience we now feel. Although the evil seems to have come unexpectedly upon us in all its terrible reality, it has long since been anticipated by those who looked into the future; and precautions have been from time to time suggested, though without much practical result, in consequence of the seeming remoteness of the danger. So long ago as the commencement of the present century, attempts were made to introduce the fibrous substances of India into this country; but they were treated with apathy, as it was then very unlikely that any substitute for those already in use would ever become desirable. Under the most favourable circumstances, it must be considered a position of great peril to depend for a supply of what is indispensable to the very existence of a vast body of our industrial population on a single material, and, what is much worse, almost on a single locality, over which we have not the slightest control. It was no doubt a great triumph of our energy and ingenuity to have created a mighty branch of national industry, under circumstances so unfavourable that not an atom of the material required for it is produced by ourselves, and very little of it by our dependencies. But the magnitude of the achievement is, at the same time, a proof of its danger, since the possibility of our supply being cut off involves the liability of a great commercial and manufacturing enterprise to meet with a sudden and disastrous interruption. It becomes, therefore, deeply interesting to examine how far such an evil may be rendered impossible hereafter, or so improbable, that the fear of it may be disregarded without hazard. This can be effected only by the employment of varied materials, or by obtaining our supplies from such a number of localities, that the derangement of our intercourse with one of them cannot greatly affect our safety, or by the adoption of both precautions.

Our vegetable textile materials have hitherto been confined to a very few species, and in a very great degree to but one. Yet the number with which nature supplies us is very great. The superintendent of the Botanic Garden at Jamaica exhibited at Paris, in 1855, fifty-one species of fibre from different plants, and Jamaica is far from being the locality most remarkable for their production. It is true that, of the numerous fibres which are dispersed abundantly over almost every portion of the globe, comparatively few are capable of taking the place of hemp and flax, and still fewer that of cotton; nevertheless, excellent substitutes for them have already been found. The Calooee, or Rhea fibre, has all the good qualities of hemp, besides being twice as strong. China grass fibre, Neilgherry nettle, etc., may be used instead of flax; and even cotton is capable of being easily imitated by substances which are almost unlimited in capability of supply. The production of "cotton" from hemp and flax has occupied attention since the middle of the last century in various countries, and it has been effected by several processes, both with economy and complete success. When the details are properly managed, the product cannot be distinguished from real cotton; and, as Berthollet remarked, an equally fine material may be obtained from refuse tow and from the finest flax. Cotton may, in the same way, be obtained from fibres which would otherwise be too coarse for the finer textile fabrics. The objection to a certain kind of fibre may be entirely resolvable into certain changes required in the spinning machinery. This is true of much of the cotton produced in India. To place our readers in a position that will enable them to judge of our resources, we shall briefly notice the vegetable textile materials already in extensive use among us, and those which are the most likely to become in any way their substitutes.

The use of vegetable textile fibres ascends to a remote antiquity. Linen was prescribed to be used exclusively in the dress of the Egyptian priests; and, in the Institutes of Menu, written eight hundred years before the Christian era, it is declared that the sacrificial thread of a Brahmin must be of cotton. Textile fibres require both strength and flexibility. Those obtained from vegetables are not confined to any particular species of plant; they are found in endogens and exogens, in herbs, shrubs, and trees; and they may often be had from otherwise worthless weeds, that are produced in the greatest abundance. Although the stems of endogens, or plants which grow on the inside, often contain a large quantity of fibre, the latter is generally obtained from their leaves, which have a parallel vena-tion—thus the fibre of the pine-apple, American aloe, plantains, etc.; but in some of them—for example, the palms—the leaves are too dense for the easy separation of the fibre. The fibres of endogens are generally white, and of different degrees of fineness in the same plant. They are capable of bearing a great strain, but are liable to break at a knot, which is a serious obstacle to their being employed as textile materials, since, in weaving, it is often necessary to join the threads, a difficulty which may perhaps be overcome by uniting them with a glutinous substance. Nearly all of them are produced on the seacoast, or in moist climates traversed by navigable rivers, and, therefore, they are easy of access. Some of them will yield a yarn which is suited to the most delicate fabrics. Fibre cannot be obtained from the leaves of exogens, or those plants which grow on the outside, since they have a reticulated venation, which does not allow the mass to be separated; but it is procured from other parts, where the texture is parallel, and usually by stripping off the bark, as with hemp and flax. To remove the fibre from the woody and other matters with which it is associated, the process of "Retting," either with dew, with the water of ponds or streams, or even—as in some northern countries—with snow, is employed. But, while this renders the woody portions easily removable by mechanical means, it injures the colour of the fibre, and, unless effected with great care, diminishes its strength. It is highly objectionable in a sanitary point of view, since the water in which the fibres are steeped becomes poisonous, and evolves the most pernicious effluvia. Many methods have, therefore, been devised to supersede retting, the best of which, not altogether a new one, is the steeping the fibre for a moderate period in water at a certain temperature.

Although fibrous plants are found in almost all parts of the world, some climates are more favourable to them than others. When the production of fibre is the purpose for which they are cultivated, they must not be too much exposed to heat, light, and air, which harden the fibre, and give the plant a tendency to become branched. The nature of the predominating product is affected by the climate and mode of culture: in the tropics hemp produces *Bhang*, a powerfully intoxicating drug known also as haschisch;* in cold and temperate climates scarcely any narcotic, but abundance of excellent fibre. In India, where hemp is reared only for its narcotic, and flax only for its seed, these plants are exposed as much as possible to the action of the air and light; but in Ireland, Russia, etc., they are thickly sown, that, sunlight and air being excluded, they may attain a considerable height, and produce but few branches.

The true hemp (*Cannabis sativa*), which is believed to be a native of the mountainous parts of Northern India, is obtained from a large annual; but there are several fibres to which the name is applied, although they are produced from plants of a very different species; thus the jute hemp, Manilla hemp, brown hemp, pité or pita hemp, sunn hemp, etc. Hemp was

* The effects of this substance have been described in the December and January numbers of the INTELLECTUAL OBSERVER.

placed by Jussieu in the family of the nettles, and along with it the hop plant; the latter also produces a fibre that might be turned to a useful account. Hemp, probably, has not been so long in use as flax, but Herodotus mentions that the Thracians made from its fibre a cloth equal to that of flax in fineness. It grows well, either in the heat of India, the cold of Russia, or the moderate temperature of Italy or England; it flourishes at the level of the sea, and in the Himalayas, six or seven thousand feet above it. But Russia and Russian Poland are the localities where it is chiefly cultivated; and some of the finer kinds are prepared with great care. It is one of the few plants grown in England which are *diœcious*, that is, have male and female flowers on different individuals; only about half the plants therefore produce seed, but the quantity they yield of it is very great. Although the male plant comes the soonest to perfection, both male and female may be pulled together, when the production of fibre, and not seed, is intended. We consume about two thousand tons of hemp annually, of which Russia supplies nearly three-fourths. If not tarred, when worn out as cordage, it answers well for paper, and for oakum: which is not the case with many of the substances that may be used instead of it.

Flax (*Linum usitatissimum*) is a native of Asia, but it was introduced very early into Europe. It has been in use as a textile material from the remotest times. The paintings in the tombs of Egypt, and a microscopic examination of the mummy cloth, afford unquestionable proofs of its early cultivation in that country. It is mentioned in the Pentateuch, and other of the most ancient portions of the Scripture; and Homer alludes to its manufacture. The flax plant belongs to the *Linaceæ*, which contains many species, most of them remarkable for the tenacity of the fibre of their inner bark. As the elements of the dressed fibre are obtained almost wholly from the atmosphere, if flax alone is removed from the land the plant is not an exhausting crop, and the prejudice against it, on this head, is unfounded. Its inorganic elements are instruments in the production of the fibre, and should be returned to the soil. Its qualities, which are dependent partly on the climate, and partly on the mode of cultivation, are so various that it may be used for the coarsest or the most delicate purposes, and its price varies from forty to one hundred and eighty pounds a ton. It may be successfully cultivated in very different climates; but it grows in those which are very hot, chiefly because their winters resemble the summers of more northern countries in temperature. Hence, in India and in Egypt it is sown in autumn and harvested in spring, before the seed is even put into the ground in colder regions. About four hundred thousand tons of it are produced annually throughout the world. Notwithstanding the great encouragement afforded to the cultivation of flax in Great Britain, it has never been grown by us in quantities sufficient for the supply of home consumption; the flax used in the United Kingdom, independently of the seed, would require half a million of acres to be devoted to it, while in Ireland, where most of what we produce ourselves is raised, not a fourth of that space is given to it. About eighty thousand tons are imported annually, all of which, there is good reason to believe, might be produced at home.

The cultivation of cotton is traced to the remotest times; five centuries before the Christian era it was in common use in India for domestic purposes; but its manufacture was almost unknown in Europe until the last century. Less than two millions of pounds of cotton wool were imported by us in 1697, but in 1795 nearly twenty-seven millions, and in 1857 about one thousand millions, and the quantity continued to increase until our supply from America was suddenly interrupted. Cotton stuffs, of gossamer fineness, were made in India at an early period; and though two thousand five hundred years have rolled away, they continue to be produced there, but only by an almost incredible dexterity, which has descended continually from father to son, no improvement whatever, during that long interval, having been made in the mechanism employed. Cotton is a filamentous down, investing the seeds of a plant called by Linnæus *gossypium,* but belonging to the mallows. It is of many species, the most widely diffused being reducible to the herbaceous, the shrub cotton, and the tree cotton. The cotton of India and the United States is the herbaceous kind; that of the West Indies, Brazil, and partially of Egypt, the shrub cotton. The tree cotton flourishes in a wild state in Borneo and other tropical regions, but as a commercial product it is almost unknown. The herbaceous species is the most useful; shrub cotton becomes coarse as the plant grows old. Most of the kinds used by manufacturers derive ther commercial names from the places to which they owe their origin. "Sea Island cotton" was first cultivated in the small islands which extend along the coast from Savannah to Charleston, it is very long stapled and strong. Its excellence caused it to be introduced on the high lands of Georgia, where it became the "uplands" or "bowed Georgian" cotton. But though it still remained a good article in this locality, it degenerated; since a humid atmosphere and sandy soil are required for superior cotton, and to produce the very best kind, a saline soil and a saline atmosphere. Besides the upland cotton grown in Georgia and South Carolina, there is another of an excellent description termed "New Orleans cotton," which is produced on the banks of the Mississippi. The finest cotton ever imported into this country was obtained from the island of Tobago, in the latter part of the last century, but its cultivation was relinquished for more lucrative occupations, and has not been resumed.

The inconvenience of depending for the greater part of our supply of cotton on any one country, renders it desirable to consider what amount may be reasonably expected from others, if we take the proper means to instigate them to cultivate it. We are, in reality, independent of the United States, since our Indian possessions would produce at least half of what we require, Italy one-fourth of it, Egypt and Algeria the remainder. All that we want need not be of the very best kind, and we can easily obtain what is necessary for the finer fabrics from several localities which produce an article fully equal to the very best American. The shortness of the staple of the Indian cotton has always been an obstacle to its extended use, but it might be improved in this respect by better modes of culture; even that which is at present produced in India would be far more valuable than it is with proper management; it is injured by dirt and exposure to the weather, and its staple is often broken by bad treatment, as appeared clearly from what was exhibited in 1851, and still more from what was seen at the late Exhibition. When due care is taken with them, the cottons of India are excellent, and the very worst of them might be profitably employed, with a slight modification of the spinning machinery, or by mixing them with the long stapled kinds; what can be done with pure Indian cotton has been clearly shown by the Messrs. Platt. That our supply from India might at once be largely increased, is evident from the fact that she exports to China twice as much as she sends to us. But to obtain from thence all that is possible, both as to quantity and quality, we must go there to purchase instead of waiting for the article to be sent to us, as it is from America; we must enable the cultivator to derive full benefit from his industry, by rendering unnecessary the intervention of those who not only swallow up all his profits, but by their mismanagement cause great injury to what is sent to us.

The quantity of cotton supplied by Egypt may be expected to increase considerably, and its quality is of a high order. Mehemet Ali devoted much of his attention to the cultivation of cotton, and the late enlightened ruler of Egypt was fully conscious of its importance. Herbaceous cotton has been introduced into the country; and a cotton is now produced there, from Sea Island seed, which is inferior only to Sea Island cotton. In 1823, less than six thousand bales were received from Egypt; thirty years later it was nearly one hundred and six thousand; the quantity has since become greater, and it is capable of further increase. Egypt now consumes all its short stapled cotton at home.

Italy, even at present, is a successful cotton-producing country, and, as was shown at the late Exhibition, it is capable of growing the most excellent kinds. The climate of Algeria is particularly favourable to the production of cotton; it already furnishes a large quantity of excellent quality, and the supply to be obtained from it, under the encouragement it is likely to receive, will become far more considerable. We may procure a large amount even from our own colonies. The British West Indian cotton is of the very best description; the finest kinds might be grown extensively in Port Natal; and to any amount in Australia. But, however numerous the sources of supply, if they are liable to be abandoned they will avail us but little, since cotton will not be cultivated for us at such a risk. But it is probable that, before the United States can supply us, as formerly, other countries will be able to compete successfully with them, which has never been the case hitherto.

To remove, as far as possible, all danger from the future, some new materials should, if possible, be adopted, not as substitutes, but as aids to those already in use; and as a means of obtaining these, our possessions in India offer peculiar advantages and an inexhaustible supply. We shall briefly notice a few of those fibres most likely to be useful for this purpose. The plantain and banana tribe (*Musaceæ*) afford abundance of fibre; one of the species (*Musa textilis*) produces the Manilla hemp, which is more beautiful in appearance, cheaper, and more durable than Russian hemp. The cordage made of it is particularly adapted to resist great strains. The plant abounds in the Philippine Islands, and is the Abaca of the natives. Another of the species (*Musa Paradisiaca*) produces a fibre adapted to both coarse and fine fabrics, in very large quantities. Both species afford three layers of fibres of very different qualities.

The nettle tribe (*Urticeæ*), even in these countries, yields a fibre which has been successfully used for thread, cloth, and paper. In the tropics nettles grow to a gigantic size, and many species produce a material exceeded by no other in fineness, and superior to all others in strength. "China grass" is the product of the most remarkable of the family (*Urtica nivea,* or *Boehmeriæ nivea*). It yields three crops in the season; the first affording fibres suited to coarse, and the two last to finer, purposes. But for a minute black spot which it exhibits, it could be applied to the most delicate and costly textile products. It may be obtained abundantly from China. Calooee hemp, or Ramee (*Urtica tenacissima,* Rox.), the Rhea of Assam, which is equally plentiful, is identical with China grass. It is stronger than the best kinds of hemp and finer than the best kinds of flax, and is beautifully white and silky in appearance. Until recently, it was found difficult to separate the fibre from the woody portions, on account of the presence of a glutinous matter which is acted on by water less easily than the fibre. It will probably rival the better kinds of flax. The plant yields four or five crops a-year, and any quantity of its fibre may be obtained. The "Horoo," "Surat," or "Neilgherry" nettle is the most widely diffused of all the species. It is an annual. The leaves, stem, and branches are armed with bristles from four to eight inches in length, the least of them causing a pain which is very acute, but fortunately of short duration. The bark affords a large quantity of strong, glossy, soft, and silk-like fibre, which is greatly prized in China. It is said to be adapted to flax-spinning machinery; and it gives a warp of great tenacity that dyes as well as flax, and unites admirably with it in cloth. When carefully prepared it may be used for the finest fabrics.

Both the cultivated and wild species of the pine-apple tribe (*Bromeliaceæ*) afford a useful fibre. The leaves of the species so well known for its fruit abound in a fine white fibre, that has been successfully applied to the manufacture of woven fabrics, both coarse and fine.

Some of the palms (*Palmaceæ*), which constitute so remarkable a feature in tropical landscapes, furnish fibres which have been applied to many useful purposes. The cocoa-nut palm (*Cocos nucifera*), which is very abundant in the East Indies, besides its other valuable products, yields "coir," the covering of its nuts. This material is employed chiefly in the manufacture of cordage and coarse woven fabrics, and, from its lightness, elasticity, strength, and durability, it is found to afford the very best kind of cable. The palmetto (*Chamærops humilis*) supplies a fibre which in Sindh and Afghanistan is used for cordage, and in Algeria for paper and pasteboard.

"Jute" is a product of the Linden tribe (*Tiliaceæ*); it is obtained from two of the species (*Corchorus olitorius*, and *Corchorus capsularis*), long used in India as pot-herbs. The fibre, which, in both species, is exactly alike, has been proposed as a substitute for flax, on account of its great length and fineness; but it gradually loses its whiteness, becoming ultimately brown, and its strength is diminished by circumstances which would not affect other kinds of fibre: it is very unfairly used as an adulteration of hemp in the manufacture of sail-cloth. If prepared without "water-retting" its qualities would perhaps be much improved, and it might be rendered fit for purposes that would not subject it to the action of moisture, which is very injurious to it. It is easily cultivated, and is obtained in abundance from the plants. Large quantities of it are consumed in India in the manufacture of *gunny-bags* and other coarse fabrics.

The aloes afford very useful fibres. The great aloe (*Agave Americana*) is a native of America; but it has succeeded so well in Africa, India, and the south of Spain as to seem indigenous to these places. Its fibre, which is of great length and strength, is obtained from the leaves, which are from eight to ten feet in length, and from the roots, which afford what is known as "pita thread." The product of this plant has been found to exceed hemp in strength and durability. Another species (*Agave vivipara*) affords "silk grass fibre," which, until lately, could not be applied to textile purposes on account of the presence of a large quantity of glutinous gum, that can, however, now be removed without difficulty. The true aloe (*Aloe vulgaris*) and the "Adam's needle" (*Yucca gloriosa*), which is sometimes termed an aloe, also yield excellent fibre.

The Liliaceous plants, likewise, produce useful fibres. The Moorva or Sanseviera (*Sanseviera Zeylanica*) is very abundant in Africa, China, etc.; its leaves contain large quantities of a fine white and tenacious material, that is used by the natives for bow-strings.

Sunn, which is obtained from a plant very commonly cultivated in India (*Crotalaria juncea*) makes excellent cordage, sail-cloth, and canvas; but it is inferior to hemp in fineness, strength, and durability. The Egoo or Gomuto yields a remarkable fibre, which is little known in Europe. It is *black*, of great tenacity, and almost imperishable, and is used largely in India for cordage. New Zealand flax, which was discovered by Captain Cook in New Zealand, has been introduced into Ireland and Scotland; it is stronger than hemp or flax, and takes colour as well as either, but, like other white fibres, it breaks at a knot. The *Zostera marina*, one of the sea wracks, has recently occupied much attention; but, like all marine plants, it contains very little solid matter, and the fibre it affords is so small in quantity, compared with the weight of the plant, that were it even possible to procure it in sufficient abundance, it would be little likely to be used as the source of a textile material. It has, however, long since been applied to many important purposes, and the idea of utilizing its fibre is not a new one, since many years ago paper was made of it in Holland.

We have now briefly glanced at the most valuable textile fibres yet known; some of them will, no doubt, from their excellence and abundance, come into very general use. We have not considered the inquiry as bearing very directly on the manufacture of paper, however desirable it has become to find new materials for it: since it appears certain that whatever is employed for this purpose, to be sufficiently economical, must be previously used for some other.

FORAMINIFERA.

BY T. RYMER JONES, F.R.S.

Few objects are better calculated to illustrate the powers of the binocular microscope than the shells of the Foraminifera; it is hardly therefore a matter of surprise that these beautiful organisms should, at the present time, suddenly have grown into favour, and become, as it were, fashionable subjects for exhibition. From their singular beauty, indeed, many genera belonging to this group of animals richly merit the attention bestowed upon them; the elegance of their forms rivals the symmetry of our most costly vases, the delicacy of their sculpture challenges all the resources of the optician, while in richness of ornament the amphora-shaped encasements of the Polycystinidæ and other kindred families far transcend the tracery exhibited in the most elaborate specimens of Chinese carving. And yet so recent is the discovery of these wonderful productions of nature, and so little is even yet generally known concerning them, that possibly a succinct epitome of the present state of our knowledge in this department of microscopic science may not be unacceptable. However much the imposing size of the larger animals may impress us with a sense of the infinite power of the Creator, however much we may admire the regularity of their forms, the complexity of their organization, or the exquisite perfection of their structure, our wonder is certainly not diminished nor our admiration lessened when we descend to the contemplation of those inconspicuous beings which, by their numbers, make up for the minuteness of their dimensions, and whose infinite hosts perform, unseen by us, one of the most important parts in the economy of nature.

Who, a few years ago, would not have been incredulous if told that on every sea-shore the very sands are half composed of microscopic shells which, in beauty, can compete with those of the Nautilus and the Argonaut, and in the manner of their formation are far more mysterious and incomprehensible? Such, however, are the Foraminifera, the most numerous, if not the most important agents employed in building up the world on which we tread. Six thousand of these exquisitely formed shells have been counted in a single ounce of sand taken at random from the shores of the Adriatic Sea, and in a similar quantity collected in the Antilles, M. d'Orbigny, the great historiographer of this prolific class of animals, calculated that there were not fewer than 3,800,000! The numbers contained in a cubic yard of such sand consequently surpass all intelligible expression—what then must be the Foraminiferous population of the immense extent of maritime coast situated in all parts of the globe? It may therefore be safely asserted that no other series of beings is comparable to these as regards the numbers in which they exist—not even those minute crustaceans whose myriads sometimes crowd the seas until they give their own colour to the waters; not even the Infusoria themselves, whose shells compose the polishing slates of commerce, or constitute the *bergmehl* and other rich deposits of animal or of vegetable origin.

If we proceed to notice the special office assigned in creation to these microscopic beings, we shall find not less cause for astonishment. The progressive accumulations of their shells form banks in the sea that become dangerous to the navigator, fill up ports and harbours, obstruct gulfs and straits, and assist, in conjunction with the corals and madrepores, in building up those reefs and islands which are continually making their appearance in the tropical regions of the ocean. The Foraminifera, moreover, constitute the principal organic element brought up by the plumb-line during the recent Atlantic soundings, and are thus proved to be distributed, more or less abundantly, throughout all the deep-sea deposits in all parts of the world. Estimating the importance of their present employment from the testimony afforded by ancient strata, it is easy to prove that these humble organisms materially affect the geological structure of our planet. During the carboniferous epoch, a single species of the genus *Fusulina* has formed in Russia deposits of enormous thickness. The entire mass of the cretaceous system is crowded with their remains. In the tertiary formations they are even still more abundant, witness the nummulitic limestones of which the largest of the Egyptian pyramids is entirely constructed, and which constitute immense beds ranging extensively in Europe, Asia, and Africa. The Foraminifera are likewise met with in countless numbers throughout the tertiary strata of France, Austria and Italy, and nowhere more numerously than in the calcareous deposits of the vast Parisian basin. These latter deposits, indeed, are so densely filled with them, that D'Orbigny estimated a cubic inch of stone taken from the quarries of Gentilly to contain 58,000 of their shells; it is therefore scarcely an exaggeration to say that the city of Paris, the stones for building which are principally obtained from those quarries, is almost built with their remains, as are all the towns and villages in that vicinity. Thus we perceive that these tiny creatures, so minute as to be almost imperceptible to unassisted vision, are at the present day modifying the depths of the sea, and during past geological epochs have materially contributed to the formation of the land.

Prior to the year 1835 the Foraminifera were generally regarded by naturalists as being minute forms of Cephalopods, and even D'Orbigny himself, although conversant with the animals in their living state, owing to the imperfection of the microscopes at that time at his disposal, actually countenanced an error which at the present day appears almost ludicrous; and it was to the observations of M. Dujardin, published in the *Annales des Sciences Naturelles* for that year, that science is indebted for the first accurate description of these remarkable organisms.

Their name is derived from the circumstance that over their entire surface they are perforated by numerous apertures or *foramina,* through which delicate filaments are protruded that serve for the purpose of progression, and constitute the so-called pseudopodia of the living animal. The interior of the shell is filled with a glutinous substance, frequently of a tawny hue, the colour of which seems to depend upon the presence of numerous granules of the same tint disseminated through a colourless transparent slime.

To obtain them alive for observation under the microscope it is only necessary carefully to examine portions of sea-weed, to which they attach themselves, or to wash with clear sea-water the surface of stones, corallines, or shells fished up at some little distance from the shore. The washings thus obtained, if set aside in a glass jar, are pretty sure to contain examples of some species, which, after a few hours, will fix themselves to the sides of the glass by means of their ramifying filaments, and may be thus examined with an ordinary lens, or they may be detached and subjected to examination with the higher powers of a compound microscope. Their movements are extremely slow; in fact, when they are upon the march their advance is scarcely more perceptible than that of the hour-hand of a watch. In cold weather, indeed, they will remain quite stationary, only projecting a thread or two of their glairy substance wherewith to attach themselves to the glass; but in summer time, or when the temperature of the room is increased, they evince somewhat greater activity, and the number of their pseudopodia is proportionately increased.

Few things are more wonderful than the movements of these extraordinary prolongations. A filament which, at its first appearance, is an almost imperceptible thread, simple, and of the same thickness throughout, gradually elongates and expands in all directions, as though in search of some point of support. Sometimes it oscillates from side to side; sometimes it exhibits an undulatory motion, and will then roll itself up into a spiral shape; the turns of the spire next become fused together into a gelatinous ball, from which various prolongations begin to be protruded. As each filament thus elongates, it seems to grow in thickness by the gradual afflux of new material, and emits from either side, at irregular intervals, secondary tendrils, from which, in turn, new filaments are given forth which proceed to ramify in a similar manner. Not unfrequently several branches become connected together by delicate gelatinous membraniform expansions, giving them a palmate appearance like that of a duck's foot, or the gelatinous matter spreads out laterally in irregular shreds and lamellæ.

The retraction of the pseudopodia is effected by movements of a precisely opposite character. The glairy substance, which has somewhat the appearance of melted glass, returns by a sort of afflux towards the central portion of the body, the branches and their anastomoses shrink and vanish in a way that appears truly magical, until they are by degrees completely absorbed into the general mass. The manner in which progression is accomplished by means of this wonderful apparatus is as follows:—When the Rhizopod advances in a given direction the filaments in front are elongated, while those on each side become more or less bent backward, until they relax their hold upon the plane of progression, and are then completely retracted, soon, however, to be replaced by others better adapted by their position to the performance of the intended movements. None of the entire class possess in the slightest degree the faculty of swimming.

Astonished at the varied evolutions of which these extraordinary creatures are capable, and the apparent perfection of their structure, M. Dujardin, naturally enough, proceeded to dissect them, and endeavour to unravel the supposed intricacies of their anatomy; and was not a little surprised, on carefully breaking their delicate shells, to discover in their interior nothing whatever but a homogeneous semi-fluid mucosity, without the slightest trace of muscular fibre, of alimentary canal, or of any of the organs or tissues met with even in the humblest polyps. On proceeding to dissolve the exquisitely-constructed shell by means of an acid largely diluted with weak spirit, the gelatinous substance, freed from its calcareous investment, and slightly hardened by the process, presented itself under the appearance of a series of gelatinous lobules, the shape of which was exactly moulded after that of the different compartments of the shell, but still entirely made up of the same homogeneous substance. MM. Carter, Williamson, and Schulze, all agree with M. Dujardin as to the complete homogeneity of the semifluid contents of all the chambers; and, indeed, the last-named of these gentlemen seems to improve upon the idea, insomuch that Ehrenberg vehemently protests against his describing the body of a living animal in precisely the same words as if it was a fluid. "Determinate organs," says M. Schulze, "cannot possibly exist in an animal all the parts of which are so perfectly identical in value that any particle may, at any time, change places with any other particle." It is certainly difficult to conceive how a creature thus constituted can secrete a fabric so elaborate as one of these polythalanous shells, with its siphons, its partitions, and its numerous foramina, even did the complexity of its structure stop here. MM. Carter and Williamson, and, more recently, the admirable researches of Dr. Carpenter, have shown us that the shells of many genera contain in the thickness of their walls a complicated system of canals, the ramifications of which may be injected with carmine, or displayed by the infiltration of mineral substances deposited during the process of fossilization. "The existence of these wonderful shells," says M. Claparède, "ought to teach us rather to doubt the efficiency of our means of observation, than to refuse to recognize structure in the soft parts of the Foraminifera. Where would have been our knowledge of the microscopic anatomy of the nervous system without the assistance of chromic acid and other analogous reagents? The sarcode of these Rhizopods has not yet found its chromic acid."

The young microscopist will find the examination of these shells a work of considerable difficulty, and one which requires much time and patience. In creatures which, from their minute size, are barely visible to the naked eye, it is only by the assistance of the microscope that the form and arrangement of the chambers, as well as the markings and sculpture of the exterior of the shell, must be determined. It is, therefore, by no means sufficient to treat these shells as ordinary objects by simply laying them on a glass slide, so as to see them only from one or two points of view; they must be carefully examined in every direction, for such is their diversity of form that nothing short of this will be at all satisfactory. For this purpose, they should be attached to the point of a fine needle, so that they may be turned in any direction, and examined by reflected light condensed upon them by means of a lens or side reflector. In many of the thick-shelled species it will be necessary to grind them down on a hone before the number and arrangement of the internal chambers is discernible; and, in order to investigate satisfactorily the minutiæ of their structure, a variety of sections, made in various ways, is indispensable. These should be examined by transmitted light, after having been immersed in fluid so as to expel the air; they may then be preserved in spirit or glycerine, or, what is better still for the less transparent species, in Canada balsam.

PUMPING SOVEREIGNS AT THE MINT.

The above appears to be a somewhat singular title for a paper, but it is literally true that sovereigns, and indeed all other coins produced at that establishment, are pumped into existence at the Royal Mint. Without entering into a detailed account of the numerous processes and manipulations by means of which ingots of gold are transformed into small circular discs of metal, of the exact size, and standards of weight and of fineness for the reception of impressions, it may be said that those impressions are finally due to the action of the air-pump. Every sovereign, therefore, which has issued from the Mint presses since the erection, in 1810, of steam-machinery for the purpose of coining, has undoubtedly been pumped, as it were, into the channels of circulation. It will be our task presently to explain the way in which the feat is accomplished. The Pneumatic Despatch Company, whose object is the transmission of letters, parcels, and merchandise through partially exhausted subterranean tubes, have simply adopted a modification of the air-pump and cylinder process of stamping money as in use at the Mint. Whether that company will succeed in introducing, on an extended scale, the atmospheric system of letter-carrying, is a problem to be solved. If they do so, the air-pump will stand a fair chance of becoming our general postman, as it is our chief coiner!

Let us, however, proceed to explain the contrivances and means by which the operation of pumping sovereigns is performed at the Tower Hill money manufactory. We will commence with the prime mover. This is a steam-engine of twenty-horse power, on the combined high and low pressure principle, and which was erected in 1846 by the justly-celebrated firm of George and Sir John Rennie. Originally this engine was intended for pumping water, from a deep artesian well on the premises, for the supply of the coining department. It is scarcely necessary to state who it was that in 1851 advised that the engine in question should be made to pump money as well as water, and showed how it could be done. The merit, at all events, of entertaining the proposition and of ordering it to be carried into effect certainly belongs to Captain (now Colonel) Harness, R.E., who was Deputy-Master of the Mint in the year named. This highly-talented officer gave instructions to the Messrs. Rennie for the construction, under the eye of the inventor, of the necessary apparatus and appliances for the purpose.

An air-pump of considerable dimensions constituted the main feature of the scheme, and this was formed on a perfectly novel plan. It consisted of a cast-iron cylinder, closely resembling in exterior appearance that of an ordinary land steam-engine, but very different in its internal arrangement. The piston of the pump was made up of a series of cast-iron rings, and these were pressed out against the sides of the accurately-bored cylinder by springs of steel. The effect was to make the piston perfectly air-tight, and yet capable of being easily moved upwards and downwards in the cylinder. There were no valves in the piston as there are in those of almost all air-pumps employed in manufacturing processes. The base of the cylinder was a hollow casting of iron, and so was its cover. In these hollow castings the inlet and outlet valves were placed. The upper casting contained sixty-four small apertures, which were covered by small pieces of steel saw-plate, each about two inches long by one inch wide, and fastened by a screw at one end. These delicate springs were in fact the valves. Thirty-two of them were made to open to the atmosphere, and thirty-two to the exhaust or vacuum pipe. The hollow base or bed-plate of the cylinder was furnished in a precisely similar manner. The diameter of the cylinder was three feet six inches, and the length of stroke of the piston three feet. The pump was placed vertically, and immediately below the working-beam of the engine to which the piston-rod was attached.

By this method of construction the air-pump became double-acting, and whether the piston was ascending or descending, it constantly exhausted air from the vacuum tube through the inlet valves, and discharged it through the outlet series. Nothing in the shape of machinery could work more smoothly than did this pump, and this arose mainly from the peculiar character of the valves. The cost of the whole apparatus, with cast-iron exhaust tube, 200 feet in length, ten inches in diameter, and face-jointed, was about £400. This is mentioned for the information more especially of the Pneumatic Despatch Company, who would find the same system of exhaustion—as we think—more effective and less expensive than the centrifugal disc plan which they have adopted at the North-Western Railway station for pumping the mail.

It has been said that the exhaust tube was 200 feet in length. This arose from the fact that the engine-house had been erected at that distance from the stamping presses. Instead of being carried underground, as in the Pneumatic

Despatch system, the tube was in this case carried over the roofs of the coining-rooms, and, descending therefrom, was attached to the great vacuum chamber.

The "vacuum chamber" had existed from the period of the erection of the Mint, and was originally devised by Messrs. Boulton and Watt, the well-known engineers of Soho. They had supplied a steam-engine of ten-horse power, and two single-acting air-pumps, each of which discharged air only in its downward stroke, for exhausting the chamber. This cumbrous and comparatively costly, though for its day very ingenious and valuable arrangement, was set aside when the new air-pump came into use. It had performed its mission, and was henceforth to be reserved as a duplicate in the event of the derangement, by accident or otherwise, of its modern supplanter. A regulating, or relief valve, and a barometer gauge fitted to the vacuum chamber, enabled the attendant to control and adjust the extent of rarefaction within the latter.

It will now be comprehended that, at all times, when the engine and pump are in action, a vacuum of more or less extent must exist in the chamber. The chamber, it may be explained moreover, is a horizontal tube of iron about fifty feet long, and two feet six inches in diameter. It runs along the floor of the Mint pump-room, in a line parallel to that in which the eight coining presses stand. Arranged along the top of the vacuum chamber, and supported by pipes opening into it, are a series of eight cylinders. These are vertical and fitted with pistons, the rods from which are connected by levers and cranks with the presses. The cylinders are open topped, and consequently their pistons are exposed to the pressure of the atmosphere, once a vacuum exists below them. This is the case when the pneumatic valves within the cylinders open to the vacuum chamber. The air within the cylinders then rushes down to the exhausted tube, the atmospheric column drives the pistons after it to the bottom of the cylinders, and the pistons drag with them the central screws of the coining presses. The instant that the beautifully engraved dies are thus made to come into contact with the discs of gold, the latter receive by the force of impact their impressions. The presses then rebound, carrying with them their pistons. The pneumatic valves again open self-actingly, the dies descend upon new blanks supplied to them by mechanical fingers, another batch of sovereigns is pumped into bright and glorious being, and so long as the great air-pump is exhausting the vacuum chamber, and the presses are fed with blanks, so long the series of minor pumps will proceed with their work, and streams of gold, silver, or bronze coins will flow down from the presses into reservoirs placed below to catch them.

THE DISSOCIATION OF WATER.

THIS term will seem strange to English ears, but perhaps not more so than its equivalent, "*la dissociation de l'eau*" to the French, and at any rate it seems most advisable to preserve the name given by M. H. St. Claire Deville to the very interesting phenomenon described by him to the French Academy, in a paper of which we proceed to give an account.*

M. Deville commences by stating that if a tolerably rapid current of hydrogen is made to traverse a porous earthen tube, and the gas which escapes is collected, it is found to be, not hydrogen, but in round numbers, oxygen 21, and nitrogen 79. "Thus the hydrogen is dispersed through the atmosphere, and air is absorbed by the porous tube in virtue of endosmose; and in spite of the pressure of some centimetres of water, or mercury, into which the abducting tube is plunged, and which is maintained in the interior of the apparatus." If the porous tube is introduced into an impermeable porcelain tube, shorter than itself, and closed at each end with a cork, through which the porous tube is inserted, a space is enclosed in which any kind of gas can be admitted. For this purpose the corks are pierced so as to admit an exit and entrance tube of glass. The porous tube is similarly provided, and if a current of carbonic acid gas is made to traverse the space between the porous tube and the porcelain tube, while hydrogen is driven through the former, the hydrogen changes its place, and may be inflamed at the exit where the carbonic acid might have been expected, while the porous tube allows nearly pure carbonic acid to escape. These facts, observes M. Deville, are in accordance with the observations of Professor Graham and M. Jamin.

If the preceding apparatus is placed in a furnace supplied with dense fuel, affording a heat of 1100° to 1300° (C), it will suffice to demonstrate the spontaneous decomposition of water, a phenomenon which M. Deville terms *dissociation.* To accomplish this, vapour of water is passed through the porous tube, instead of the hydrogen in the former experiment, while carbonic acid gas traverses the space between the two tubes. The gases that emerge are collected over a bath containing potash, to absorb the carbonic acid, and received in small glass jars. When the furnace is in activity the tubes yield an explosive mixture of oxygen and hydrogen—the elements of water.

Thus it appears that part of the water is decomposed or "dissociated" in the porous tube, "the hydrogen attracted (*appelé*) by the carbonic acid in the annular interspace, has traversed the walls of the porous tube, and separated itself by

* *Comptes Rendus*, Feb. 2, 1863.

the simple action of a filter from the oxygen which remains in the interior tube. A considerable quantity of carbonic acid is attracted in a contrary direction, according to the rule established in the preceding experiments, and mingles with the oxygen." This is the broad explanation which M. Deville gives, but he remarks that the action is in reality more complicated; as, when the hydrogen comes in contact with the heated carbonic acid, some carbonic oxide is formed, and a certain quantity of the latter gas is found to replace the hydrogen. It is also difficult to avoid the escape of some hydrogen, which leaves the oxygen in excess, and the water contains enough air to effect the result. "The carbonic acid determines the separation of the gases by endosmose; but it may also act mechanically." M. Deville adds that he has proved that water heated in a platina tube almost to the fusion point of the metal, reconstitutes itself entirely as it makes its exit, or is not decomposed in a sensible quantity.

In explanation of these facts M. Deville states that the temperature of the combustion of hydrogen in oxygen is not equal to 2500° C, at which point the volume of the gases, estimated at 0° C, is multiplied tenfold, and beyond which the complete decomposition of water takes place. "But this decomposition is accompanied by a considerable absorption of latent heat, to the extent required to keep the molecules of oxygen and hydrogen at a distance beyond the radius of the sphere of their affinity. Thus the decomposition of a body resembles the ebullition of a liquid, the principal characteristic of which is invariableness of temperature under the same pressure." Admitting the comparison between decomposition and ebullition, M. Deville regards "dissociation," or partial decomposition at a temperature below the decomposing point, as resembling the evaporation of liquids below their boiling point. "If," he observes, "you shut up some water in a small vessel, at ordinary temperature, the evaporation is slight, on account of the tension that is produced when vapour is formed; but if you introduce a piece of chloride of calcium, the water evaporates until that substance is saturated, the tension remaining constant all the time." He imagines the carbonic acid to carry off the dissociated gases just as the chloride of calcium absorbs the vapour, and then the process of dissociation, like that of evaporation, is enabled to go on.

JAMAICA SEA-SIDE NOTES.

BY THE HON. RICHARD HILL.

TURTLE.—The chelonians known by our fishermen distinctively as the green turtle and the hawk's-bill turtle, are common on the outside shoals of Old Harbour Bay. I went down to the beach where the turtlers were busy repairing and adjusting their nets preparatory to a start, and learned that the turtle are now (February) numerous, and that they will continue frequenting the shoals here in numbers till the month of July. The hawk's-bill turtle breed here, but the green turtle are migratory visitors. They come, as the fishermen express it, *clean,* that is free from barnacles, and are the yearly thrown off broods of the older ones to windward. They pass to leeward in successive schools, and only loiter among the marine pastures of *Testudinaria,* or the turtle-grass, to feed, and then they depart onward and deposit their eggs on the sands of the Central American shoals. The clean condition of their plates, or epidermic scuta, is the evidence that they are the full-grown young of the windward turtles in search of those unfrequented solitudes where alone they are reconciled to deposit their eggs and watch them into life. It would seem that the fields of turtle-grass are not extensive to windward, and that migration is necessary to enable the young generation to subsist. Had the extensive fields of the *Testudinaria* here been the unfished wildernesses that the Honduras sands are, or the shoals of the Mexican gulf are expected to be, the *Chelone Midas* would remain and breed, for the bay of Old Harbour is almost one continued pasture. But being pretty well resorted to for fish for the coast markets, the space, great as it is, is not solitary enough for the turtle, and they make it only a passing visit, and go further onward, but always moving socially.

It is in shallow waters, where the islets in the neighbourhood of the continent stand amid marine meadows, and afford occasional stretches of dry sand, that the turtles congregate to breed. The sea in these island clusters is tranquil, and the turtle may be observed browsing there, gathered into flocks, but so watchful and timid that they take flight upon any intrusion. They rise, however, soon to breathe; but if their confidence is not re-established, nothing promises safety but a dash onward into the open sea. Surprised upon land, they are a sure capture. Their power of moving onward is at best but a hasty scumble on shore. Caught and turned upon the back, they flounder and pivot about, but do not regain their fins.

The SNAPPERS, *Mesoprions,* in one or other of the species, are fishes of the market at all seasons; some kinds are, however, only obtainable in particular places at particular times. The large fish known as the *Mutton Snapper,* is especially common at Old Harbour. It occurs, however, only upon some of the outer shoals in that Bay of Columbus's Seven Islands. It is a splendid fish, if we regard nothing but its colour and size, but in flavour it merits the same appellation, being full fleshed, with all the prevailing delicacy of the snapper. Its ordinary size in the market is from two to three feet, with more than common breadth for a snapper.

It is not easy to determine, in the absence of pictorial delineations, whether our Mutton Snapper be the *Mesoprion Campecheanus,* the *Pargo guacinango* of Mons. Poey's list of fishes of the coast of Cuba. The fish of the Campeachy banks in the Gulf of Mexico is roseate in colour, varied with bandelets, and ordinarily of three feet in size. The habitat is shallow water. The colour of our fish is subdued rose-red, slightly yellow at the tail, with opaline lines about the head, and a particular curved azure mark from the eye to the mouth.

The deep-water Silt-Snappers include some five different species, all similar in colour, with prodigiously large eyes, brilliant with bright yellow orbits. The market people point out the difference in the size of the eyes as indicating the different depths at which they were fished for by the line and taken, but in all instances at depths so fathomably great that the dilation of the air in the cavities of the socket sends the organ of sight out of its place in the head, while the natary bladder is forced into the mouth. The air, compressed by the deep water at a temperature very much below that of the surface, expanding suddenly, tears the vessels containing air out of their place, with the force of pellets from an air-gun, and the fish comes to the hand blind and choked.

The mode of fishing for deep-water Silts is very effective. The hooks are most favourably disposed for attracting the fish to the bait. A piece of iron is bent in such a way as to hold steadily a stone of some twenty pounds weight. The hooks are arranged in diverging lines from above the stone. The line is let down steadily till it touches the sandy bottom, or the hard and smooth silt. As soon as it reaches its resting-place it detaches the stone, and the baited hooks stretch out into their place. The lines are set and re-set every morning early. They are then taken up, and the fish taken off the hooks, from line after line in succession. The lines are buoyed when laid out, the play of the buoys indicating that fish are on the hooks. A single fishing canoe or so may be seen quietly paddling out to seaward with the first blush of day. It is on its way to the Silt-ground at two hundred fathoms depth, for the purpose of laying out and taking in the deep-water lines. On hauling in these lines the iron that held the stone weight feels to the hand cold like ice. It has been ascertained that the temperature of the Caribbean Sea in depths of two hundred and forty fathoms is 48° Fahrenheit when the surface water is from 83° to 86°. This sudden depression under the tropics, so near the freezing point, gives a sensation as cold as ice.* It is in such cold strata of the sea that the *Mesoprion profundus* (Poey) and the *Ojanco* Snapper feed. The flesh is not very firm. It soon deteriorates after being drawn up from such frigid waters into an atmosphere expanding from 80° in the morning to 90° at noonday. It is a delicate-tasted fish, but only really good when cooked early as a breakfast fish.

It is not possible to see the deep-water Silts on the market-stall conspicuous for the brilliant rose-hues, without noticing their extremely large eyes. The sight of these dwellers in deep water would be very obscure if the breadth of the organ of vision did not, by the space from which the rays converge to the optic ganglion, supply by quantity the deficient intensity of light, so far below the surface.† The market-people know the fact that the size of the eye of a fish indicates the depth at which it feeds, and they understand, without any theoretic knowledge of the expansion of air by heat, that the sudden removal of the deep-water silts from the cold sea-depth to the warm atmosphere dilates the air of the bladder, and either breaks it in the abdomen, or sends it with violence into the œsophagus, while the enclosed air in the cavities of the eye expands, and thrusts that organ from the socket into the cheek of the fish.

Beyond the South Keys, and the South-east Key off Port Royal, where a line of reefs rises to the surface, along a coral wall of some three miles, there shoals out some four miles more of from eight to eighteen fathoms. This is the fishing ground for Snappers and Groupers. Out immediately further beyond, the bank descends with no bottom at one hundred and fifty fathoms. This is what the fishermen call the edge, and here they fish for deep-water Silts, and King Fish (*Scomber maximus*). A few mornings ago (December, 1861) the fishing boats were coming in with their take, from fish-pots and lines, when they observed a prodigious large Rock Hind, *Serranus catus*, following close upon the canoes. A line was baited. It tempted him to play round it, but he would not snap at it. The

* The deep-sea thermometer of the American Coast Survey, referred to by Lieutenant Maury in his *Geography of the Sea*, records a temperature as low as 35° F.

† "Leur vue dans les profondeurs où ils vivent, aurait peu d'exercise, si la plupart des espèces n'auraient, par la grandeur de leurs yeux, un moyen de suppléer à la faiblesse de la lumière."—*Histoire Naturelle des Poissons.* Cuvier et Valenciennes. Tome i. livre ii. chap i.

bait was changed from cut-up flesh to a small fish; immediately the Rock Hind drove at it, gulped it, and was taken. It was full five feet in length, one of the largest fishes of the kind that the fishermen were acquainted with. It was a perfect picture of a Grouper (*Serranus*).

We find *Sciænas* more numerously and more constantly in the market than any other family of fishes. The Red-mouth Grunt, as the *Hæmulons* are called, are much more common than any of the family. They feed in numbers on particular sands of the shore, and on particular grounds about the outside shoals and islets. They take the bait greedily. If the line for two feet be strung with some dozen pendant hooks, every hook will be found with a Hæmulon. It is amusing to sit in a boat anchored where they are known to frequent, and hear the outburst of grunting sounds with which they congregate around the baited line, and thrust each other aside for the shrimps, with which the hooks are set. It is only on sandy and silty shores that the seine can be used. Its capacious sweep, carrying the plumbed net down to the bottom, and scouring the ground as it is gathered in by the haulers in shore, whilst the boats are lifting it forward, brings into a diminishing circlet all the fish feeding on the silt, or in the ooze, and among these the Grunts will be usually found in abundance. It is not a fish of much flesh or flavour. The size is commonly small for a fish of the stall, but their colours and markings are very diversified, and they make a goodly show among the gatherings of the nets, with Gurnards and Rays, and young sharks, with *Corvinas*, or Drummers, and the *Leiostomas*, or Yellow-tail; both alliances of the *Hæmulons* and *Pristipomes*, all being feeders on the same clean sandy or silty shoals and beaches. The Hæmulons and Pristipomes are *Sciænas* of the division of united dorsals, with seven rays at the gills. In noticing the circumstances under which these fishes have acquired the name of Grunters and Croakers—*Crocros* and *Cricris*—and Drummers among the *Corvinas*, we shall quote Baron Humboldt's account of his first experience of their musical noises. "Towards seven in the evening," he says, "while in the South Sea, on the 20th of February, 1803, the whole crew were astounded by an extraordinary noise, which resembled that of drums beating in the air. It was at first attributed to the breakers. Speedily it was heard within the vessel, and especially towards the poop. It was like a boiling, in other words, like the noise of air escaping from a fluid in a state of ebullition. They began to fear that some leak might be in the vessel. It was unceasingly heard in all parts of the ship; and, finally, about nine o'clock it ceased altogether." Humboldt was not able to explain the cause of these sounds, but some twenty years after, Lieutenant

White, of the United States navy, published his voyage in the Chinese Seas, and in relating the sounds that astonished himself and his crew at the mouth of the Cambodia River, he acquainted us, that the interpreter informed him they were produced by a troop of fishes that had the faculty of attaching themselves to bodies by the mouth. The noises were heard around the bottom of the vessel. "It was," he says, "like a mixture of the bass of an organ, the sound of bells, the guttural cries of a frog, and the tones which imagination might attribute to an enormous harp; one might have said that the vessel trembled with it. These noises increased, and finally formed a universal chorus over the entire length of the vessel, and the two sides. In proportion as they went up the river, the sounds diminished, and finally ceased altogether." In a recent communication to "the British Association for the Advancement of Science," it is observed that, "every mariner who has anchored early in the spring on the coasts of Carolina, Georgia, and Florida, must have been annoyed by the drumming noise produced in the night, apparently at the bottom of the ship, and loud enough to deprive the stranger of rest until habit has rendered the sound familiar." Neither of these accounts seem distinctly to assign the noise to the *Sciænas*, but our fishermen are familiar with them. The sounds vary in their tones in different species of Grunts and Drummers. The fishermen know that by imitating them they can attract them to their nets, and they practise the imitation of their sounds successfully as a lure.

On reading these accounts one is disposed to ask whether Shakspeare in his play of the "Tempest," has not converted these marvellous natural phenomena into the supernatural one of his "Ariel," the tricksy spirit—

> "Where should this music be, in th' air, or th' earth?—
> It sounds no more,—and sure it waits upon
> Some god of the island.
> This music crept by me upon the waters;
> This is no mortal business, nor no sound
> That the earth owes."

MAN'S PLACE IN ZOOLOGY.

Professor Huxley's long-announced and long-expected work has at length made its appearance,* and contains little that was not previously made known through reports of his lectures during the last three years. It will not, however, be deemed of less value on this account, as it is the most important statement made by any great comparative anatomist on the position of man as a member of the animal kingdom. We object to the title of the new work, as *Man's Place in Nature* is a wider and more comprehensive question than his position in zoological classification, which is all that Professor Huxley endeavours to decide. The latter depends entirely upon physical structure, the former involves a host of considerations, metaphysical and psychological, which it is difficult to conceive that physical science will ever be able to explain. A scientific investigation of this description ought to excite no passions, nor ought any portion of it to be approached with prejudice, either because it seems likely to furnish support for a theory that has been espoused, or to provide weapons for the demolition of another theory that is repulsive to a particular mind. We all know that Professor Huxley, in common with Sir Charles Lyell, Dr. Hooker, and many other scientific men, leans to the Darwinian hypothesis as offering the most probable solution of the origin of species and the succession of organic forms; and all who hold such views look upon some kind of monkey as having possibly been the very great-grandmother of humanity, thousands or millions of ages ago. If man's dignity is annoyed by this supposition, they remind him of the humble beginning of every individual. They show him that the human egg, from which he is slowly hatched, is not distinguishable in its earliest stages from the germ of some lower creature. The young dog, for example, and the incipient prince, or philosopher, begin alike as a germinal vesicle inclosed in a microscopic bag, containing "a mass of viscid nutritive matter—the yelk." The first terms of the development are much the same, whatever the creature is ultimately to become; but after a little while the embryos diverge, and progress in their divergence, in proportion as the adult animals are destined to differ, so that the "embryos of a snake and a lizard remain like one another longer than do those of a snake and a bird, and the embryo of a dog and of a cat remain like one another for a far longer period than do those of a dog and a bird, or of a dog and an

* *Evidence as to Man's Place in Nature.* By Thomas Henry Huxley, Fellow of the Royal Society. Williams & Norgate.

opossum, or even than those of a dog and a monkey." As recently shown in our pages, Balbiani has traced the egg generation down so low as the ciliated infusoria, and with the explanations given by Quatrefages, every living thing may have sprung directly or indirectly from a similar source. But, in point of fact, whatever theory may prove correct, it is what we are, and not what we come from, that gives us importance. We take no pride in being composed of carbon, oxygen, hydrogen, phosphorus, iron, and so forth; and the material forces which build us up would not be the less under Divine command if their mode of action should be found to differ from what we formerly conceived.

If Professor Huxley instituted his comparisons between man and the anthropoid apes for the express purpose of sustaining Darwin's hypothesis, and was blind to all evidence of an opposite character, we should attach little importance to his anatomical labours; but he is singularly honest as an inquirer, and endowed with an unusual proportion of that philosophic quality which makes the real student the devoted worshipper of truth, and prevents his being the slave of any theory to which doubt can reasonably attach. We, therefore, take his account of bones, or brains, as so many explanations of structural fact, complete as far as they go, and neither distorted nor clipt to adapt them to preconceived views. A less honest writer might have been tempted to claim the Neanderthal skull, spoken of in our last number, as a link between the monkey and the man; but Mr. Huxley, while characterizing it as the "most pithecoid of human crania yet discovered," points out that, from its dimensions, it must have held as much brain as the average of Polynesian and Hottentot skulls; and he observes that so large a mass of brain "would suggest that the pithecoid tendencies did not extend deep into the organization," and that the bones of the skeleton confirm this opinion, so that "in no sense can the Neanderthal bones be regarded as the remains of a human being intermediate between men and apes."

With these remarks we may proceed to consider what are the physical and structural relations of man to the anthropoid apes. First, it appears that the distinctions of two-handed and four-handed—Bimana and Quadrumana—will not hold good, as the gorilla and other apes possess true feet, which differ widely from real hands. Professor Huxley observes, "the skeleton of the foot is very like that of the hand in some respects. Thus there are three phalanges in each of the lesser toes, and only two in the great toe, which answers to the thumb. There is a long bone termed *metatarsal*, answering to the metacarpal for each digit; and the *tarsus* (which corresponds with the carpus, or wrist) presents four short polygonal bones in a row, which correspond very closely with the four carpal bones of the second row of the hand. In other respects the foot differs widely from the hand. Thus the great toe is the largest digit but one; and its metatarsal is far less moveably articulated with the tarsus than the metacarpal of the thumb with the carpus. But a far more important distinction lies in the fact that, instead of four more tarsal bones there are only three, and that these three are not arranged side by side, or in one row. One of them, the *os calcis*, or heel bone, lies externally and sends back the large projecting heel; another, the *astragalus*, rests on this by one face, and by another forms, with the bones of the leg, the ankle joint; while a third face, directed forwards, is separated from the thin inner tarsal bones of the row next the metatarsus by a bone called the *scaphoid*." The tendons and muscles of feet and hands also present certain differences; "but perhaps the most absolutely distinctive character about the muscles of the foot is the existence of what is termed the *peronæus longus*, a long muscle fixed to the outer bone of the leg, and sending its tendon to the outer ankle, behind and below which it passes, and then crosses the foot obliquely to be attached to the base of the great toe." Keeping these distinctions in view, it appears that the gorilla's hand is clumsier, heavier, and with a shorter thumb than that of a man, and that his hind limb ends in a true foot of a prehensile character, "differing from that of man not in any fundamental character, but in mere proportions, in the degree of mobility, and in the secondary arrangements of its parts." Thus the gorilla has an inferior hand and an inferior foot, and throughout his whole structure a similar difference prevails, although at every point comparisons may be made.

When we come to the brain of the anthropoid apes there is a most marked and striking inferiority of size, both absolute and relative. The differences between a gorilla's skull and a man's are pronounced by Professor Huxley to be "truly immense," and it is the covering of a strikingly inferior organ. The smallest adult human skulls, of which there is certain evidence, have a capacity of not less than 62 cubic inches, while the most capacious gorilla skull known does not exceed 34½ cubic inches. This circumstance is sufficient to mark the enormous interval which separates "Man's place in nature" from that of the gorilla; but diversity of size is not in itself of much importance in zoological classification, which gives a greater prominence to structure. But even in cranial capacity "men differ more widely from one another than they do from the apes, while the lowest apes differ as much, in proportion from the highest, as the latter does from man." The structure of the brain of the ape has been the subject of an unfortunate controversy carried on for some years by Professor Owen, who finds, or imagines distinctions which no other anatomist is able to see, and which, if established, instead of being disproved by investigation, would not in the least help to account for the glory of the man, or the inferiority of the brute. We could not present a more concise account of the whole brain question than in the words of Professor Huxley, who says :—

"The brain of a fish is very small compared with the spinal chord into which it is continued, and with the nerves which come off from it; of the segments of which it is composed—the olefactory lobes, the cerebral hemisphere, and the succeeding divisions—no one predominates so much over the rest as to obscure or cover them; and the so-called optic lobes are frequently the largest masses of all. In reptiles, the mass of the brain, relatively to the spinal chord, increases, and the cerebral hemispheres begin to predominate over the other parts; while in birds this prominence is still more marked. The brain of the lowest mammals met with, such as the duck-billed platypus, and the opossums and kangaroos, exhibit a still more definite advance in the same direction. The cerebral hemispheres have now so much increased as more or less to hide the representatives of the optic lobes, which remain comparatively small, so that the brain of a marsupial is extremely different from that of a bird, reptile, or fish. A step higher in the scale, among the placental mammals, the structure of the brain acquires a vast modification—not that it appears much altered externally, in a rat or a rabbit, from what it is in a marsupial, nor that the proportions of its parts are much changed; but an apparently new structure is found between the cerebral hemispheres, connecting them together, as what is called the '*great commissure*' or '*corpus callosum*.' The subject requires careful re-investigation; but if the currently received statements are correct, the appearance of the '*corpus callosum*' in the placental mammals is the greatest and most sudden modification exhibited by the brain in the whole series of vertebrated animals—it is the greatest leap anywhere made in nature's brain work. For the two halves of the brain being thus once knit together, the process of cerebral complexity is traceable through a complete series of steps from the lowest rodent or insectivore to man; and that complexity consists chiefly in the disproportionate development of the cerebral hemispheres and of the cerebellum, but especially of the former, in respect to the other parts of the brain."

"In the lower placental mammals the cerebral hemispheres have the proper upper and posterior face of the cerebellum completely visible when the brain is viewed from above; but in the higher forms the hinder part of each hemisphere, separated only by the *tentorium** from the anterior face of the cerebellum, inclines backwards and downwards, and grows out as the so-called 'posterior lobe,' so as at length to overlap and hide the cerebellum. In all mammals, each cerebral hemisphere contains a cavity which is termed the 'ventricle;' and as this ventricle is prolonged on one hand forwards, and on the other downwards into the substance of the hemisphere, it is said to have two horns or 'cornua,' an 'anterior cornu,' and a 'descending cornu.' When the posterior lobe is well developed, a third prolongation of the ventricular cavity extends into it, and is called the 'posterior *cornu.*'"

In the lower and smaller forms of placental mammals the brain is either smooth or evenly rounded; in the higher order the grooves and convolutions are conspicuous and complicated, "until in the elephant, the porpoise, the higher apes, and man, the cerebral surface appears a perfect labyrinth of tortuous foldings." "When a posterior lobe exists and presents its customary cavity—the posterior cornu—it commonly happens that a particular *sulcus* appears on the inner and under surface of the lobe, parallel with and beneath the floor of the cornu, which is, as it were, arched over the roof of the sulcus. It is as if the groove had been formed by indenting the floor of the posterior horn from without with a blunt instrument, so that the floor should rise as a convex eminence. Now this eminence is what has been termed the 'hippocampus minor,' the 'hippocampus major' being the larger eminence on the floor of the descending cornu. What may be the functional importance of either of these structures we know not."

We have cited Professor Huxley at this length because the argument on brain structure has been carried on with absurd virulence, and as though man would be an injured individual if an ape possessed a "posterior cornu" and a "hippocampus minor." Notwithstanding that some drawings, confessedly made in error from damaged brains, give a contradictory impression, the leading English and continental anatomists who have had the opportunity of personal observation, are agreed (Professor Owen excepted) that every marmoset, American monkey, old world monkey, baboon, or man-like ape has its cerebellum entirely hidden, posteriorly, by the cerebral lobes, and possesses a large posterior cornu, with a well-developed "hippocampus minor." On the contrary, the lemurs have the cerebellum partially visible from above, and the posterior cornu and hippocampus minor are more or less rudimentary.

Until the use of every portion of the brain and the effect of

* A sort of parchment-like shelf or partition, which in the recent state is interposed between the cerebrum and the cerebellum.—*Op. Cit.* p. 99.

enlarging particular parts is distinctly understood, we cannot expect that cerebral anatomy will enable us to appreciate the distinction, so far as organization is concerned, between the man and the monkey. But we have already seen that the size of the human brain is immensely greater than that of the anthropoid ape, and Professor Owen confesses that he cannot appreciate the distinction between the psychical phenomena of a chimpanzee or of a Boschisman, or of an Aztec, "as being other than a difference of degree." It is impossible to deny that animals possess moral faculties, as well as a rudimentary reason; and when we take creatures that have had for generations the advantage of human care and companionship, such as the dog, the virtues of fidelity, self-denial, and devotion are conspicuously exhibited, and the simple elements of ratiocination plainly seen. Still we have no reason to believe that our dogs are more moral or more intelligent than those which our forefathers trained, nor do we see any ground for supposing that our descendants will discover the means of carrying dog-progress to much higher perfection than we have achieved. Some naturalists place the anthropoid apes higher in the scale of intelligence than the dog or the elephant, but we fancy they do so in compliance with a physiological theory, rather than from an investigation of fact. It is also important to bear in mind a suggestion of Professor Rolleston, cited by Sir C. Lyell, that even if it were proved that the differences between man's brain and the ape's are differences entirely of quantity, there is no reason in the nature of things why so many and such weighty differences should not amount to a difference in kind. We ought indeed to guard carefully against false analogies drawn from physical nature when we come to speak of the worlds of intelligence, emotion, and thought. The contraction of a muscle is palpably an action of physical force, and if a thousand fibres contract together with equal intensity, they will be able to move a thousand times as much matter as if one of them had contracted alone. The action of a large brain may not, however, be merely a greater action of precisely the same kind as that which a smaller brain of the same pattern can exert; and without going to the monkey, or the quadrupeds for illustrations, we may reasonably doubt whether the work done by the well-formed and well-cultivated brain of a European philosopher is nothing more than an amplification of the task performed by the very inferior and less cultivated brain of the Australian savage. Among the lowest specimens of humanity, travellers can trace no capacity for forming abstract or general conceptions of any kind. Their arts are few, simple, and, in the main, purely imitative, and their most *obvious* difference from the lower animals is the possession of language in a very elementary form. Their real difference is, however, a capacity for progress, if subjected to higher influences, which cannot be found in any brute. Give time enough and a sufficient action of civilizing agencies, the savage will grow more distinctively human, and, as generations succeed, the average cerebral development will improve and render possible a still further stage.

History has never traced the growth of any important people from the lowest to the highest stage, but we are nevertheless justified in believing an improvable reason to be the special gift bestowed upon man. How comes this gift? The physiologist shows a certain correspondence of structure with function, but we know nothing of the nature of mind, although on every hand we perceive its effects. Were it possible, as Arabian legends and fairy stories tell, for a human being to be transformed into an ass or a dog, what would the human soul do with the inferior brain assigned to it by the change? We should expect, as these legends and stories relate, something more than asinine or canine ways, and Professor Huxley suggests important considerations when he protests against the assumption that intellectual power depends altogether on the brain. That organ he considers supplies one condition only, the others being chiefly the organs of the senses and the motor apparatuses, especially those which are concerned in prehension and in the production of articulate speech. He observes that a man born dumb would be capable of few higher intellectual manifestations than a chimpanzee if he were confined to the society of dumb associates, although his brain might not exhibit the slightest difference from that of an intelligent person. We admit the necessity for considering what machinery for collecting information, and for executing its commands, the brain may have at its disposal, and can easily conceive that a colony of dumb men, if able to get a living, would be little better than chimpanzees. This idea has been well put forth by a blind surgeon, Mr. Bird, who has long protested against educating and segregating the blind with the blind, and thus depriving them of the healthy action, and of the ideas that belong to the people who can see; but if it were possible for a race of dumb men to exist for a few generations without any power of speech, should we not find that their cerebral organization would deteriorate? And even if the brain of a single dumb man which had not been exercised could not be distinguished from the well-exercised brain of "a highly intelligent and cultivated person," would not the fault be in the investigator, and in the state of the science by which he was informed? Does not the brain bear some permanent record of its previous states, or are all the phenomena of memory purely psychical and not cerebral occurrences? In an interesting collection of anecdotes strung together with little philosophy by Dr. Forbes Winslow,* the reader will find under the head of "Psychology and Pathology of Memory" a variety of illustrations that what the writer terms "mental impressions" are indestructible. Thus, the Countess of Laval in her sleep spoke the language of Brittany, although when awake she had so completely forgotten it, that when her own words were repeated to her they conveyed no corresponding ideas; and then there is Coleridge's story of an ignorant peasant girl whom the priests and monks supposed to be possessed by "a very learned devil," because she spouted Latin, Greek, and Hebrew, during a nervous fever attack, the explanation being that when nine years old she had lived with a clergyman who was in the habit of reading ancient authors as he walked up and down a passage leading to the kitchen door. In these cases the anatomist would not have known how to look for traces of the past cerebral action which was the foundation of the strange utterances; but they were no doubt there, like sun pictures, invisible until the right mode of development is tried.

We do not undertake to form opinions for our readers on these subjects. Our function is the faithful narration of what men of science are doing. There is nothing less satisfying and more annoying than the common run of reviews, which seem designed to prevent the public from knowing what the books, so treated, are about. What Lyell or Huxley and other eminent men say and think concern us all. The last believes that the philosophy which he unfolds will teach man to "discern in his long progress through the past, a reasonable ground of faith in his attainment of a nobler future;" and the first observes that "so far from having a materialistic tendency, the supposed introduction into the earth at successive geological periods, of life—sensation, or instinct—the intelligence of the higher mammalia bordering on reason—and lastly, the improvable reason of man himself presents us with a picture of the ever increasing dominion of the mind over matter."

The substance of this faith may be held by members of divers schools of science, and those may agree concerning man's destiny who differ as to his origin, while all may coincide in the advice to—

> "Move upward, working out the beast,
> And let the ape and tiger die."

We repeat that Man's place in Nature is a wider question than his position in zoology, and while the last is determined merely by his structure as an animal, it matters not whether, as Huxley proposes, he is arranged at the head of the primates or in an order by himself.

* *Obscure Diseases of the Brain and Mind.*

TRADE MARKS—ANCIENT AND MODERN.

BY H. NOEL HUMPHREYS.

So much has recently been said and written on the subject of trade marks, and the advisability of adopting some stringent measures to secure their genuineness, that it may not be uninteresting to examine the character of certain usages, with regard to commercial stamps, which prevailed among the states of ancient Greece, and which archæological research has recently brought to light. Without entering upon an account of the trade marks used at the present time, and their fraudulent imitation in various branches of manufacture, from cutlery to Eau-de-Cologne, it may be as well just to call to mind, *en passant*, the case of the famous Cross Cotton, which in the names of Cartier *versus* Prichard, Cartier *versus* May, and Cartier *versus* Lund, occupied the Court of Chancery, in the year 1861, on June 27th and July the 12th and 18th; the second case being an application to commit the defendant for breach of an injunction already granted.

The ancient trade marks about to be described do not belong to a precisely analogous branch of manufacture, but will serve equally well to show the feeling entertained by the Greeks, that in commercial transactions a distinguishing mark, forming a dependable guarantee, was very desirable. In order to render this kind of guarantee a reliable one, it was undertaken by the state itself, and not left to the good faith of individuals as with us; the consequences of which we have recently seen. The worst result of falsifying marks is, that the loss of character in foreign markets which follows, recoils upon the general commerce of the country rather than upon the fraudulent imitator, as the low price of an inferior article secures to it a certain amount of circulation after all faith in the qualities of the superior product has been destroyed. It was with this conviction that the Governments of Greek states undertook to guarantee the quality or quantity of a staple product by the application of a national seal. The manner in which our Government endeavours to prevent the evasion of duties on patent medicines, by forbidding their sale without a stamp, is a course which produces, accidentally, a somewhat analogous result, as, in addition to securing the Government duty on every box or bottle that is sold, it serves at the same time as a guarantee that the article so stamped is the thing it professes to be, as few individuals would venture upon the forgery of the official stamp of the Government. We have indeed a custom, which though not that of the Government, possesses nearly an equivalent value, as being that of a powerful national Guild—the gold and silver marks of the Goldsmiths' Company having proved as efficient as any Government stamp could be, in serving as a dependable guarantee for a certain amount of purity in articles professed by their manufacturers to be of gold or silver. It seems, therefore, that if a general system either of guild marks or state marks were adopted, the fraudulent use at present made of the trade-mark system would be rendered unprofitable, and therefore extinguished.

Almost the only trade marks of the ancients that have come down to us are those in the wine trade. Thiersch and Stoddart first described the official stamps or marks on the amphoræ, or wine vessels, of the little island state of Thasos, celebrated for its wines; but these antiquaries had only discovered three Thasian marks, while they described a number of those of Rhodes, Cnidos, and other places. The Rhodian inscriptions of this class are fuller than those of any other place of which similar remains have been brought to light, and have on this account proved of some literary value. For instance, the name of the month during which the stamping took place is often added to that of the stamping magistrate, and in this way the names of seven Rhodian months and the intercalary month have been recovered; five only being known previous to the discovery of the stamped amphoræ. Curious peculiarities of local spelling of Greek words also occur, and the titles conferred on the stamping magistrates by different states have also been recovered, as in some places they were added to the names. Thus we find the stamping officer styled *ιερεις* at Rhodes; *δημιουργος* at Cnidos; and *αστυνομος* at places on the Black Sea.

This stamping, or rather sealing, was analogous to that of stamping or sealing the current coin with the device of the state, to guarantee that each piece was of a certain weight and purity; and as in the Grecian style of coinage, when in its highest state of development, the name of the stamping magistrate appeared on the coin, by the side of the device of the state seal, so on the amphoræ of the wines intended for exportation the name of a magistrate accompanied the stamp of the official seal, and sometimes appeared by itself. The official seal used for the purpose of trade mark is often the same as that which appears on the national coinage. It is, however, frequently of distinct design, though nearly always having reference to the monetary type. The following illustrations and descriptions will elucidate more fully the nature of these stamps. They are principally taken from those of Thasos, recently discovered by M. Stephanos Comanoudis.

The stamp, No. 1, on the handle of a Thasian amphora, consists of the figure of an archer, which is a rude copy of that on the fine gold staters of Thasos, of ancient make. It represents Hercules in the act of drawing a bow. In some of the stamps of this class the archer is represented in a standing attitude. The name of the magistrate is indistinct in the stamp under description. The portion of the inscription attached to this stamp is illegible for want of the context.

No. 1.

On the stamp, No. 2, the bow only is represented as an early emblem of Hercules. It is sometimes accompanied by a club, to distinguish it from the bow which is sometimes used as an emblem of Apollo. On this stamp the name of the state is nearly perfect, and precedes that of the stamping magistrate. It stands ΘΑΣΙΩΝ, in the genitive plural (of the Thasians). The name of the magistrate, ΑΝΑΡΙΩΝ, is probably miswritten with an Ω, instead of an Ο, giving it the appearance of a genitive plural, while it is doubtless intended to be in the nominative case singular.

No. 2.

No. 3.

The type of another stamp is a short sword, which is, in all probability, another attribute of Hercules. This stamp also has the beginning of the word ΘΑΣΙΩΝ (of the Thasians).

Among some of the types of these seals which cannot be directly traced as Thasian types are the diota or two-handed amphora, a symbol generally considered as sacred to Bacchus, as shown in the illustration, No. 3; or the horn of Abundance, or occasionally a dolphin; while some have a rude head of Diana, very similar to that on an ancient Thasian coin described by Eckhel. The name on this stamp, which, like most of the others of this series, evidently belongs to a late period of ancient Greek commerce, is incomplete, and it is written from right to left, or, as we should say, backwards; an affectation of ancient style* of which we are not without abun-

* It will be remembered that all the earliest forms of Greek writing run from right to left.

dant examples in the present day, as in the occasional use of old English or Gothic letters in decorative inscriptions. The imperfect name is probably ΑΡΙΣΤΟΝ (Ariston), as found complete on the stamp of the dolphin type (No. 4), where it is also written in the ancient manner, from right to left, though the workmanship of the stamp plainly indicates that it belongs to a period long posterior to that during which Greek writing ran in that direction.

No. 4.

It has been stated, as the general supposition, that the names accompanying the official stamp were invariably those of the state official; but it appears probable that when the name appears in the genitive case, as it occasionally does, it may be that of the producer himself; while a second name, which often occurs, may be that of the stamping magistrate.

On some of the most recent of these antique stamps the sigma (Σ) is written in what is called the square manner—that is, in nearly the form of a C, as indeed it is on late Greek coins.

The theta (Θ) is also sometimes abandoned for the simpler and softer sound of S; and thus we find on some of these handles of amphoræ what ought to be ΘΑΣΙΟΩΝ (Thasiōn) written as ΣΑCΙΩΝ (Sasiōn). The Thasian money of late date has often debased spelling of a similar kind, as ΘΑΤΙΩΝ for ΘΑΣΙΩΝ. It may be stated here the amphoræ of different states are, in many instances, easily distinguished by archæologists without reference to their description; for instance, the clay of Thasos differs from that of Rhodes or Cnidos in being lighter coloured, and also coarser. The Thasian vessels are also less baked than those of Rhodes.

Such are a few of the points of general interest to be met with in the study of these broken remains of the ancient amphoræ that once contained the Thasian wine, in addition to the knowledge acquired through their evidence that the Greek states took upon themselves the regulation of the trade marks of the articles of staple produce, instead of leaving them at the mercy of the caprice or dishonesty of individuals. The site of almost every historic Greek city, whether at present occupied by a modern town or not, has in its vicinity some mound or mounds formed of the ancient refuse of the place, often consisting in great part of accumulations of broken pottery. It is in such of the mounds, on the high ground above the Piræus, that M. Stephanos Comanoudis, professor of Latin in the University of Athens, has discovered a vast number of the stamped handles of the amphoræ of Thasos, of which the illustrations of the present article are examples. M. Comanoudis proposes to publish the result of his archæological labours, which will form a very interesting volume, opening up several new channels of information concerning the ancient commerce of Athens, and the laws by which its transactions were regulated; among which may perhaps be found many hints for the better regulation of our own system of trade marks and stamps.

THE EXAMINATION OF TADPOLES.

As we are now in the midst of the season of tadpoles, our microscopic readers may be advantageously reminded of the researches of Mr. Whitney, laid before the Microscopic Society of London in 1861, and briefly described in a former number of this magazine. Mr. Whitney recommends the binocular microscope to assist in the process of looking into the tadpole, which should be placed on its back. He observes, when matters are thus arranged, "before us is the beating heart, a bulbous-looking cavity, formed of the most delicate transparent tissues, through which are seen the globules of the blood, perpetually, but alternately, entering by one orifice and leaving it by the other. The heart appears to be slung, as it were, between two arms or branches extending right and left. From these trunks the main arteries arise. The heart is enclosed within an envelope or pericardium. This pericardium is, perhaps, the most delicate, and is certainly the most elegant beauty in the creature's organism. Its extreme fineness makes it often elude the eye under the single microscope; but under the binocular its form is distinctly revealed. Then it is seen as a canopy or tent, enclosing the heart, but of such extreme tenuity that its folds are really the means by which its existence is recognized." To the right and left of the heart the lungs should be looked for, in which the circulation can be seen in the middle and later periods of its life. In its first stage the tadpole "respires exclusively by gills," which are very interesting organs to watch.

Mr. Whitney considers that in the middle and later stages of the tadpole's metamorphoses, in which it is neither a reptile nor a fish, the "three large arteries which arise from the heart become the cephalic, the pulmonary, and the aortic trunks." The cephalic artery, he asserts, "receives into it small branches from the subdivisions of the pulmonary artery, so that there is a direct communication between these two vessels." The second trunk he considers the true pulmonary artery, which enters and is distributed through the lung; and the third trunk, he states, "also enters and passes through the lung, inosculating in its course with branches of the pulmonary artery, and then emerges from the floor of the lung to enter the abdomen, and with its fellow form the aorta or great systemic trunk." Previous observers had not arrived at results presenting so complete an aeration of the tadpole's blood during its active and carnivorous and even cannibal stage of existence; but Mr. Whitney was careful to examine specimens sufficiently transparent. The great obstacle to this is the opacity usually presented by the coil of intestine. Mr. Whitney tried purgative medicines as a remedy, but without effect. He succeeded, however, by placing his tadpoles upon water diet, when the intestine could receive little solid matter, and ceased to obstruct his view.

When the tadpole is lying on his back, the liver is a lobed organ below the left lung; and still lower is the oval kidney, lying close to the caudal vein.

The reader will be assisted in tracing the blood-vessels by another quotation from Mr. Whitney, who observes, "all these are closely connected with the corresponding lung. The upper one—the cephalic—runs along the upper edge of the lung, and gives off, in its course, a branch which ascends to the mouth. The cephalic artery continues its course around the lung (forming, to all appearance, the *edge* of that organ), until it suddenly curves upwards and backwards, and reaches the upper surface of the head, when it dips between the eye and the brain, towards which it is evidently travelling." Enough has probably been said about the two other arterial trunks, but those who wish for further details can consult Mr. Whitney's paper.* We may add that his most successful tadpole looked quite opaque when taken from a jar containing green weeds, but proved on examination to be perfectly transparent. He had no red blood, and his other fluids were equally colourless.

* *Quarterly Journal of the Microscopical Society*, Jan., 1862.

VARIABLE STAR OBSERVATIONS.

BY GEORGE KNOTT, LL.B., F.R.A.S.

In endeavouring to lay before the readers of the INTELLECTUAL OBSERVER a short account of the method of observing variable stars, I am desirous, at the outset, of disclaiming any pretensions to originality in what I shall have to advance. For the substance of the following paragraphs I am principally indebted to various papers by N. R. Pogson, Esq., Director of the Royal Observatory at Madras, who has prosecuted this branch of research with much assiduity and deserved success.

Preparatory to commencing operations on a variable star, the following equipment is necessary:—An approximate chart of its neighbourhood, and a list of stars whose magnitudes have been carefully determined, to be used as points of reference in fixing its magnitude at the several times of observation. The "comparison stars" should be lettered or numbered for convenience of reference, corresponding letters or numbers being affixed to them on the chart.

Thus furnished, the observer compares the variable with such of the "comparison stars" as may not, at the time, too widely differ from it in brightness, and carefully estimates the differences in tenths of a magnitude. Several values, which, after a little practice, will be found to be fairly accordant, are thus obtained for the magnitude of the variable at the time of observation, and the mean of these is assumed as its magnitude for the night. For convenience I shall term these "nightly means."

The preceding remarks will be best illustrated by an example, which I take from my journal.

"Jan. 7th, 1862.—U Geminorum. Estimated equal to — b + 6 : d—5 : e—10 : f—13 : (the differences being expressed in tenths of a magnitude)." The assumed magnitudes of the "comparison stars" are as follow,—b = 9·3 : d = 10·3 : e = 11·0 : f = 11·3 :—hence, the resulting values for the magnitude of the variable are,—9·9 : 9·8 : 10·0 : 10·0 :—the mean being 9·9, which is, probably, not very far from the truth.

The next step in the process is to project all the "nightly means" on cross-ruled paper, taking the dates of observation for the abscissæ and the corresponding magnitudes for the ordinates. A curve is then drawn by hand evenly among the points thus laid down, so as to leave as few discordances as possible; this is termed the "light-curve," and the epoch of *maximum* or *minimum*, as the case may be, is determined by reading off the date on which the curve passes through its highest or lowest point. If, owing to slowness of change in the magnitude of the variable, the "light-curve" is flattened near the vertex, the date of maximum or minimum cannot accurately be determined by inspection. In such cases the following expedient may be adopted:—Bisect the lines joining points where the "light-curve" in ascending and descending passes through equal magnitudes; among the points thus obtained draw a curve, producing it till it cuts the "light-curve;" the point of intersection is assumed as the epoch of maximum or minimum. A discussion of several observed maxima or minima gives the *period* of the variable star, which, with the range of variation, is in some cases found to be remarkably irregular.

I have thus endeavoured to give a general idea of the mode of observing variable stars. Various difficulties will doubtless suggest themselves to the reader as likely to occur in practice. Of these the most serious, probably, is connected with the obtaining charts and lists of "comparison stars." I am in hopes, however, that this difficulty will be before long removed by the publication of the Hartwell Variable Star Atlas, commenced by Mr. Pogson, at Dr. Lee's observatory, and now in process of completion at Madras. This valuable work will in all likelihood do much to popularize an interesting branch of inquiry, and one in which the zealous amateur may labour with every prospect of success.

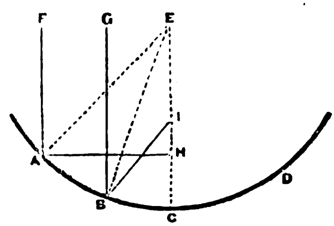
SPECULA FOR TELESCOPES.—DOUBLE STARS.—OCCULTATIONS.—TRANSITS OF JUPITER'S SATELLITES.

BY THE REV. T. W. WEBB, F.R.A.S.

THE process of grinding and polishing specula, whether of metal or glass, for optical purposes, is not merely a laborious or, at least, tedious one from the hardness of the material, but one of much difficulty from the extreme delicacy of some of the operations, and the impossibility of obtaining the highest perfection which art can accomplish, by any other than what may be termed an indirect mode of working. The circular disc of metal or glass has, in the first instance, to be ground on one of its faces to the required curve, by means of a tool of brass or iron of similar form to itself, and not much differing in size. This is effected by working one surface on the other, with a due intermixture of circular strokes and straight ones carried in all possible directions, employing as an abrading material moist emery—a mineral powder of an extremely hard nature, which is obtained of progressive degrees of fineness by agitating it with water, and collecting the sediment after different intervals of time. As the grinding (which is a very slow operation) proceeds, finer and finer qualities of emery are successively brought into use, till the scratches produced in the earlier stages are effaced, and an exquisitely smooth and, to some extent, reflective surface is the result, when the process of grinding is complete; though metal is occasionally still more delicately smoothed by being subsequently applied to a tool of whetstone or slate. Polishing is effected on a similarly-shaped tool covered with a layer of paper or pitch, either of which materials will admit of the polishing powder's imbedding itself and retaining its position to the last. Several powders may be employed for this purpose: putty powder, which is said to be a mixture of the oxides of tin and lead, has been often used; but the preference seems now to be given to the *rouge* of the jewellers—in chemical language, the sesquioxide of iron, as producing a blacker lustre: with this substance a process corresponding with that of grinding is continued, till a perfectly equable and splendidly reflective polish is obtained. In all this, nothing more is involved than a considerable expenditure of time and labour; the latter, however, admits of being greatly reduced by the employment of machinery,* which has of late been extensively introduced with admirable results. Much care also must be taken to avoid the slightest inequality of pressure or irregularity of action, as well as to efface all scratches and prevent their reproduction; though this is a matter of secondary importance, as affecting the appearance, but scarcely at all the performance, of the speculum. The final result will be, under experienced management, a mirror of great splendour to the eye, but of inferior performance in the telescope; the image, fairly distinct with a low power, becoming less sharp and defined than it ought to be under deeper magnifiers. The reason of this defect may be easily rendered intelligible. The brightest possible polish is of no value unless it is wrought out upon a figure, as it is called, or curvature of surface, capable of reflecting the rays accurately to a single point or *focus*, and thus forming a picture of the object whence they proceed, distinct enough to admit of being highly magnified; and hence, while an inferiority of polish induces only a want of brilliancy in the image, a deficiency in correctness of figure occasions a confusion and haziness far more prejudicial

* With large diameters, the increase of weight and friction becomes very inconvenient. The late Mr. Ramage, of Aberdeen, an ingenious artificer, who succeeded Herschel I. in point of time, astonished the London workmen by the size of the specula which he could work by hand, even (if I recollect right) up to fifteen inches.

to the quality and value of the instrument. Now, the form naturally resulting from working two surfaces equably upon each other in all possible ways for a length of time, will be that of a portion of a sphere, no other concavity having the same amount of curvature in every possible direction; and therefore the figure of a speculum finished in the way just described would be spherical; but a spherical surface is incapable of collecting parallel, or nearly parallel, rays, such as reach us from the heavenly bodies, into one point; and therefore our mirror would, after all, disappoint our expectations. The cause of the incapacity of such a surface to collect the whole of a parallel pencil of rays in the same point may be illustrated by the following diagram; if we bear in mind the first principle of catoptrics, that whatever angle the incident ray makes with a perpendicular to the reflecting surface, it will be reflected at a precisely equal angle on the other side of the perpendicular.



Let A B C D be a section of a spherical mirror, of which E is the centre; then E A and E B will be perpendiculars to the surface, and the incident parallel rays, F A and G B, will be reflected so as to make the angle E A H = F A E, and also E B I = G B E. But the ray A H, instead of intersecting the ray B I in I, as it ought to do, to assist it in forming the image, will, from the properties of the sphere, the curvature of which is too rapid, be reflected to another point, H, nearer to the surface of the mirror, so that the focus of the more distant, or marginal, will be shorter than that of the more central rays; and instead of the intersection of the whole incident pencil taking place in one point, there will be a continued succession of intersections, or foci, each closer to the surface of the mirror in proportion as the reflecting point, or rather zone, to which it corresponds, is further removed from the centre. Hence results the test of figure so well known to opticians, the aspect of the luminous disc formed by a large star on each side of the focus: if the disc at some distance within the focus is bordered by a bright and sharp limb, while the appearance is reversed and the centre brightest on the other side of the focus, it indicates that unduly rapid convergence of the marginal rays which is the sure indication of a spherical form; hence also follows the advantage, with telescopes containing such imperfectly figured specula, of contracting the aperture by a diaphragm, as the error increases with extraordinary rapidity in proportion to the distance from the centre. Such is the defect inseparable from the spherical figure; it is fortunately remediable, but only, at least in the Newtonian or Lemairean* construction, by transforming the circular into a parabolic curve, the property of which is to reflect all parallel rays to one focus; and the accomplishment of this object is the great triumph of the optician's skill. A concave parabolic, or, more correctly, paraboloidal,† surface corresponds about its centre with a sphere of shorter radius, at its margin with one of longer radius, than the one that would most nearly fit its intermediate portion; and consequently the sphere may be made to approximate to a parabola by either deepening its centre, or flattening its edges; as will be apparent from considering the diagram, where a deepening of the curvature about B would so alter the direction of the reflected ray B I as to bring it down to H, or a flattening in the region of A would raise A H up to I. If this could be accomplished by a simple rotatory motion, there would be less difficulty; but the polish would be spoiled by becoming a succession of concentric rings: motions in other directions are requisite to prevent this, and the best mode of employing them becomes a complicated problem, which, however, has been frequently solved with great success. Fortunately the quantity to be removed is comparatively very small, amounting, according to Sir J. Herschel's computation, to only one21,333rd part of an inch for the edge of a speculum of 48 inches in diameter and 40 feet focus—a striking incidental proof, by the way, of the extraordinary delicacy which these processes involve, and the corresponding care which they require. Different methods have been adopted by different artificers to produce the parabolic form, whether in metal, or in glass prepared according to the new invention, which has been frequently referred to in these pages, for the reception of a film of silver. The mode followed by one of the inventors, Steinheil, seems not to be known in this country: that pursued by the other, Léon Foucault, is fully described in his elaborate memoir on the production of silvered specula. It consists of applying by hand smaller secondary polishers of deeper curvatures to bore out, as it were, the central part of the mirror, or, in the case of very large apertures, attacking the margin also with flatter ones. Other methods are at present used by the amateurs in this country who have taken up this beautiful manufacture with so much spirit and perseverance. The degree of success already attained will be readily appreciated by those who know the quality of the tests which have been resorted to;

* The front view without a small speculum is sometimes so called, from the name of its inventor. In the Gregorian form, and that of Cassegrain, a compensation of errors between the two specula is practicable.

† The parabola is the curved line;—the paraboloid, the surface produced by its supposed revolution round an axis; just as a circle, by a similar revolution, may be conceived to produce a sphere.

and a few notices of their progress will form a suitable conclusion to the present remarks.

Professor Frankland, of the Royal Institution, some time back completed a silvered glass speculum of 6 or 7 inches aperture, which bears a power of 750 on the moon with scarcely any perceptible diminution of sharpness and no want of light. Mr. Bird, of Birmingham, has wrought a 12-inch glass mirror to such perfection that in its unsilvered state it is capable of dividing ζ Cancri, now an exceedingly close star, while his speculum of 8¼ inches will separate ε Arietis, 52 Arietis, η Orionis, or η Coronæ Borealis, elongate ω Leonis, and show occasionally the sixth star in the trapezium of Orion. Mr. With, of Hereford, has finished a speculum of about 6 inches, which separates ζ Orionis with an interval equalling the disc of the larger star; shows a good black division between the components of 170 P. VII (the little pair closely *s f* Procyon); and brings out the fifth star *in trapezio* as a steady object. The Rev. H. C. Key is also engaged upon two 12-inch glass discs, and devoting the greatest attention to the attainment of extreme perfection in the spherical figure, as he has already discovered a method of subsequently rendering it parabolic, which has been tested with complete success. He employs, in common with Messrs. Bird and With, a modification of the Earl of Rosse's polishing-machine.

DOUBLE STARS.

In the wide and tolerably bright region of the galaxy lying to the E. of *Orion*, which is occupied by part of Hevel's constellation *Monoceros*, we shall find two good objects. First, if we carry a line from λ in the head of *Orion* (No. 99) through *a*, or *Betelgeuse*, the large red star a little *sf* in the Giant's shoulder, it will point somewhat below the brightest of several small stars—

101. 8 *Monocerotis*. 12″·9. 23°·8. 5½ and 8. Yellow and flushed blue. This beautiful pair, Smyth thinks, may perhaps be in orbital motion. It lies in a glorious low-power field.

If we now draw a line from *Sirius* to *a Orionis*, a little to the left of it, and some way below its centre, lies the *lucida* of the vicinity, which is—

102. 11 *Monocerotis*. 2″·8. 102°·3. 7 and 8. Pale white. The immediate neighbourhood of a third white 6½ mag. star (which is properly 11), at 7″·2 and 130°·3 from the nearest of the pair, makes this a triple combination, called by Herschel I. "one of the most beautiful sights in the heavens." Notwithstanding the aspect of physical connexion so strongly impressed upon this group, no motion has as yet been detected in it: a singular fact, leading to some remarkable speculations.

Had we only a double system before us, it might have been supposed that the components had reached the opposite apparent ends of an orbit lying nearly in the plane of our sight, in which position the real motion being directed nearly towards or from the eye, becomes for a considerable time almost inappreciable. But this idea is contravened by the long interval since its discovery, which would surely ere now have effected some change of distance, and is completely overthrown by the combination of a third object, which would as surely not have remained apparently unmoved during the whole of that period from the same cause. It would seem, therefore, that we are obliged to suppose, either that these bodies are only in apparent and not actual proximity, or that they are not amenable to the law of gravitation, or that some peculiarity in their constitution modifies its influence. The first of these suppositions may be readily laid aside; the chances being inappreciably great against the position of three objects almost in a line behind one another, whose different degrees of brightness would so nearly compensate their different distances as to produce the effect which we see. The second ought not, if possible, to be admitted, as being contrary to the whole analogy of the known creation, and especially to instances in every part of the heavens in which systems of stars are found to be in motion in accordance with this, or at least some similar law. We are obliged, therefore, to fall back upon the third, as the more probable, hypothesis, and to explain this apparent immobility by inferring a condition in which gravity would act feebly, and motion would be in proportion slow. This might be met by the supposition of unusual remoteness between the components of the group, in which case, as they appear so close, they must be at an amazing distance from us, much exceeding that of the majority of such objects; or else, if their interval does not exceed an average limit, we may suppose the naturally-resulting rapidity of motion counteracted by deficiency in density or inferiority in magnitude. In these ideas there is nothing extravagant, for our own sun has a density only one-fourth of that of the earth; the huge globe of Saturn is so light that it would actually *float in water;* and a far higher attenuation is easily conceivable: diminutive size, on the other hand, might be compensated by greater intrinsic splendour without our detecting it, since, from extreme remoteness, we have never yet distinguished the real disc of any star, and magnitude and brilliancy have evidently no mutual dependence. In fact, there are reasons for supposing that the Apostle's expression, "one star differeth from another star in glory," though apparently employed by him merely as a popular illustration drawn from their different aspect to our eyes, may be equally true as applied to their intrinsic splendour. None of these hypotheses, therefore, drive us upon any improbability, while they enlarge our ideas of the wonderful diversity, as well as magnificence, of the works of the Creator.

If we now cross the galaxy in an E. direction, till we reach a line down from *Polaris* through *Castor*, we find a beautiful first-magnitude star, *α Canis Minoris, Procyon,* introduced here as a pointer to a delicate pair, too small, otherwise, for our list, but so readily found from its splendid neighbour, and so especially valuable as a test-object, that it well deserves insertion. It lies a little way *sf* from *α*, in the same field with it under a moderate power, and is the brightest among many companions. It has been often referred to as "31 *Canis Minoris* (Bode)," having been so designated by that astronomer; but we shall give it Smyth's appellation:—

103. 170 P. VII. *Canis Minoris.* 1″·4. 132°·9. 7 and 8. White and ash-coloured. Secchi thinks this very pretty double star is in slow angular motion. I have seen the discs in contact with 144 on $3\frac{7}{10}$ inches; with 300 on my present $5\frac{1}{2}$ inches the division is about equal to one diameter of the smaller star. The remark in Herschel and South's catalogue (1821—1823) that 133, the usual observing power of the 5 feet equatorial, gave no suspicion of its being double, and 303 just separated the discs, would lead to the idea of a widened distance, which, however, the measures of Struve and Secchi do not confirm.

We now proceed to two objects which, from want of space, were obliged to be postponed last spring till they had advanced too far into the twilight. The first of them is a glorious double star—

104. *γ Leonis.* 2″·6. 103°·2 (1831·36). 2″·8. 107°·2 (1843·18). 2 and 4. Bright orange and greenish yellow. Herschel I. called them white and reddish-white; and as his bias was in favour of ruddy tints, there is a suspicion of change since his day. This has been called the noblest pair above our horizon, for the grandest of all, *α Centauri,* both of 2nd mag., only begins to be visible in Egypt and conspicuous in the West Indies. It is an excellent test for small instruments. I have divided it well with a beautiful $2\frac{1}{4}$ inch glass by Bardou, of Paris, and Smyth found it within the reach of 2 inches. It is impossible to look upon these two golden suns without admiration, and we shall not be surprised to find that they form a binary system. Smyth's measures alone show this; but it is still more evident from Herschel I.'s angle, 83° 30′, in 1782, and the recent measures of Secchi, whose mean is 3″·047 and 108°·11 (1858·869). The motion, however, is slow,

and the period must be long; but, perhaps not, as formerly supposed, so much as 1000 years. This object may be found from the great star *Regulus* (*α Leonis*, the Lion's Heart), the brightest in a large tract E. of the Twins and Procyon. N. of Regulus, at a short distance, lies a 3rd mag. star, *η Leonis; n f* from this, at a still less distance, is *γ*, next after *α* the brightest in the vicinity. Regulus possesses some interest as marking very nearly the position of the ecliptic, or apparent path of the sun in the heavens, the star being only a few minutes above the N. limb of the sun on August 21 of the present year.

Our next is a more difficult object,—

105. *ι Leonis*. 2″·4. 90°·5 (1836·4). 2″·5. 81°·3 (1853·29). 4 and 7½. Pale yellow and light blue. This pair, missed by previous observers, and discovered by W. Struve at Dorpat, is no doubt a binary one; its continued retrogradation appears from Secchi, the mean of whose measures gives 2″·568 and 76°·38 (1856·263). Its beauty fully entitles it to a trial, but it is too close for a very small telescope. I have seen it well with $3\frac{7}{10}$ inches and power 144, 80 only just separating it. It will be caught as the nearest 4th mag. star *s p Denebola*, a 2nd mag. star in the Lion's tail, which is the most conspicuous to the E. of Regulus, but at a considerable distance, and lying nearly in the direction of Arcturus from the latter star.

OCCULTATIONS.

The following occultations will be conveniently visible:—April 2, B. A. C. 4006 (*i. e.* the star so numbered in the British Association Catalogue), 6 mag., from 11h. 25m. till 12h. 4m. 26th, *κ* Cancri, 5 mag., from 9h. 46m. till 10h. 54m. 29th, *e* Leonis, 5 mag., from 10h. 29m. till 11h. 28m.

DARK TRANSITS OF THE SATELLITES OF JUPITER.

Jupiter having now become very conspicuous in the S.E. sky, the dark transits of his satellites will again be objects of curiosity; and as the opposition of the planet takes place on the 12th, the reversion of the relative positions of the satellites and their shadows in the course of the month, and their very close proximity about the time of the opposition, will be noticed with much interest. The following transits are those most convenient for observation:—April 3rd. The shadow of II. leaves the disc at 9h. 52m., followed by the satellite at 10h. 14m. 4th. The shadow of I. enters at 11h. 26m., the satellite following at 11h. 38m. 6th. The shadow of I. passes off at 8h. 8m., the satellite at 8h. 16m.; the shadow of III. at 9h. 28m., III. itself at 9h. 50m.: thus previously to 8h. 8m.

two satellites with their respective shadows will be on the disc at the same time. 10th. The shadow of II. is on Jupiter from 9h. 55m. till 12h. 26m.; the satellite from 10h. 3m. till 12h. 28m. 13th. The opposition being past, and the shadows transferred to the other side, I. will be in transit from 7h. 48m. till 10h.; its shadow from 7h. 49m. till 10h. 2m.: at 10h. 54m. and 10h. 59m. the shadow of III. and III. itself respectively enter. 20th. The ingress of I. is at 9h. 32m., of its shadow, at 9h. 43m.; their respective egresses at 11h. 44m. and 11h. 56m. 27th. I. will enter at 11h. 17m., followed by its shadow at 11h. 37m.

ANALYSIS OF MIXED FABRICS.

The interesting researches of M. Persoz, jun., on the power of a strong solution of chloride of zinc to dissolve silk, affords the means by which a real analysis of a mixed fabric of silk, cotton, and wool may be made.

To dissolve silk, a strong solution of chloride of zinc should be first boiled with excess of oxide of zinc, and the clear solution should be afterwards separated either by decanting or by filtering through a funnel stopped with asbestos. Silk boiled in this solution readily dissolves, and if a mixed fabric of silk, cotton, and wool be so treated, the silk only is dissolved out. If the residue of the fabric is then removed, carefully washed so as to get rid of all adhering chloride of zinc, and afterwards boiled in a strong solution of caustic soda or potash, the wool is dissolved, when the remaining cotton, after having been washed from the potash solution, can be recognized under the microscope.

The properties of the solution of silk are strikingly shown if the chloride of zinc is got rid of by dialysing. This may be perfectly accomplished if the solution is weak, when a golden yellow varnish of dissolved silk remains in the dialyser; this is viscid and may be drawn out into threads; on evaporation it leaves the silk in a somewhat altered form, the tenacity being much lessened.

If, on the other hand, a concentrated solution is dialysed, the whole of the chloride is not got rid of, but towards the conclusion of the operation the silk solution in the dialyser increases very much in size by the absorption of water through the parchment paper, sometimes even to such an extent as to fill up the vessel, and eventually becomes a ropy magma, or tenacious semi-solid mass.

This mode of separating the different tissues in mixed fabrics offers an interesting contrast to that adopted by Mr. Ward, in which the wool is destroyed by a heat just sufficient to char it, leaving the cotton or linen in an uninjured state.

FLAME-COLOURS.

Although a spectroscope is requisite in order to recognize with certainty the various metals in a mixture by means of the systems of coloured rays characteristic of each metal when burning, yet some very instructive and beautiful effects may be obtained with scarcely any apparatus at all. For this purpose it has been suggested* that the chlorates of the different metals should be used. If inside the edge of the flame of a small spirit-lamp, or, better, of a Bunsen gas-burner, a fused bead of chlorate of potash be held in a loop of platinum wire, after a second or two there takes place an explosive flash of violet flame, intense and beautiful; while chlorate of soda gives the well-known yellow light with peculiar brilliancy: but it is, perhaps, with chlorate of baryta that the most striking phenomenon is produced. In this instance it is sufficient to bring a crystal of the salt (which may be readily obtained in commerce) in contact with the flame, when a series of decrepitations occur, accompanied by bursts of the characteristic green light. A pretty effect is seen when chlorate of baryta is introduced into one side of a flame, and chlorate of strontia on the other. The chlorates of lithia, strontia, and lime offer, when thus ignited, a spectacle of great splendour; and if a spectroscope be employed, the blue bands of lithia are clearly seen, although with its other salts the high temperature of the electric arc alone developes them. Chlorate of copper is another compound, the violet-blue flame of which is unusually brilliant when shown as we have described. But it is quite possible to dispense with the Bunsen gas-burner or spirit-lamp, and even with the platinum wire, and yet to obtain results as striking, if not more so. For this purpose some *gun-paper*, made in the same way as gun-cotton, is to be soaked in solutions of the various chlorates mentioned above, dried with care, and *kept* dry. A good gun-paper for the purpose is prepared by soaking strips of Swedish filtering-paper for ten minutes in a mixture of four parts of oil of vitriol with five parts of strong nitric acid, both by measure: the strips when taken out of the acid should be washed first with cold, and then with hot rain or distilled water, till the washings

* *Chemical News.* A. H. Church, Dec. 24th, 1859, and W. Crookes, April 26th, 1862.

are no longer sour to the taste. The solutions of the metallic salts need not be very strong; but if they are warm, the strips of gun-paper will be more easily and completely saturated with them. Since some of the chlorates attract moisture from the air, it is better to dry the papers prepared with these compounds before the fire carefully previous to lighting them. They are shown to best advantage when a strip is loosely crumpled up into a pellet, lighted quickly at one corner, and thrown up into the air against a dark background. They leave, after burning, if properly prepared, no ash whatever.

The flame of copper is well seen even with the chloride of that metal, while paper soaked in nitrate of potash shows the flame better than if the chlorate be used. Gun-paper prepared with a very weak solution of chloride or chlorate of thallium shows the characteristic spring-green flame of that metal with great distinctness.

Chlorate of baryta, being an article of commerce, may be employed for the preparation of the other chlorates, it being necessary merely to add to this salt in solution an exactly equivalent quantity of the *sulphate* or *carbonate* of the metal whose chlorate is desired. For instance, in order to make chlorate of copper, 15·1 grains of chlorate of baryta being dissolved in hot distilled water, a boiling solution containing 12·5 grains of pure crystallized sulphate of copper is to be added to it. Insoluble white sulphate of baryta falls, while the solution, filtered and evaporated, yields the new chlorate in crystals.

In some cases, by means of coloured glasses and coloured liquids, interposed between the flame and the eye, it is easy, when two metals are burning together, to shut off the rays due to one metal, and permit those due to the other to reach the observer. If, for example, a mixed potassium and sodium flame be viewed through a piece of deep cobalt-blue glass, or through a flat bottle filled with water rather deeply tinted with aniline purple (mauve), the violet potassium flame is seen, while the far more intense yellow of the sodium spectrum is totally obscured.

PROCEEDINGS OF LEARNED SOCIETIES.

BY W. B. TEGETMEIER.

ROYAL SOCIETY.—*Feb.* 19.

THE NEW METAL THALLIUM.—A second memoir on this singular metal, by its discoverer, Mr. William Crookes, was read by the Secretary. The paper was a most voluminous and elaborate one, treating in an exhaustive manner of the sources, mode of preparation and purification, and of the chemical and physical characters of this widely-diffused element. When we state that nearly two hours were occupied in reading the more important portions only of the memoir, it will be understood how impossible it would be to give here any adequate idea of the immense mass of results which it recorded. At the conclusion of the evening a high tribute was paid by Professors Miller and Williamson and by Dr. Stenhouse to Mr. Crookes, for his acuteness, zeal, and industry in discovering, and so thoroughly investigating, this unique metal. We gleaned the following interesting information from the paper read:—The specific gravity of thallium varies from 11·81 to 11·91; it melts at 550° F., and may be most readily welded. If the formula Tl O, SO_3 be assigned to its sulphate, the atomic weight of the metal approaches the number 203. The colour of metallic thallium, when freshly cut, is dull white, it has neither the brilliancy of silver nor the blue tint of lead. It tarnishes rapidly, and a straw-yellow colour almost immediately appears on the freshly-cut surface. The oxide thus formed is alkaline and caustic to the taste, and is far more soluble in water than the corresponding oxides, also alkaline, of silver and lead. Thallium is very strongly diamagnetic, approaching bismuth in this particular: the behaviour of its solution when electrolysed ranges the metal by the side of cadmium. Its effects, when alloyed with other metals, are generally well marked. Half a per cent. of thallium renders copper brittle, although its alloy with tin is malleable. The remarkably simple spectrum of this metal has been made the subject of further examination both by Mr. Crookes and Professor W. A. Miller. In the exalted temperature of the electric arc, the single green line proper to thallium when burnt in a Bunsen's gas jet, is complicated by the appearance of several blue, green, and other lines; but no means have yet been found sufficient to resolve the extremely narrow green line first seen, which approaches, but does not coincide with, the line δ of the barium spectrum. The flame of thallium, like that of sodium, is opaque to its own light. This phenomenon may be beautifully displayed by placing a small thallium flame in front of a large one, the latter containing, in addition, a quantity of lithium insufficient to neutralize its proper colour. Instead of a *black* border to the smaller flame, a *crimson* one appears, since the lithium rays are alone able to traverse the thallium flame in front. By means of the spectroscope one 5-millionth of a grain of thallium may be detected. Since the reading of Mr. Crookes' paper the specific heat of thallium has been published by Regnault, who describes it as being ·03355.

ETHNOLOGICAL SOCIETY.—*Feb.* 17.

"ON THE ORIGIN OF THE GYPSIES," BY J. CRAWFURD, ESQ.—The origin of the persons calling themselves Egyptians, or Gypsies, is a subject of great curiosity and etymological import. Their first appearance in Europe was coeval with the discovery of the New World and the new passage to the Indies, but no one thought of ascribing to them a Hindu origin, and this hypothesis, the truth of which the author now proposed to examine, was of a very recent date. Their Hindu origin has of late years received general credence; the arguments for it consist in the physical form of the people, in their language, and in the history of their migration. The conclusion the author came to was, that the gypsies, when above four centuries ago they first appeared in Western Europe, were already composed of a mixture of many different races, and that the present gypsies are still more mongrel. In the Asiatic portion of their lineage there is probably a small proportion of Hindu blood. Strictly speaking, they are not more Hindus in lineage than they are Persians, Turks, Wallachians, or Europeans, for they are a mixture of all these, and that in proportions impossible to be ascertained.

GEOGRAPHICAL SOCIETY.—*Feb.* 23.

ON THE SUBGLACIAL SPRINGS OF GREENLAND.—Dr. Binks described the peculiar character of the glaciers of Greenland, regarding them as frozen mountain rivers, carrying the drainage water of 200,000 square miles into Davis Straits and Baffin's Bay. The upper portion of these torrents only is frozen, and forms the slowly-moving glacier; the lower flows on rapidly through the channels underneath the ice. It is noticed that where the glacier reaches the sea, large springs appear to issue from the bottom in front of the outer edge of the ice, the water, which is brackish, is much agitated, and sea-birds are to be observed diving after the food brought down by the current. Dr. Binks maintains that these phenomena can only be explained on the supposition that the glaciers are mountain torrents, frozen on the upper surface. Sir Roderick Murchison regarded the investigations as of great importance, and stated that they threw light upon the former condition of the northern portion of Scotland, which must have closely resembled the present actual condition of Greenland.

NOTES AND MEMORANDA.

THE EOSAURUS ACADIANUS AND ANTHRACOSAURUS RUSSELLI.—The *Quarterly Journal of the Geological Society*, Feb. 1863, contains an abridgment of a paper by O. C. Marsh, Esq., M.A., "On the Remains of a New Enaliosaurian (or great Sea Lizard) discovered in the Coal Formation of Nova Scotia, at South Joggins." It appears to have been of great size, air-breathing, carnivorous, and adapted for rapid swimming. If the view taken of these remains should be confirmed, they will supply additional evidence to show that a high form of reptile life existed at a period when those who found their theories upon negative evidence very recently imagined that no reptile of any kind had made its appearance on our globe. In the same journal will be found Professor Huxley's description of the *Anthracosaurus Russelli*, a new Labyrinthrodont from the Lanarkshire coal-field. He says, "Of the unquestionable Labyrinthodonts which occur in the carboniferous rocks, *Anthracosaurus* is the only genus, regarding the vertebral column and ribs, of which there is any information, and the description and comparisons which I have given, seem to me to necessitate the conclusion that, side by side with the Archegosaurian type, the Mastodonsaurian type of vertebrate organization, hitherto known only to occur in the Trias, was well developed in the *Anthracosaurus* of the Scotch coal-field."

SECCHI ON STAR SPECTRA.—We mentioned in our March number that M. Secchi had examined the spectra afforded by various stars, and in the *Astronomische Nachrichten*, No. 1405, we find a letter from him on this subject, accompanied with diagrams. He observes that his attention has been chiefly directed to the most brilliant stars, and that their scintillations occasion considerable difficulty. He found α Orionis the most remarkable, and states, "this spectrum is composed of a multitude of separate portions, somewhat like that of the electric light. The ray D of the solar spectrum corresponds exactly with a tolerably broad obscure space . . . . After Orion comes the spectrum of Aldebaran, which likewise exhibits many discontinuities, but not in equal number, nor of so great an extent. The ray D is, however, visible and sure. Then Pollux exhibits bands less easy to perceive, but nevertheless noticeable in the least refrangible part. The preceding are coloured stars, and the white stars that I have examined present notable interruptions, especially in the blue (like the others) and in the violet, but the interruptions are rarer in the less refrangible parts, except the red. Sirius and Rigel have a large band at the limit of the blue and the green, with two others, one in the blue and one in the violet. Ray No. 11 is found in all the stars and in the sun. May it not have its origin in the terrestrial atmosphere? . . . Besides the rays, we remarked a different intensity of the colours in different positions of the spectrum. These diversities in intensity are enormous, particularly in α Orionis, and surpass the finest effects in the spectra of flames . . . We see in general that the most coloured stars have the most gaps in their rays. This, I think, confirms the opinion that our sun is a yellow star. . . . The limits of the colour depend much upon the intensity of the light. The red commences at nearly the same place in all the stars, but the violet exhibits great variableness, to which the state of the atmosphere contributes a good deal." Upon this subject the Rev. T. W. Webb remarks:—"The Astronomer Royal has completed an apparatus for the purpose of examining the dark lines in the spectra of stars with the great equatorial at Greenwich. This very curious subject was first entered upon by Frauenhofer, from whose experiments it would be inferred that the light of some of the fixed stars is essentially different in constitution from that of our sun. It has since been several times taken up, but not carried out to any very satisfactory conclusion: we will hope that its full development may be reserved for our national observatory and for its able director."

DARK STARS.—The Rev. T. W. Webb observes:—"When close attention began to be paid to the 'proper motions' by which a great proportion of the fixed (or rather *un*fixed) stars are slowly drifting from their places, it was soon found that the movements of the brilliant stars Sirius and Procyon were such as to deviate considerably from the sensibly straight course pursued by the rest, and a suspicion was excited in the master mind of Bessel that the irregularity was the indication of a marvellous physical fact—the existence of invisible bodies grouped into binary systems with those bright suns, and of such great magnitude, or at least density, as to compel them to describe orbits, visible even at the distance of our earth. It is remarkable that more than a century ago the German mathematician, Lambert, suggested the possible existence of great non-luminous bodies in the universe; and now at length the Council of the Astronomical Society have stated that from the researches of W. Stafford, of Harvard College, North America, and Herr Auwers, of Königsberg, it 'appears established as an astronomical fact, that the heretofore anomalous motions of *Sirius* and *Procyon*, both in Right Ascension and in Declination, are explained and satisfied by the existence of invisible masses, round which these stars may be conceived to revolve, Sirius in fifty, and Procyon in forty years.' Such is also the opinion of the Astronomer Royal, Sir J. Herschel, and Professor Bond. No reference has been made to the minute attendant of Sirius, discovered by Alvan Clark, which Dr. Peters seemed disposed to accept as the physical companion, and as to the distance of which there seems to be some unexplained difficulty." (See *Intellectual Observer*, v. 401. vi. 482.)

Orbit of Comet, 1862.—The orbit of the comet so conspicuous in August of last year (Comet II. 1862) is certainly elliptical, and from a careful discussion by Herr Oppolzen of the Vienna Observatory, the period appears to be about 142 years. The other three comets of the year give no indication of a period. —T. W W.

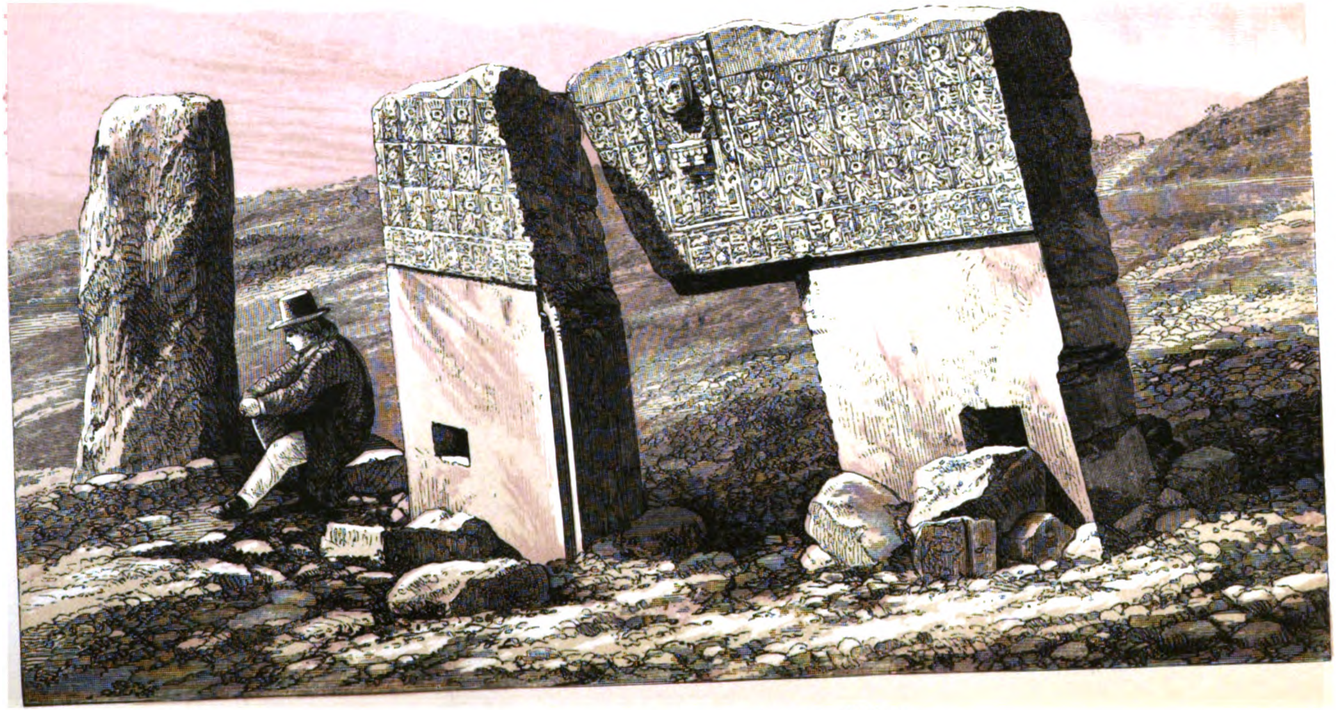
Smith and Beck's Quarter and Lieberkuhn.—This new object-glass has an angular aperture of 75°, which adapts it for binocular use, and allows a convenient distance between the front combination and the object. The lieberkuhn, which is removable, affords abundant light with the first or second eye-piece, and enables large diatoms, such as Arachnoidiscus or Aulacodiscus, to be viewed in a very splendid and effective way. Many which seem flat by ordinary illumination have their curved surfaces distinctly shown by this method. It works well upon many preparations of insects, thin sections of bone, etc., and is well suited for employment with the parabolic illuminator. In several cases we found that the parabola and the lieberkuhn could be used together with great advantage.

Crouch's Binocular Microscope and Cabinet for Slides.—Messrs. H. and W. Crouch have introduced a new binocular microscope to meet the demand for an instrument of moderate price and sufficient excellence for ordinary purposes. The novelty consists in a moveable stage, intended, like the excellent one devised by Mr. Pillischer, to act as a substitute for the superior, but necessarily expensive, screw movements. The object-carrier, furnished with two spring clips, is attached to a sort of chain composed of three flat links joined to each other by screws, so as to produce a moderate stiffness of motion. The lowest link is screwed to the stage a little out of the centre. If the object-holder is pushed upwards, the links are straightened, while, if it is pushed downwards, they are bent into elbow-joint angles, and lateral motion is easily effected. A few minutes' practice will enable any one to work this arrangement so as to be useful with a low power, or with a quarter. The prism of this instrument performs well, as do the cheap series of glasses with moderate angles of aperture. We tried a number of objects with the two-inch and one-inch powers, and can state that few students will desire a greater perfection or refinement of performance. Messrs. Crouch undertake to supply objectives of high quality for those who wish them, but we congratulate them, and other successful makers of cheap instruments, on the good they are accomplishing, as it is by such means only that the taste for microscopic studies can be extended, and students trained so as to be able to employ with advantage the exquisitely perfect instruments and glasses that our best makers can produce. The new microscopic cabinet is made of ornamental white deal, French polished. It presents a neat and pretty appearance, and the material permits a great reduction in price. The drawers hold one thousand objects, lying flat, and they are furnished with ivory knobs and ground-glass labels. The workmanship is very good.

Irritability of Plants.—Professor J. Cohn, after elaborate experiments on the irritability of plants, has arrived at the conclusion that they possess a low form of sensation similar to that manifested by the lower animals, in which neither muscular nor nervous system can be traced. Dr. Arlidge, in an abstract of these investigations (*Annals of Natural History*), thus cites Cohn's views:—"On applying flame to the leaflet in the compound leaf of *Mimosa pudica*, it is not only that particular leaflet that is affected—for if so, it might be fairly attributable to the direct effect of heat—but all other leaflets, and the entire leaf, including its attachment to the stem, are similarly affected, and collapse; and, what is more, the direction of the propagation of the impulse varies according to the point at which it impinges. Indeed, it is impossible to reduce these movements to the level of mechanical results." He considers that the vascular bundles propagate the external excitation, and that the "phenomena of contractility depend upon a muscular tissue." In another passage it is stated that "there is a difficulty in believing that, in possessing the faculties of sensation and motion, the animal kingdom, including its lowest and most simple representatives, partakes of vital endowments entirely denied to plants, for the sole reason of their being plants."

Gassiot on Electrical Discharges.—The *Proceedings of the Royal Society*, No. 53, contain a paper by M. Gassiot on the stratified appearance of electrical discharges, and details of numerous experiments made with various vacuum tubes, and a battery of 3360 cells charged with salt and water. He finds that under certain conditions the discharge is continuous, and in others intermittent, or appear so when viewed in a revolving or rotating mirror. The intermittence is produced by any resistance introduced into the circuit. The discharge will not pass through a perfect vacuum, the presence of a certain quantity of matter being indispensable. The striæ in the discharge can be controlled, their number increased or reduced, and their places altered by the introduction of a measurable amount of resistance into the circuit. M. Gassiot asks, "May not the dark bands be the nodes of undulations arising from similar impulses proceeding from positive and negative discharges? Or can the luminous stratifications which we obtain in a closed circuit of the secondary coil of an induction apparatus, and in the circuit of the voltaic battery, be the representation of pulsations which pass along the wire of the former, and through the battery of the latter—impulses possibly generated by the action of the discharge along the wires?"

Photographs of the Moon.—Messrs. Smith and Beck having purchased Mr. De la Rue's admirable negatives, have published a series of lunar views, which will prove of great use to those who have the means of studying our satellite through a telescope, and afford no slight compensation to those who must content themselves with pictorial representations. The photographs are numbered from one to twelve, the first giving the crescent when six days old, and the remainder tracing the lunar progress through the waxing and waning periods to the 23½ day. The large eighteen-inch plates are superb specimens of astronomic photography, and not less excellent is the small portable series of the carte de visite size, and arranged in pocket-book form. None of them display to advantage the grand mountain peaks and chasms standing out in advance, as it were, of the body of the moon, which constitute such striking spectacles in a good telescope, used at appropriate times; but nearly every mountain or object of importance may be distinctly seen in one or other of the views, which exhibit a minuteness of perfection that would scarcely have been deemed possible. They are very superior to any lunar maps that have ever been published, and will be found extremely valuable accompaniments to the series of papers on the moon which Mr. Webb commenced in a former number, and will continue at convenient times. The public cannot fail to appreciate these illustrations of lunar scenery, both for their artistic beauty and scientific use, and we hope they will be followed by the publication of further specimens of Mr. De la Rue's photographic skill. We should add that the explanatory pamphlet issued with the views forms an excellent guide to all the principal objects.



Helsby & Co., photo

Sculptured Monolith Portal at Tia Huanaco, Bolivia.