THURSDAY, JUNE 5, 1879

SCIENCE TEACHING IN LONDON BOARD SCHOOLS

IT was a fortunate circumstance that at each of the three elections of the School Board for London science has been represented. On the first occasion Marylebone gave Prof. Huxley a seat at the board, and at the second and third elections Chelsea has sent Dr. Gladstone as one of its representatives. To the former was due, in great measure, the Code of Regulations in which the subjects of instruction were laid down. To the latter has fallen the task of bringing them into a systematic and practical form. The Committee, of which Prof. Huxley was the chairman, determined that there must be given, in infant schools, "object lessons of a simple character, with some such exercise of the hands and eyes as is given in the Kindergarten system"; and in boys' and girls' schools, "systematised object lessons embracing in the six school years a course of elementary instruction in physical science, and serving as an introduction to the science examinations which are conducted by the Science and Art Department." The time-tables of all the schools under the Board are made to conform to these requirements; the walls of the class-rooms are hung with illustrations in natural history and other diagrams; and in many of the schools boxes of objects are also to be found. Many of the teachers, especially those trained by the Home and Colonial Society, endeavour to carry out the regulations as fully as practicable; but hitherto the scheme has worked very irregularly, and there has generally occurred a break of continuity on the children passing from the infants' departments to the upper schools. The Board's Inspectors, who are required to report in all cases on object teaching, have often had to bear testimony to this defect.

In November last the Store Sub-Committee, of which Dr. Gladstone is chairman, prepared a systematic scheme to supply the deficiencies of the former regulations, which has been adopted by the Board. The syllabus is as follows:—

Infants' School (Non-Standard Children).

Aim.—To develop in the children's minds an interest in the things round and about them; to teach the use of all the senses, and form habits of observation; to impart a correct knowledge of the commonest things; to increase the infants' vocabulary and power of expressing themselves.

Subjects of Instruction.—Objects illustrative of the three kingdoms of nature—animals, plants, and minerals, especially such as the children meet with commonly in their ordinary life. The different parts, qualities, and uses of these objects.

Means.—Diagrams; objects procured by the teacher or supplied from the store, and a small case of apparatus to enable the teacher to perform the simplest operations necessary to illustrate the properties of the objects. Children are to be encouraged to bring the needful objects both in this and subsequent stages.

Standard I.

Aim.—To carry on the previous training, leading also to the exercise of the judgment, in showing the relations of the different parts of bodies, and how their different qualities fit them for the uses to which they are applied.

Subjects of Instruction.—A somewhat more extended series of objects, with fuller information as to the qualities, uses, and history of common things.

Means.—Diagrams of animated nature, &c., classified—small cabinet of objects, classified for purpose of comparison, with simple apparatus as before.

Standards II. and III.

Aim.—To lead up from the previous training to the "specific subjects" of the Code.

Subjects of Instruction.—Series of objects illustrating the most important manufactures. Geographical distribution of products and means of procuring them. Objects for teaching the fundamental notions of matter and force.

Means.—Diagrams—same small cabinet as before. Loan collections of objects tracing the raw material to the final product (such as cotton, flax, silk, leather, wool, iron, and clay).

Standards IV. to VI.

Aim.—To teach the "specific subjects" of the Code.

Subjects of Instruction.—One at least of the following:—

Mechanics.	Taught by diagrams and working models (on loan).	
Physiology.	ditto	models (on loan).
Physical Geography.	ditto	maps and experiment.
Botany.	ditto	specimens and models.
Domestic Economy.	ditto	demonstrations and experiment.

The practical instruction which, during such a course as the above, will be imparted to the children, is altogether in advance of what is contemplated by the new code of the Education Department. The Government have provided that an annual grant of 4*s.* per subject be given for every scholar in the Fourth, Fifth, and Sixth Standards passing in not more than two of these "specific subjects;" but they give no grant for any of the preliminary teaching which under this scheme is intended to lead up to these studies. This defect in the scheme has been brought before the notice of Parliament year after year by Sir John Lubbock. The London School Board has therefore decided, on the motion of the Hon. George Brodrick, that an application should be made to the Education Department to get the teaching of the elements of natural science included among the recognised subjects of class examination—history, geography, and grammar; and a deputation will shortly wait upon the Lord President of the Council with that object.

This will manifestly be a step of very prime importance not only to the School Board for London, but to all those in the Provinces, and to the cause of education in general, as the possibility of thus obtaining a grant for the teaching in the lower standards will be the most effective stimulus that can be applied. Whatever, however, may be the result of this application, the London Board will not be deterred from fully carrying out the programme they have set themselves; and they have prepared a circular of instructions to their teachers, full of excellent and valuable suggestions, which is to be

accompanied by a box of apparatus, simple and cheap, to enable the object-lessons to be properly illustrated. Loan collections of models illustrative of mechanics, physiology, and botany, will also be provided; but as far as possible the children are to be encouraged to bring familiar objects, and to make their own models and apparatus. After giving very full directions for the teaching of the infants and the first standard children, which we need not insert in detail, the course prescribed for the upper classes is as follows:—

Standards II. and III.

As the aim in these standards is to lead up to the specific subjects of the Code, the teaching must be more advanced, and should make a larger demand on the thinking powers of the children.

The objects contained in the previous groups should be again employed, but fresh ones should be occasionally introduced, especially for the purpose of comparison.

In the animal group children should be led to compare and classify the different animals, and to notice the chief differences and resemblances between the leading divisions of the animal kingdom. The children should also have explained to them the preparation, qualities, and uses of animal substances employed in the arts, such as leather, silk, wool, and horn.

In the vegetable group such distinctions as that of endogen and exogen should be made clear; the gradual growth of plants such as beans and wheat should be traced; the uses of vegetable substances, such as cotton, linen, starch, sugar, coffee, tea, and india-rubber, with the processes of manufacture, should be explained.

In the mineral group attention should be called to the general properties of metals, iron, copper, silver, gold, lead, tin, zinc, mercury, &c., and the qualities peculiar to each. The iron and steel manufactures, and the making of bricks, pottery, earthenware, &c., may be explained; and the distillation of coal and manufacture of gas, may be experimentally illustrated.

The knowledge of the points of the compass, and form and motions of the earth, which is required by the Code, will naturally be imparted by means of object lessons.

This object teaching may be connected, as occasion offers, with the lessons in geography, and may often be made to illustrate the reading and dictation lessons.

The teacher is not expected to attempt to teach all the subjects mentioned in the preceding paragraphs, nor to limit himself to them, but the Inspector will inquire what particular course the object lessons have taken, and will frame his examination accordingly, taking care that the fundamental facts connected with matter and force are not overlooked.

Standards IV. to VI.

Though in the higher standards one or more of the scientific specific subjects of the Code is expected to be taken, it will be generally found necessary to continue some of the training just described. Thus, in the Fourth Standard, lessons on the principles which are at the foundation of all physical, mechanical, and chemical science should be given; during which clear ideas should be imparted as to size, weight, and specific gravity, as to the laws of motion of solids, liquids, and gaseous bodies, as to the production, radiation, conduction, and absorption of heat, and as to the difference between chemical combination and the mere mixture of the constituents. Occasional lessons also on the atmosphere and its composition, and the ordinary meteorological changes should be given, and local phenomena of springs, streams, hills, ponds, excavations of the soil, &c., should be observed. Boys as well as girls should be taught something of the laws of health. Domestic economy should not be taught empirically, but the scientific principles involved in the lighting of a fire, in cooking, in the choice of clothing material, in washing, and in ventilation, should be experimentally explained.

The foundations of a "knowledge of common things," as Dr. Lyon Playfair happily called it, will thus be well laid; and the children of the London schools will at an early age acquire the habit of correct observation—no mean advantage whatever may be their future occupation in life. This additional course of instruction will not occupy more than about two hours a week, and will involve scarcely any extra expense, while it will sharpen the wits of the children and freshen their minds for their more literary studies.

NOAD'S "ELECTRICITY"

The Student's Text-Book of Electricity. By H. M. Noad, Ph.D., &c. A new edition, carefully revised, with an Introduction and Additional Chapters by W. H. Preece, M.I.C.E., &c. (London: Crosby Lockwood and Co., 1879.)

IN his introductory note to this new edition of the "Student's Text-Book of Electricity," Mr. Preece informs us that the revision is only partially his own, having been begun by Dr. Noad shortly before his lamented decease. In fact a large portion of the work appears to be reprinted from former stereotyped plates.

In addition to a large number of illustrative cuts, the work possesses a very valuable feature, too rare in elementary books, namely, frequent references to important original memoirs. A judicious use is made of extracts, as, for example, from the lectures of Prof. Fleeming Jenkin on submarine telegraphy, and from those of Sir W. Thomson on atmospheric electricity and terrestrial magnetism. New chapters on telephones, duplex and quadruplex telegraphy, and on the electric light, bring up the scientific information to the present year. As an elementary treatise on the purely phenomenal side of the science of electricity, it is probably the fullest text-book in the language.

Having said this, our commendations must end. Mr. Preece's opening paragraph bears the stamp of being an excuse for the shortcomings of the work; and we must regard it as his misfortune, rather than his fault, if a book which he has had to revise fall far short of what it might have been had it been produced under his sole responsibility. It is unfortunately—in science, at least—the reviewer's duty to be candid on the shortcomings of the work under his notice; and the only way to prevent the repetition of erroneous statements, and to secure their effective correction, is to point them out fearlessly. We are bound, therefore, to undertake the ungracious task of indicating sundry blemishes which it is to be hoped will not be perpetuated in another edition.

There appear to be several discrepancies between the earlier and the later parts of the book. On p. 178 mention is made of "a battery known as the *Pile Marie Davy*," in which *sulphate of mercury* is used; and which is stated to be *weaker* than Daniell's cell, but to have *been used to some extent in France*. On p. 434 appears an account of the "*Marié-Davy Battery*," which "has been *much used in England, and is largely employed in France and on the Continent*." It is twice stated to contain *bisulphide of mercury;* and lower down on the same page it is declared on the authority of Latimer Clark to have an electromotive force of 76, as compared with 56 for a Daniell's cell.

The divided ring electrometer of Sir W. Thomson is described on p. 79. Another description and a figure of the instrument are given on p. 529. The quadrant electrometer, of which there is no mention in the early chapter where Peltier's and other electrometers are given, is described at some length and figured on p. 537.

In a couple of pages devoted to the "Insufficiency of the Contact Theory" of voltaic electricity, the authorities cited are Faraday, Roget, and "lastly," Sir W. Snow Harris; the later fundamentally important researches of Hankel, Thomson, Kohlrausch, and Clifton, being absolutely ignored.

Two pages (22 and 23) are devoted to Varley's multiplier, but there is not a word about the earlier invention of Nicholson, nor the more recent "replenisher" of Sir W. Thomson. Nor is there a single word about the Holtz machine.

In magnetism there is no attempt to explain the meaning of the term "declination," and the word "variation" is made to do duty both for declination and for the variation of declination, in a manner most perplexing to the uninitiated in electrical terms. And yet the book is avowedly "written under the idea" that the student "approaches the subject from the datum line of ignorance!"

We cannot accept without protest the following statement:—

"The fall of tension is always accompanied by its conversion into heat" (p. 198). Nor this: "With sulphuric acid the iöns (*sic*) are H and SO_4 (Sulphionide of Hydrogen)."

The term the "*absolute quantity of electric force in matter*," used on p. 223, is open to serious objection. On p. 209 we read that "the common non-absolute unit of work involving the product of a weight into a length is styled *kilogramme*, or foot-pound."

The following statement:—"we have, calling C the charge, Q the quantity, and S the surface, $C = \frac{Q^2}{S^2}$," appears on p. 61. After pondering over this formula, we give it up.

We are compelled to take exception to the following manner of stating the well-known law of Ohm:—"Thus let F denote the actual force of the current, that is, its power to produce *heat*, magnetism, chemical action, *or any of its other effects;* E the electromotive force, and R the resistance of the wires and liquids, then $F = \frac{E}{R}$" (p. 199). To say nothing of the assumption that all the "effects" of the current are simply proportional to the current strength, we protest against the introduction of that much-abused word, *force*, where every other treatise on electricity in the language has put "strength" of current or "quantity" of current or "intensity" of current. On p. 209 the formula again appears, this time as $C = \frac{E}{R}$, which is the form adopted by Maxwell, Jenkin, Culley, Foster, Chrystal, the British Association Committee, and in the well-known treatises of Ganot and Deschanel. Guthrie uses $Q = \frac{E}{R}$, and the form $I = \frac{E}{R}$ is used by Maxwell, Cumming, Clark and Sabine, Verdet, Daguin, Wiedemann, Jamin, and continental writers generally. It is very desirable that needless departures from one or other of the established forms should be discouraged. The "Return Charge" of the Leyden jar, so-called on p. 46, is now almost universally denominated the "residual" charge, a term which is far preferable, as it cannot be confounded with the return shock or return stroke, or "back stroke," as it is termed on p. 91.

In the chapter on the telephone occurs the following passage:—"In 1874 Mr. Elisha Gray, of Chicago, America, succeeded in effecting the transmission, through a wire, by means of electricity, of the variable intensity, as well as the pitch of a sound. Subsequently he invented a form of telephone by which all the three characteristics of sound could be transmitted. *As a result, the electrical transmission of articulate speech became an accomplished fact.* It remained, however, for Prof. Graham Bell, of the Boston University, to accomplish this latter feat in the most effective manner." Do we understand Mr. Preece to endorse Elisha Gray's claims to precede Bell as the inventor of an *articulating* telephone? As a minor blemish, we notice the name of Philip Reis appears as Reiss. Many persons confound the inventor of the original singing telephone with Peter Riess the author of the *Reibungselectricität;* and the misspelling of his name helps to perpetuate the error. One other quotation from the editorial add tions is not devoid of interest:—

"The subdivision of the (electric) light has recently occupied the attention of inventors. Jablochkoff works four lamps simultaneously. Wallace has worked ten. Attempts have been made to do this on a much larger scale by raising platinum and iridium to incandescence, or to that temperature just below melting-point. A soft and gentle light is thus obtained. But the result has not been commercially successful, *though probably this is the direction in which ultimate success will be obtained*" (p. 576).

We wish heartily that the editor of this new edition had himself re-written the work; a reviewer's task would then have been much more agreeable.

SILVANUS P. THOMPSON

LENZ'S SKETCHES FROM WEST AFRICA

Skizzen aus Westafrika. Selbsterlebnisse von Dr. Oscar Lenz. (Berlin: Hofmann and Co., 1878.)

DR. LENZ'S "Sketches from Western Africa" are unusually interesting and instructive. They are not descriptions of travel in the ordinary sense of the word, but form a collection of essays, perfectly independent of each other, describing in a masterly manner the natural and social conditions of that scantily investigated coast, as they presented themselves to the eminent

traveller during a journey undertaken at the request of the German African Society, and extending over three years (1874 to 1877). Everything, therefore, which Dr. Lenz describes, he has seen and witnessed himself, and apart from this important advantage the sketches have that additional one, that they are written from a completely unprejudiced and neutral point of view as far as the social or political conditions of the various West African tribes are dwelt upon. Thus a series of no less than fourteen different pictures of travel are presented to the reader, and it is indeed difficult to determine which of them are the most interesting.

After a condensed account of the previous exploring expeditions, and an explanation of the great difficulties attending all travels in Western Africa, Dr. Lenz begins his first sketch with the French colony of Gaboon. In June, 1874, he landed for the first time on African soil, viz., on the small island of Elobi in the Bay of Corisco. This bay is situated in lat. 1° N., between Capes Ninje (St. Jean) and Esteiras and contains the three islands—Corisco, the larger and the smaller Elobi; Spain numbers these islands amongst its colonies, as is also the case with the large and well-wooded island Fernando Po, a few degrees further north, with its high volcano called Clarence Pic. Between Capes Santa Clara and Pongara the sea forms a wide inlet into the coast of the mainland, and here the French have established a colony in the fine estuary of Gaboon and have extended their influence even to the mouth of the mighty Ogowe River. Two large rivers, the Muni and the Mundah, the sources of which are situated in the outskirts of the West African Slate Mountains, or the Sierra do Crystal, have their estuaries in the Bay of Corisco, which has flat banks thickly clad with evergreen mangrove trees. These mangrove swamps form the dark and dense wall which here protects the African continent against European trespassers, as they give rise to the fatal fever miasma which has won for this coast the unenviable reputation of being the most deadly one in the world. Many a traveller who landed here full of hope and with a view of exploring the interior and adding his share towards making it accessible to commerce and civilisation, has acquired in these mangrove swamps the germs of premature death; many an active and striving colonist who sent home to Europe the costly natural products of the land and who introduced to the natives the useful appliances and productions of the "n'tangani," *i.e.*, white men, here fell a victim to the ever-prevalent fevers.

From Elobi Dr. Lenz proceeded to Gaboon, a journey which in the opposite direction a steamer can perform in about eight hours, but which on account of both wind and tide coming in a south-northerly direction took some three days in a sailing vessel. The sanitary conditions of Gaboon are much better than those of the coast a little further north, yet malaria fevers are frequent. The annual mean temperature, although the colony is situated almost on the equator, does not rise beyond 27–28° C.; yet the fact that the thermometer never sinks below 20° C. makes the climate unbearable to all Europeans in the long run. The best months for travelling here are June, July, August, and the beginning of September. In the middle of the latter month the rainy season sets in and lasts till the middle of January, when a short dry season begins, lasting to the beginning of March. Then another rainy period commences and continues to the end of May. It is very peculiar that during the long dry period from the end of May till September the sky is invariably overcast, while during the rain season the sun sends down its perpendicular rays with all their intensity, the sky covering itself with heavy rain clouds only towards evening.

Dr. Lenz mentions a curious fact in connection with the sanitary conditions on the west coast of Africa :—

"It appears that amongst the European colonists each one thinks his particular place of residence to be the healthiest of all. Thus the colonists at Banana, a sandy strip of land near the mouth of the Congo, consider this place extremely healthy and know of no worse parts for fever than the Gaboon districts; but in the latter the colonists make the sign of the cross if the Congo is mentioned. The inhabitants of St. Paul de Loanda are in raptures about their upper town (in the lower town, close to the sea, there are only stores and shops) and others again designate this largest town of West Africa, the only place indeed which has a right to the name of town, as the worst plague-hole in the world. Unfortunately there is no place on the west coast which is unanimously designated as healthy (perhaps with the only exception of Mossamedes, in the south of Benguela), but on the other hand there are a number of districts about the deadly climate of which nobody is in doubt. To these Gaboon distinctly does not belong, while Cape Lopez in the delta of the Ogowe estuary does; and so does the island of Fernando Po and a number of the so-called 'oil rivers,' such as Camerun, Old and New Calabar, Bonny, Opobo, &c., places of great importance in the palm-oil trade."

The native population of Gaboon belongs to the great family of Bantu negroes, and they call themselves Mpungwe. They are a relatively fine race, and certainly superior in frame and growth to the neighbouring Akelle, Okota, and others. They have not progressed very much in civilisation in spite of their long connection with the French, yet there exists a tolerably friendly feeling betwixt them and the colonists; they are even to a certain extent guided by French laws. Their political significance is very small; the last of their kings, Denis by name, died two years ago aged over ninety years. The Mpungwe live in little huts, of which some ten or twenty form a village, and these are disseminated in every direction among the "factories" of the Europeans. The former occupation of the native Gaboonese was solely and exclusively slave trading, but at present their principal object in life seems to be to obtain goods on credit from European colonists, and to exchange them against gums, ivory, or ebony in the interior. Apart from this the slave trade still flourishes among the Mpungwe themselves, indeed the wealth of a Mpungwe nigger consists principally in the number of his slaves, whom, however, he treats very kindly. Polygamy of course exists generally among the West African natives, also with the Mpungwe, although most of the latter call themselves Christians. But with all this the superstitious customs and fetish creed of past centuries exist to this very day, and if the wealthy Gaboonese laughs at them in public he yet continues the same old religious humbug on his travels into the interior. Apart from the Gaboonese proper, the Mpungwe, different other tribes live close to the European colonies, such as the mighty Fan and

Akelle. These strive to replace the Mpungwe. To the north, towards the Mundah River, the Osekiani, the Mbenga and Mbuschu tribes are met with, which occupy the whole area of the Bay of Corisco. All these tribes speak different languages and differ in their manners and customs.

The colony of Gaboon consists of three little villages inhabited by Europeans—Plateau, Glass, and Baraka (or Libreville). They are situated about a mile from one another. The French Government house, offices, and barracks, as well as the Catholic Mission house and four or five factories are at Plateau; eight or ten English and German factories are at Glass, and the Anglican Mission house is at Baraka. Each factory forms a complex of houses by itself, all comprised in an inclosure; there is generally the dwelling-house of the colonist, the sale rooms or shops, a store-house, a kitchen (always built separately), a house for the workmen, and a shed for canoes and boats. The houses are built of wooden planks imported from Europe, and all have a verandah. The roofs are covered with mats, which are impenetrable even to the most violent rain. The only house built of stone is the Government house.

Dr. Lenz now gives minute details on the political condition of the colony as well as of the work and progress of the religious missions, and concludes his sketch by an elaborate account of the commerce of the place.

In the above we have given but a scanty outline of Dr. Lenz's sketch of Gaboon. Our readers may judge of the interest of the whole work when we state that there are thirteen other chapters equally elaborate and crowded with details. Our space will not permit us to enter further upon the subject, and we must confine ourselves to the mere statement of the contents of the other chapters. Thus we have one on the Cape Lopez colony, then the Ininga, the Fan and the Abongo tribes are treated in turn, the Fan being remarkable through their being cannibals and the Abongo through their extraordinarily small size, which entitles them to the appellation of a "tribe of dwarfs." A general description of the commercial conditions of West Africa follows, and we then come to some animated pictures of elephant and other hunting. The next chapters treat of the superstitious beliefs of the various tribes, of the free state of Liberia and the Croo Coast. A journey from the Okande land to the Osaka tribe and thence to the Aduma and the Banshaka is described in the three following sketches, and the two last ones are dedicated to a description of the Ogowe Lakes and the town of St. Paul de Loanda. We can recommend Dr. Lenz's book most heartily to all lovers of geographical and ethnographical science who are familiar with the German language.

LETTERS TO THE EDITOR

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts. No notice is taken of anonymous communications.*

[*The Editor urgently requests correspondents to keep their letters as short as possible. The pressure on his space is so great that it is impossible otherwise to ensure the appearance even of communications containing interesting and novel facts.*]

The Average Flush of Excitement

I WITNESSED a curious instance of this on a large scale, which others may look out for on similar occasions. It was at Epsom, on the Derby Day last week. I had taken my position not far from the starting-point, on the further side of the course, and facing the stands, which were about half a mile off, and showed a broad area of white faces. In the idle moments preceding the start I happened to scrutinise the general effect of this sheet of faces, both with the naked eye and through the opera-glass, thinking what a capital idea it afforded of the average tint of the complexion of the British upper classes. Then the start took place; the magnificent group of horses thundered past in their fresh vigour and were soon out of sight, and there was nothing particular for me to see or do until they reappeared in the distance in front of the stands. So I again looked at the distant sheet of faces, and to my surprise found it was changed in appearance, being uniformly suffused with a strong pink tint, just as though a sun-set glow had fallen upon it. The faces being closely packed together and distant, each of them formed a mere point in the general effect. Consequently that effect was an averaged one, and owing to the consistency of all average results, it was distributed with remarkable uniformity. It faded away steadily but slowly after the race was finished. F. G.

Lunar Crater

ON April 1 last I saw, between Landsberg and Rheinhold, a small but very remarkable crater, which does not appear in Schmidt's map. It is situated east of a line joining the centres of the above craters, and at rather more than a third of the distance from the former to the latter. Either closely adjoining, or in the position of the small crater, there is an isolated hill within the angle of a forked ridge as shown by Schmidt, who must, undoubtedly, have noticed the crater if it existed at the time of his observation. Might it be that the hill seen by him subsequently opened out as a crater? I remarked neither the hill nor the ridge, but these, like many of Schmidt's objects, might be above my telescopic power, so I cannot say whether the crater is identical with the hill or not. Nearer Rheinhold there is a smaller crater not in Schmidt, who, however, shows a similar one that I failed to see not far off to the south. This may be only a case of misplacement in the map.

JOHN BIRMINGHAM

A Remarkable Meteor

A REMARKABLE meteor was seen in Western Australia on February 1 this year. The following account has been forwarded to me by Mr. S. Worsley Clifton, Collector of Customs at Freemantle:—

"A small black cloud on a clear day appeared in the east, travelling not very swiftly towards the north-west, which burst into a ball of fire with an apparent disk the size of the full moon, blood-red in colour; it left a train of black or dark-coloured vapour across the heavens which was visible for three-quarters of an hour. No sound was heard, sky perfectly clear, and thermometer 100° F. in the shade." ROBT. J. ELLERY

Observatory, Melbourne, April 16

Disease in Salmon

THERE has lately been much correspondence upon the subject of a disease affecting the scales of the salmon, and I chanced to come upon the passage which I inclose to you in an old book, the fly-leaf of which bears the autograph of *a* Duke of Richmond, the one, I imagine, who was at Brussels in 1815. I am not a scientific naturalist, and it is quite possible that this passage is familiar to those who are conversant with such subjects; but thinking it better to err on the side of superfluity than that of carelessness, I trouble you with it. W. WALKER

May 26

Extract from Rev. C. Cordiner's Letters to Thos. Pennant, Esq., on Antiquities and Scenery of the North of Scotland. Lond. 4*to*, 1780.

I here beg leave to introduce a memoir, relative to an insect attendant on the salmon which come up this river (the Devron), communicated to me by an ingenious friend.

The foul salmon, of which a drawing has been already sent to Mr. Pennant, was caught February 10, 1776. When brought into the house the colours upon this fish were remarkably lively. The general appearance was that of a reddish brown; but the

spots of red and black upon particular parts, were exceedingly bright and beautiful. When one compared the whole appearance to that of a clean fish, it was wretched and disagreeable; it was lank; the belly empty, flabby, and of a dirty yellow; the jaws at a considerable distance in the middle, the under jaw with a large protuberance standing perpendicular upon the extremity; the upper jaw with a hole almost quite through (and I am told in some quite through), in which, when the jaws were shut, the protuberance lodged. Not one fin entire; the scales and skin being in many places destroyed, presented the appearance of foul ulcers. The gills were full of the *Lernæa salmoneæ*; such salmon are called *Kipper*, or foul fish.

The cruves in the river Devron are (following the windings of the river), about a mile and a half from the sea. In the sandy places below the cruves, where there is a sufficient depth of water, a great many salmon spawn. In those places they are seen raising considerable hills of sand, probably to cover and protect the spawn.[1] They are likewise seen frequently pushing and striking one another; and the fishermen assert that they have many battles: their conjecture is that the battles are occasioned by the males endeavouring to get at the spawn in order to devour it, and the females endeavouring to defend it. About these hills they remain during the winter, and until the young fry appear, unless forced off by a torrent, probably in order to keep the hills in repair and to defend the spawn from the many enemies ready to attack it. *Quære*,—Are not the form of the jaws, the foul ulcers in the skin, and the destruction of the fins owing to the above-mentioned operations? *Quære*,—If salmon spawned in the sea, would they not be found more or less in the condition of kipper? But in this condition they are never found out of the rivers.

Linnæus says of the LERNÆA *Salmonea*: "*Habitat in branchiis salmonum; ergo etiam marina*:" this latter is certainly a mistake; for these *Lernæa* are never found with us out of the rivers; and several sensible fishermen have assured me, that salt water proves absolute destruction to these animals.

Salmon, at a certain time during their stay in the sea, are infested by another animal of that genus, called by *Linnæus* MONOCULUS, which is as really a marine, as the other is a fresh-water animal. This species seems to me to be undescribed by authors and very distinct from the *M. piscinus* of *Linnæus*, which it in some measure resembles. In a few hours after a salmon has entered the river, not one of these MONOCULI are to be found upon it. *Quære*,—Have we not in these *vermes* a provision made by the Author of Nature for forcing the salmon from the sea into our rivers, and from the rivers back again into the sea?

Inherited Memory

YOUR correspondent "A. B." has propounded a theory which would satisfactorily explain a good many facts in natural history which have hitherto been extremely perplexing. I am strongly inclined to believe that in some of our birds, at any rate, the knowledge of localities is inherited. About thirty years ago I lived at a farmhouse, my father's home; the house stood alone in the country; my father also occupied some premises in a village, about half a mile distant. On these premises there was a large, very old dove-cot containing blue rock pigeons.

My brothers and I wished to establish a similar dove-cot at the farm, and prepared a suitable room for the purpose. In the first instance we caught, one winter's night, about fifty of the old rock pigeons; these we confined for five or six weeks, but when liberated they of course flew straight home. We next took a number of fledged young ones out of the nests. These had never been outside the old dove-cot, but when sufficiently strong they all flew away, as the old ones had done.

Discouraged, but still determined to succeed, we next bought a number of tame pigeons, and when they began to sit we put eggs of blue rocks under them, taking their own eggs away. Several were reared; but as soon as they were strong enough to dispense with the care of their foster-mothers, they one after another deserted them and returned to the ancestral dove-cot. A few years after this the premises where the old dove-cot was situated were altered, and the way into the dove-cot quite stopped up. The pigeons were sold and driven away.

For nearly twenty years blue rocks continued to visit the old premises. Some of them built on a ledge in an old gateway, that being the place in which it was possible for them to find nest-room the nearest to the old dove-cot. These occurrences seem to point to remembrance of localities in the race as well as in individuals, and "inherited memory" would, I think, best account for *all the facts* of the case. JAMES ELLIS

The Gynsills, Leicester

[1] Br. Zool. iii. 4to ed., p. 252.

A Golden Eagle and a Decoy—Audacity of a Hawk

WHILST staying a few days at Manhattan, a little town in Kansas, I spent some hours in the office of a dentist, Dr. C. Blackley, who is also an ornithologist, having stuffed a goodly number of the birds of the state. He was then occupied with a fine specimen of the common pelican (*Pelicanus communis*) one of a flock of over a thousand that passed over the town in the month of April, some of them alighting in the neighbouring marshes. These birds are not unfrequent visitors to these far inland regions, and I have known them shot and brought to me from the alkali lakes in Colorado, both regions from 600 to 800 miles from the sea. The doctor told me an amusing incident of a day's wild goose shooting in the vicinity. He took with him to one of the ponds frequented by wild geese, a stuffed specimen of the Canada goose, to act as a decoy. Having firmly planted his bird in the sand with its wooden platform well covered over, he lay behind the bushes awaiting a shot. Suddenly there was a rush of wings, and like a flash of lightning a golden eagle swept down on the decoy, knocking the bird over, and tearing out some of the stuffing. The eagle then sat down near his prey, staring with amazement at its remarkably quiescent character, as well as at the strange wooden appendage attached to its claws. Deeming there was something uncanny about such a goose, and there might be danger in the neighbourhood, he prudently flew away. Unfortunately a branch of a tree prevented the sportsman from shooting the marauder.

(I can vouch for the truth of this story; the doctor showed the goose and where it had been struck).

A few days after this, when in the village of Morrison, Colorado, I was struck with the audacity of one of our smallest hawks. I was standing on a lumber pile in the middle of the street, when I heard a scuffling of wings, and a squeaking; the latter proceeded from a small prairie squirrel, about the size of a rat, who was making the best of his way to a hole in the lumber, hotly pursued by a tiny hawk, whose body was no larger than that of his prey. The squirrel just escaped into the hole by the tip of his tail, the hawk unable to stop the impetus of its onset, dashing right against the lumber-pile, within six feet of where I was standing. I jumped down in pursuit, but totally regardless of my presence, the plucky little bird made another swoop at his prey, who had again made a sally from another hole. I knocked the hawk down this time with my hat, and the squirrel escaped under the wood pile. This took place in the centre of a little village street, with bystanders within a few yards of the occurrence.

The hawk resembled the female sparrow-hawk (*Falco sparverius*). A. LAKIS

School of Mines, Golden City, Colorado

INTELLECT IN BRUTES

NOW that the discussion on this subject in NATURE seems to be running dry, perhaps a few concluding remarks by one who has not hitherto taken any part in it may be admitted.

The discussion was started by Mr. Nicols recording a case of the gnawing of water-pipes by rats. This is not at all an unusual thing for rats to do, and I cannot see that the fact of their doing so, in order to obtain the water, would imply so incredible an amount of sagacity as some of the other writers in NATURE appear to suppose. The water can be heard within the pipe, and if the rats are thirsty, it seems a sufficiently simple device to gnaw the pipe. Of course it may be an open question whether they gnaw the pipe for this purpose, or for the mere sake of gnawing, or for any other purpose; but that a rat should have sufficient intelligence to gnaw through a water-pipe, supposing the animal to require water obtained in this way, I think there can be no doubt.

The discussion was enlivened by Mr. Henslow introducing certain general propositions as to the features wherein animal intelligence differs essentially from human, and it

is upon this topic that I should now like to offer a few remarks.

Although Mr. Henslow has not been very fortunate in the expression of his views, I think he has before his mind the most essential, as well as perhaps the most conspicuous, quality wherein animal intelligence differs from human. He says: "It has always seemed to me that brute reasoning is always *practical* and never *abstract*. They do wonderful things suggested by the objective facts before them, but, I think, never go beyond it. Thus, a dog left in a room alone rang the bell to fetch the servant. Had not the dog been taught to ring the bell (which, on inquiry, proved to have been the case), it would have been abstract reasoning, but it was only practical. The Arctic fox—too wary to be shot like the first who took a bait tied to a string, which was attached to the trigger of a gun—would dive under the snow, and so pull the bait down below the line of fire. This is purely practical reasoning; but had the fox pulled the string first out of the line of fire *in order* to discharge the gun, and *then* to get the bait, *that* would have been abstract reasoning which he could not attain to."

To this Dr. Rae replies: "To pull the bait downwards *out of the line of fire* was the only safe way for the fox to have acted. . . . . Had he used what Mr. Henslow calls 'abstract reasoning'—which, I presume, means pulling the bait, not the line, to *one side* out of the line of fire—the fox would certainly have been shot, as the bait could not have been moved more than four or five inches from the wooden stake through which the bait-line passes.

"If Mr. Henslow really means that the fox should have shown his powers of 'abstract reasoning' by going up to the line of fire between the gun and the bait, and then pulled the string until the gun went off, I think the chances of reynard's ever eating the bait would be very small indeed. I have known him do what showed equal or greater intelligence, namely, cut the bait-string, as already mentioned."

It having been thus clearly shown that the "practical reasoning" of the fox was more to the point than the "abstract reasoning" of his critic, and several others of your correspondents having supplied more or less well-authenticated instances of the display of deliberative reasoning by brutes, Mr. Henslow concluded his part in the correspondence by modifying his original statement thus:—"I will abandon my notion of abstract reasoning, at least as hitherto described, for I now think that what I meant by the want of the faculty would be better described as an impotence, or, at least, a feebleness of mind in concatenating correlative ideas; or, perhaps, a want of receptivity of the suggestiveness of things will express my meaning." Owing, perhaps, to a feebleness of mind in concatenating correlative ideas, or perhaps to a want of receptivity of the suggestiveness of things, for my own part I cannot perceive these words to express any meaning at all—or, at least, any meaning that is not flagrantly absurd. I have never known an animal unable to concatenate the idea of eating with the correlative idea of the thing suited to be eaten, and very few among the higher animals show any want of receptivity of the suggestiveness of such a thing as a whip. The truth is Mr. Henslow has only darkened his meaning by this latest multiplication of words. What he originally intended to say is, not that animals do not possess *any* power of abstract thinking, but that this power is in them feeble as compared with what it is in man. Abstract thinking means thinking in or of abstractions, *i.e.*, of qualities as apart from particular objects. Now it would be absurd to maintain that no animal has any idea of quality except as in association with particular objects of past experience. Give a cat or a dog some kind of meat or cake which the animal has never before met with, and the careful examination which the morsel undergoes before it is consigned to the mouth proves that the animal has properly abstract ideas of sweet, bitter, hot, nauseous, or, in general, good for eating and bad for eating, *i.e.*, abstract ideas of quality as apart from the object examined—the motive of the examination clearly being to ascertain which general idea of quality is appropriate to the particular object examined. Thus Mr. Henslow cannot mean that animals possess no power at all of abstract thought. What he must mean is that this power is manifested in an extremely undeveloped form, the mind of an animal being only furnished with abstract ideas of the simplest or least elaborated type, and being therefore unable to carry on for any considerable distance the process of forming and joining ideas irrespective of suggestions supplied by immediate sense-perceptions. In other words, as Mr. Henslow himself very clearly states the case in one of his earlier letters, "it is this *mental reflection* which seems to me to be wanting in animals."

Taking, then, this as the only meaning which Mr. Henslow has to convey, it is, I think, the only meaning which with philosophical justice he can have to convey. For the more that we push analysis into the region of brute psychology, the more do we become convinced that the only very considerable difference between it and human psychology consists in the comparatively small development of the power of "mental reflection."

And here I may remark that this is just the difference which the theory of descent would lead us to anticipate as the chief, if not the only, difference; for it is evident that this difference has reference to the highest qualities of mind—*i.e.*, those most removed from simple mechanical responses to stimuli supplied by the senses—and therefore to the qualities which must have been of the most recent development. The tree psychological has been a long time in growing; its roots are constituted by mere excitability, reflex action is its stem, its branches are the association of ideas, the emotions are its leaves, and the faculty of abstract thought is a single blossom borne upon its topmost spray. And if we compare this tree with that of zoology, we find that the single blossom of the one corresponds with the highest product of the other. *Homo sapiens* is the lord of creation, because, having sprung from the primates he started with some little power of abstract thought, which, through the instrumentality of continuously improving language, was forced on by natural selection at a probably astounding pace.

So far, then, as the theory of descent is concerned, there is no serious difficulty presented by this chief point of difference between animal and human intelligence.[1] I think, however, that both in this connection, and also for the sake of comparative psychology, it is desirable to say that although Mr. Henslow has, in my opinion, stated the only great difference that obtains between human and animal psychology, there is no reason to think that this difference is so great or absolute as he appears to suppose.[2]

[1] I may here remark that a great deal too much stress seems to me to be laid by many writers on the presence of self-consciousness in man as a feature distinguishing his mind from that of animals. For this faculty, it seems to me, is obviously one that *must* arise so soon as the power of forming abstract ideas has advanced sufficiently far to admit of an animal thinking of itself as distinct from its surroundings. And this is surely not any so enormous an advance as to be impossible without supernatural assistance. A semi-human animal might well have had an abstract idea of thou, you, and they, and also an abstract idea of its own body as being more or less similar to that of its fellows. From this to an abstract conception of I, as distinguished from thou and not I, the transition seems sufficiently easy; and when once the idea of self began to dawn, it would be assisted by reflection, rendering past states of consciousness objective to present ones. But the idea of self *plus* the power of introspection is all that can be meant by self-consciousness.

[2] In saying that Mr. Henslow has stated this difference to be the only one that obtains between human and animal psychology, I do not forget the remarks with which he concludes his correspondence. These remarks may be summed up in his own words—animals "cannot be self-conscious, cannot conceive of God, and can neither be moral nor immoral." As all these distinctions between human intelligence and animal intelligence clearly rest upon, or are included in, the distinction above considered in the text, it is needless to occupy space with considering them in detail. Although I have myself maintained that on the theory of evolution we might antecedently expect the more intelligent and sympathetic of the higher animals to present the germs of a moral sense, and further, that in the case of dogs this expectation seems sometimes to be realised, this, of course, is a widely different

Several of the instances which your other correspondents supplied, would, as Mr. Henslow himself admits, "if correctly stated, and *if the motive* of the animals could in every case be proved, completely overthrow my supposition that animals never copy us with the same or a rational purpose." And even if we allow, for the sake of argument, that none of these instances have been "correctly stated," yet there are such a multitude of other instances on record of substantially the same kind, that it is impossible to doubt that animals present the beginnings of "mental reflection." Not to occupy too much space, I shall confine myself to stating a few instances which have not hitherto been put on record. Mr. Henslow says, "Why is it that no dog ever (to my knowledge, of course) observed a person ring a bell, noticed that the bell brought the servant, and then went through the process of reasoning—'Because such was the result I will ring the bell too?' This I call abstract reasoning." Well, Mr. Lawson Tait tells me that he has a cat which, without having been taught, does precisely what is here imagined. That is to say, when the cat wants milk and cannot persuade the persons in the sitting-room to supply her wants, she touches the bell, with the evident purpose of attracting attention to her wants in a more emphatic manner. The animal must have observed that ringing the bell has the effect of calling the servant, who sometimes brings milk, and therefore when her solicitations are unheeded or misunderstood, she makes a sign which conveys her meaning more conspicuously and more explicitly than she is able to make with her voice. Although this is no doubt a very remarkable case,[1] it is really only a higher manifestation of the faculties of observation, reflection, and communication by signs, which in lower degrees are met with in many animals. Thus, I myself had a terrier which used to express all his desires—even the sexual—by the same sign, that of "begging;" but he was able to make this general sign of desire express the particular thing desired by the manner in which he performed the sign. Thus, for instance, if he wanted water, he used to go to a wash-hand stand, or other place where he had observed that water was kept, and beg with his face towards the water-jug. I adduce this instance because, while it involves the manifestation of the three faculties above-named, it does so in a comparatively low degree, and therefore serves a stepping-stone to their higher manifestation in such instances as that of Mr. Tait's cat. There is nothing so very extraordinary in a dog observing that water is frequently poured out of a certain jug, and reflecting, "I can make my thirst known to my master by begging towards the jug." Yet this involves the same faculties of mind as does the ringing of a bell for a servant as a sign for desiring milk—the only difference between the two cases consisting in the more direct nature of the association and rational sign, Water, Water-jug, Begging towards water-jug, than of the association and rational sign, Milk, Servant a milk-bearer summoned by bell-pulling, Pulling bell to summon servant. Thus, so long as we have abundant evidence of the presence in animals of the faculties of observation and reflection in a low degree, we need not, as evolutionists, be over-solicitous to meet with the presence of these faculties in a higher degree, although as a matter of comparative psychology it is of interest that the highest degree to which such faculties attain in various species of animals should be ascertained. Among the instances which have been published in NATURE, perhaps the most remarkable is that communicated by Dr. Frost—the case, I mean, of the cat sprinkling crumbs to entice birds. I would suggest that Dr. Frost ought to supply more particulars as to where the cat obtained the crumbs, whether or not she had to carry them, and if so, to what distance, how she scattered them, and generally to furnish all the information that he can. So extraordinary does this case appear, that it ought to be stated with all possible minuteness. I have indeed met with alleged cases of precisely similar ingenuity—one displayed by a fox, another by a bear, and so on; but some well-observed instance is required to render these similar instances in any degree credible. Dr. Klein has told me of a case which resembles that of Dr. Frost's cat up to a certain point. For Dr. Klein satisfied himself that the cat he observed had established a definite association between crumbs already sprinkled on the garden-walk and sparrows coming to eat them; for as soon as the crumbs were sprinkled on the walk the cat used to conceal herself from the walk in a neighbouring shrubbery, there to await in ambush the coming of the birds. The latter, however, after all, showed themselves more wideawake than the cat, for there was a wall running behind the shrubbery, from the top of which the birds could see the cat in her supposed concealment, and there a long line of sparrows used to wait, watching the cat and the crumbs at the same time, but never venturing to fly down to the latter until the former, wearied with waiting, went away. In this case the observation and reasoning of the cat—Crumbs attract birds, therefore I will wait for birds where crumbs are scattered—was as complete as in the case of Dr. Frost's cat; but the reasoning in the latter case seems to have proceeded a stage further—therefore I will scatter crumbs to attract birds. And just because it is so rare a thing to find an animal taking this further step in reasoning—the step, I mean, from passive expectation to active adjustment—I think that Dr. Frost ought to be requested to supply more detailed information.

As further evidence of "mental reflection" by animals, I may give a few additional instances.

thing from supposing a dog to be either a moral agent or a religious animal. No one with an atom of common sense could entertain such a supposition for a moment; for morality and religion are among the highest products of abstract thought. Some time ago I had to give a lecture on evolution at one of our large provincial towns. Next Sunday the vicar told his congregation that there could be no truth in the modern doctrine, and the reason he gave had the merit of being boldly startling. "No one," he said, "had ever seen an ape pray." The answer to this profound argument is, that if any one ever did witness such a spectacle, the fact would deal the heaviest of possible blows against the theory of descent in the domain of psychology. A religious monkey would be a phenomenon impossible to explain by any scientific theory, so that—mimicry apart—if a naturalist were to see an orang outang kneel down, clasp its hands, and raise its eyes to heaven, he could only conclude that the animal was divinely—or diabolically—inspired.

[1] On reading the proof of this article, it seemed to me desirable to obtain more full information concerning this case, and, accordingly, I wrote to Mr. Tait to furnish it. The following is extracted from his reply:—

"The cat, a female, white, yellow eyes, absolutely deaf to all sounds not conveyed through solid media, was remarkably acute in the matter of sight, and singularly intelligent, being a granddaughter of my begging cat." [This was a cat which *spontaneously* adopted the habit of begging for food, and transmitted the habit to her kittens, and her kittens' kittens. I have seen one of these, now grown into a cat, which begs quite as well as any terrier; and the interesting fact is that all this family of begging kittens take to begging spontaneously, independently alike of teaching and of seeing their mothers beg.] "When in the room with Mrs. Tait and myself, and feeling a desire for milk, she first expressed that desire by peculiar cries, then by sitting in front of us and begging like her grandmother, but not in such an accomplished manner. This failing, she would go to the side of the fire-place, and, standing on a foot-stool, would pat with her hand the knob of the fire-place bell." [Of course, a cat, not having a properly prehensile hand, could not actually ring such a bell.] "This was never resisted, and as soon as she saw the bell rung, she went towards the door at which the servant would enter, and then waited in perfect confidence for the milk which she brought. She did not attempt to leave the room with the servant, but waited patiently for her second coming.

"This cat was also remarkable as a fisher. She would wade into a small pond up to the shoulder and catch fish—trench, goldfish, minnows, &c.—always fond of dabbling in water."

I may here observe that cats seem to be more intelligent than dogs, at least in understanding special mechanisms. Thus it is not an unusual thing for cats, while it is an unusual thing for dogs, to ask admittance to a door by standing up on their hind legs and rattling the handle of the door with their fore-legs. Also, among the immense number of letters that I have received on the subject of animal intelligence, there is no one case narrated of a dog, while there are several cases narrated of cats jumping at knockers on street doors in order to obtain admission to their masters' houses. Similarly, I have only received one instance of a dog, while I have received several instances of cats jumping at thumb-latches for the purpose of opening the doors which the latter fasten. I myself had a cat which was constantly in the habit of entering the stables in this way. She used to spring at the handle below the latch, and, while holding on to the handle with one fore-paw, depress the latch with the other, and kick the door-post with her hind-legs in order to push the door open while she held the latch down. This complicated action can only be explained by supposing that the cat observed how her human friends manipulated a thumb-latch, reasoning that she might do likewise, and experimenting until she succeeded.

At the Zoological Gardens I have seen a small monkey hold out to me a nut to crack which was too hard for him to crack himself, and the conflict of emotions with which he held out, again withdrew, and eventually surrendered his treasure was positively painful to witness. Of course I cracked the nut, and Prof. Huxley tells me that he once performed a similar act of charity under precisely similar circumstances. Now the process of "mental reflection," which led to this surrender by the monkey of his valued property must have been both vivid and complex.

Although I have never myself observed an instance, I can have no doubt from the concurrent and independent testimony which I have received that dogs are sometimes capable of reasoning thus: Is my master out or not? When he goes out he always takes his great-coat with him; therefore I will go and see whether or not his great-coat is hanging in its accustomed place.

Lastly, I have just received a letter from the Vicar of Carn, which relates an instance of mental reflection on the part of a poodle dog that has the merit of admitting neither of mal-observation nor unconscious exaggeration. The vicar's friend—a Canon whose name I have at present no express permission to publish—went to visit a cousin, who owned the poodle dog. I will conclude by telling the rest of the story in my correspondent's own words: "The poodle, whose name is Mori, went into the dining-room with them, and kept quietly under the table till the end of lunch, when he begged for a little food, and he was given a small shred of beef. They returned to the drawing-room, while the servant cleared away, and the beef was taken into the larder. The dog did not think he had had his fair share. . . . Now, he had been taught to stand on his hind legs, put his paw on a lady s waist, and hand her into the dining-room. He adopted the same tactics with my friend the Canon, . . , but the sagacious dog, instead of steering for the dining-room, led him in the direction of the larder, along a passage, down steps, &c., and did not halt until he brought him to the larder, and close to the shelf where the beef had been put." [After giving him a piece of beef, the Canon went upstairs and refused again to be led down as before.] "Finding he could not prevail on the visitor to make a second excursion to the larder, he went out into the hall, took in his teeth Canon ——'s hat from off the hall table, and carried it under the shelf in the larder, where the coveted beef lay out of his reach. There he was found with the hat, waiting for its owner, and expecting another savoury bit when he should come for his hat."

GEORGE J. ROMANES

NOTES ON THE FAUNA OF THE SOLOMON ISLANDS

AT a late (January, 1879) meeting of the Linnean Society of New South Wales Mr. E. P. Ramsay, F.L.S., &c., read a paper on the Zoology of the Solomon Islands, the subject of this paper being a large collection of mammals and birds collected at Gaudalcana, Savo, and Cape Pitt by Mr. James Cockerell, a well known Australian collector. The collection was obtained from Capt. Brodie, of the schooner *Ariel*, who had made arrangements with Mr. Cockerell to collect in the islands. Among the novelties described we find two species of Monarcha: (1) *M. barbata*, with elongated black plumes from the throat, belonging to the *M. loricata* and *M. leucotis* section; (2) *M. rufocastanea*, black above, deep chestnut rufous below; (3) a Sauloprocta, *S. cockerellii*, black above and as far as the breast, which is striped with white and with the abdomen and under tail-coverts white; two species of Myiagra, (4) *M. ferocyanea*, of a beautiful clear steel-blue black above and on the throat, the remainder of the under surface white; (5) *M. pallida*, ashy blue above, white below, tail chiefly pale rufous; (6) a fly-catcher, allied to *Rhissidura rufifrons*, but distinct in being smaller and having much more rufous on the head and less on the tail, has been named *R. rufofronta;* (7) a curious little sun-bird, *Cinnyris melanocephalus*, having a black head and the remainder of the body dull olive yellow above, brighter yellow below; (8) a Pseudorectes, of a rich cinnamon colour, with whitish throat, and yellow crissum and ochre-yellow under tail-coverts, is called *P. cinnamomeum;* and (9) a Calornis of a uniform bright steel-green colour, with a sharply ridged keel-shaped culmen, but otherwise resembling *C. cantor*, is named *Calornis solomonensis.*

In addition to the new species, the collection contained some of great interest to ornithologists, particularly a beautiful series of the rare *Lorius cardinalis*, and *Halcyon leucopygia*, of which the female only was previously described. A var. of *Halcyon chloris* is also described, which differs from Mr. Sharpe's plate (Sharpe, "Monog. Alced.," pl. 87) in having the whole of the under surface rich buff, the under wing-coverts of a deeper tint. There is also a large series of *Megapodeus brenchleyi* (Gray), adults and young, and quite a number of *Dicæum erythrothorax.* Among the pigeons *Carpophaga rufigula* (Salvad.) is conspicuous from its peculiarly formed cere, also another large species allied to or identical with *C. van-wickii* (Cass.). A var. of (?) *Ptilopus viridis* is described, also *P. superba* from the same place.

The following is a complete list of the species recorded and their habitats:—

		Locality.
1.	*Astur soloensis*	Cape Pitt.
2.	*Baza stenozoa*	Gaudalcana.
3.	*Ninox* ,, ...	,,
4.	*Cacatua ducorpsii*	Savo.
5.	*Lorius cardinalis*	Savo and do.
6.	,, *chlorocercus*	,,
7.	*Geoffroyius heteroclitus*	,,
8.	*Eclectus polychlorus*	,,
9.	*Centropus milo*	Gaudalcana.
10.	*Cuculus taitensis*	Savo.
11.	*Chalcites plagosus* (?)	,,
12.	*Eurystomus crassirostris*	Cape Pitt.
13.	*Eulabes kreftii*	,,
14.	*Calorius metalica* (?)	Savo.
15.	,, *solomonensis*, sp. nov.	,,
16.	*Sturnoides fulvipennis*	Gaudalcana.
17.	*Graucalus hypoleucos*	,,
18.	,, ,, sp. nov.	,,
19.	*Edoliisoma* (*? plumbeum*)	,,
20.	*Tachycephala orioloides*	,,
21.	*Pseudorectes cinnamomeum*, sp. nov. ...	,,
22.	*Monarcha barbata*, sp. nov.	,,
23.	,, *rufocastanea*, sp. nov.	,,
24.	*Sauloprocta tricolor*	,,
25.	,, *cockerelli*, sp. nov.	,,
26.	*Rhissidura rufofronta*, sp. nov.	,,
27.	*Myiagra ferrocyanea*, sp. nov.	,,
28.	,, *pallida*, sp. nov.	,,
29.	*Cinnyris melanocephalus*, sp. nov. ...	,,
30.	,, *frenata*	,,
31.	*Dicæum erythrothorax*	,,
32.	*Halcyon leucopygia*, Ven.	,,
33.	,, *chloris*, var.	Cape Pitt.
34.	,, *sanctus*	Savo, &c.
35.	*Carpophaga rufigula*, Salvad.	,,
36.	,, *van-wickii*, Cass.	Gaudalcana.
37.	*Ptilopus viridis*, var.	,,
38.	,, *superbus*, Temm.	,,
39.	*Chalcophaps chrysochlora*, var.	,,
40.	*Macropygia* ,, ...	Savo.
41.	*Megapodius brenchleyi*	,,
42.	*Butoroides javanica*	,,
43.	*Herodias garzetta*	,,
44.	*Sula personata*	,,
45.	*Sterna bergerii*	,,
46.	,, *gracilis*, Gould	,,

In addition to the birds Mr. Cockerell obtained in quantity two species of Pteropus, two varieties or perhaps species of Cuscus, a species of Harpyia, a new Chiero-

pteruges, and a Macroglossus, also a species of Scotophilus, probably *S. nigrogriseus*, Gould.

The fishes were not numerous, but some interesting species were obtained, respecting which the Hon. Wm. Macleay read some remarks which will be published in due time.

The insects, about fifty species, will also we hope be taken up by Mr. Macleay. Among the spiders are some very interesting forms, apparently quite new.

The collection of birds numbers about 350 specimens, the mammals about 120. Spirit specimens about 100.

We believe a large portion of this fine collection has been secured by the curator, Mr. E. P. Ramsay, F.L.S., for the Australian Museum.

THE SORTING DEMON OF MAXWELL[1]

THE word "demon," which originally in Greek meant a supernatural being, has never been properly used to signify a real or ideal personification of malignity.

Clerk Maxwell's "demon" is a creature of imagination having certain perfectly well-defined powers of action, purely mechanical in their character, invented to help us to understand the "Dissipation of Energy" in nature.

He is a being with no preternatural qualities, and differs from real living animals only in extreme smallness and agility. He can at pleasure stop, or strike, or push, or pull any single atom of matter, and so moderate its natural course of motion. Endowed ideally with arms and hands and fingers—two hands and ten fingers suffice—he can do as much for atoms as a pianoforte player can do for the keys of the piano—just a little more, he can push or pull each atom *in any direction*.

He cannot create or annul energy; but just as a living animal does, he can store up limited quantities of energy, and reproduce them at will. By operating selectively on individual atoms he can reverse the natural dissipation of energy, can cause one-half of a closed jar of air or of a bar of iron to become glowingly hot and the other ice-cold; can direct the energy of the moving molecules of a basin of water to throw the water up to a height and leave it there proportionately cooled (1° Fahr. for 772 feet of ascent); can "sort" the molecules in a solution of salt or in a mixture of two gases, so as to reverse the natural process of diffusion, and produce concentration of the solution in one portion of the water, leaving pure water in the remainder of the space occupied; or, in the other case, separate the gases into different parts of the containing vessel.

"Dissipation of energy" follows in nature from the fortuitous concourse of atoms. The lost motivity is essentially not restorable otherwise than by an agency dealing with individual atoms; and the mode of dealing with the atoms to restore motivity is essentially a process of assortment, sending this way all of one kind or class, that way all of another kind or class.

The classification, according to which the ideal demon is to sort them, may be according to the essential character of the atom; for instance, all atoms of hydrogen to be let go to the left, or stopped from crossing to the right, across an ideal boundary; or it may be according to the velocity each atom chances to have when it approaches the boundary: if greater than a certain stated amount, it is to go to the right; if less, to the left. This latter rule of assortment, carried into execution by the demon, disequalises temperature, and undoes the natural diffusion of heat; the former undoes the natural diffusion of matter.

By a combination of the two processes, the demon can decompose water or carbonic acid, first raising a portion of the compound to dissociational temperature (that is, temperature so high that collisions shatter the compound molecules to atoms), and then sending the oxygen atoms this way, and the hydrogen or carbon atoms that way; or he may effect decomposition against chemical affinity otherwise, thus: Let him take in a small store of energy by resisting the mutual approach of two compound molecules, letting them press, as it were, on his two hands, and store up energy as in a bent spring; then let him apply the two hands between the oxygen and the double hydrogen constituents of a compound molecule of vapour of water, and tear them asunder. He may repeat this process until a considerable proportion of the whole number of compound molecules in a given quantity of vapour of water, given in a fixed closed vessel, are separated into oxygen and hydrogen at the expense of energy taken from translational motions. The motivity (or energy for motive power) in the explosive mixture of oxygen and hydrogen of the one case, and the separated mutual combustibles, carbon and oxygen, of the other case, thus obtained, is a transformation of the energy found in the substance in the form of kinetic energy of the thermal motions of the compound molecules. Essentially different is the decomposition of carbonic acid and water in the natural growth of plants, the resulting motivity of which is taken from the undulations of light or radiant heat, emanating from the intensely hot matter of the sun.

The conception of the "sorting demon" is purely mechanical, and is of great value in purely physical science. It was not invented to help us to deal with questions regarding the influence of life and of mind on the motions of matter, questions essentially beyond the range of mere dynamics.

The discourse was illustrated by a series of experiments.

[1] Abstract of Lecture at the Royal Institution, Friday, February 28, 1879, by Sir William Thomson, LL.D., F.R.S.

PAOLO VOLPICELLI

THIS eminent Italian physicist, whose death we recently recorded, was born at Rome on January 8, 1804. He lost his mother a few days after his birth; his father was Prof. Alexander Volpicelli, a member of the Medical College of the Roman University. Paolo was educated at the college of Veroli and the University of Rome, where, in accordance with the wish of his father, he commenced the study of medicine, but abandoned it after the first year, declaring that medicine was not a science. Of his own accord he applied himself seriously to the course of mathematical philosophy, and four years later received the degree of doctor *ad honorem* in that faculty. It should be mentioned that doctorates *ad honorem* are given to only two students each year, and Volpicelli's fellow-doctor was the eminent Professor Tortolini, who followed the same course. Before leaving the University his professors recommended him to the Government for a scientific position. In fact, Prof. Morichini wished to name him his successor to the Chair of Chemistry in the University of Rome, but Volpicelli preferred to succeed Dr. Barlocci, Professor of Experimental Physics in the same University, and in 1845, on the death of Barlocci, became titular professor. Volpicelli occupied this chair till 1873, when he was appointed Professor of Mathematical Physics in the same University. In 1851 he was made a member of the Philosophical College, an honour accorded to only twelve professors of the University of Rome. Besides his position at this University, Volpicelli also filled that of Professor of Mathematical Physics at the Roman Seminary, taught geometry to the pupils of St. Michael's Hospital, and founded at Rome the special School of Artillery, of which he was director for thirty years.

When Pope Pius IX. revived the celebrated and historical Lincei Academy in 1847, Volpicelli was appointed secretary, a post which he held for thirty years, when, as his health was failing, the academicians made him secre-

tary *emeritus*. By his tact and energy at the time of change of government at Rome, he was enabled to save the Archives of the Academy, of which during his lifetime he was one of the most active members.

Volpicelli was well known abroad, and the Emperor of Brazil when in Rome spent some time with the professor, and conferred upon him the grade of officer of the Imperial Order of the Rose. Volpicelli travelled much, and in 1850 he made a long stay in England, where he made the acquaintance of Faraday, Brewster, Airy, Murchison, Sabine, Panizzi, Wheatstone, and others, with whom he afterwards continued to correspond. In France and Switzerland also, he was the friend of the most eminent men of science.

Volpicelli was an energetic worker in his favourite field of electrical research, and to the last maintained with vigour the theory of Melloni, at which he had worked for twenty years. The papers and other works published by Volpicelli were very numerous; no less than 270 are enumerated in a list published by the Academy dei Lincei. Although he is chiefly known by his researches in electricity, these papers show that he did much other work in various departments of mathematics and physics. Volpicelli's papers will be found mainly in the *Atti de l'Accademia dei Lincei*, and the *Comptes Rendus* of the Paris Academy. Very few of them have, however, been translated into English, a circumstance which must be regretted for the sake of English scientific men, to many of whom Volpicelli's researches are known only by name. He died calmly on April 14, having been visited shortly before his death by the Pope's brother, Cardinal Pecci.

AN AMERICAN SUGGESTION

WE have occasionally noted in these columns the formation of mathematical societies, and we have ventured, in our ignorance, to suggest that as a consequence of the great advance in the cultivation of mathematics recently made by our American cousins, the time had come for the formation of an American or (following the analogy of associations nearer home) of a Baltimore Mathematical Society.

A short account of the *Proceedings* at the fifth meeting of the Lehigh Mathematical Society—recorded in the *Bethlehem Daily Times* (Pa.) for March 17—may interest kindred societies on this side the Atlantic, and serve to show that the transactions of such learned bodies may contain "something of importance and profitable (*sic*) to the general reader."

It appears that in order to remedy the defects in the art of surveying, it has been made imperative (so says Mr. S. R. Vay, Civil Engineer, the reader of the paper[1]) by the American legislature that "each county should at its own expense and on its own land, plant, or erect, two monuments of stone, so that the straight line between them should be an exact and due meridian, or north and south line; in order that thereby surveyors, by setting a compass on the one monument, and pointing it to the other, might readily ascertain the deviation or variation of the magnetic needle, and thus be prevented from committing errors in the determination of property lines and landmarks." His soul was much stirred at the neglect of this "scientific duty." It seemed to him that "the scientists of the valley ought to urge, with no uncertain voice, the erection of such or similar monuments. With but little extra expense they could easily be made to interest and to educate, as well as to serve the purpose designed by the legislature. Imagine, for instance, two beautiful granite monuments standing in appropriate situations on the spacious ground of Lehigh University, one mounted with a sun-dial, and the other with an anemometer. On one of them should be cut in plain letters the latitude, longitude, and elevation above the sea of that exact spot. On the other should be recorded a statement of the mean annual temperature and rainfall of the valley. The axis of the sun-dial would not only point to the steadfast pole, but be parallel to the earth's axis; it could, indeed, be furnished with a hoop or circle, to represent the equator, and with others to represent the meridians of Greenwich, Washington, and Bethlehem; a circle to indicate the ecliptic would not be difficult to add, which, by properly constructed clock-work should be always kept parallel to the real ecliptic itself. Thus all who might pass that way would be interested in reading the inscriptions and observing the time, and many would be instructed in the science of astronomy. Even to students it would be of benefit in lightening their mental struggles to grasp, conceive, and understand the idea of the ecliptic circle and the ecliptic plane."

In the discussion which followed, the President doubted the wisdom of the legislature, and thought the better way would be to require higher qualifications from surveyors.

Dr. H. E. Licks inquired the expense of such a sun-dial as Mr. Vay had described.

Mr. A. S. Tronomy said "it was usual to consider the ecliptic as a fixed plane when illustrating the yearly motion of the earth. When considering the daily rotation, however, he could see that Mr. Vay's plan had some advantage."

The next paper was by Prof. Ternion, "On the consequences which would result from denying or reversing the tenth axiom of Euclid." The argument, we learn, was "elaborate and profound, being exemplified by long formulas written on the blackboard." He showed that "if the properties of matter or space were such that the axiom became false, a knot could not be tied in a string, that a hollow rubber ball could be turned inside out without tearing or stretching, and that no satisfactory system of paper or silver money could be employed."

Mr. K. M. Puter considered the paper as an example of mathematical analysis, one of very great value, but he considered it fortunate that we cannot practically reverse the axioms of geometry. "If we could, the results would be disastrous." Our notice of the *Proceedings* at this interesting meeting have extended to some length, but they may be suggestive of matter for societies on this side of the world. We cannot close, without alluding to another feature, and that is the subsequent proceedings (unscientific) before the members separated.

Crackers and cheese were brought forward and the knot untied by the Secretary "without denying any axiom whatever." "The mathematical joke and the hearty laugh were heard," and, tell it not in Gath, they sang a song. Of a Mathematical Society not a hundred miles off, the first President wrote, "not a drop of liquor is seen at our meetings, except a decanter of water; all our heavy is a fermentation of symbols; and we do not draw it mild. There is no penny fine for reticence or occult science; and as to a song! not the ghost of a chance."

[1] Touching first upon the necessity of preserving boundaries and upon the methods employed by the ancients; tracing the word geometry to its source, and relating how the Egyptians were puzzled to find their landmarks, he then passed on to the discovery of the magnetic needle, and the perplexity caused to country surveyors by the deflection of the same.

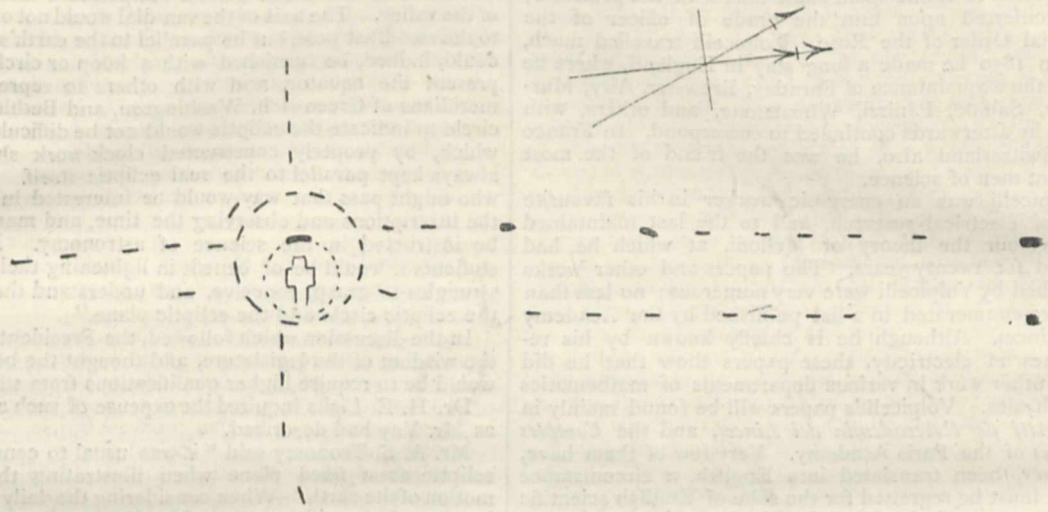
THE STANDING STONES OF CALLANISH

THE object of the present paper is to describe the standing stones of Callanish, Island of Lewis, accompanied by notes of such measurements as the author was able to take during a somewhat hurried visit to these very interesting memorials of the early inhabitants of our islands.

Leaving the town of Stornoway, we soon find ourselves amongst great tracts of moorland, with sheets of water large and small on all sides. The deep black peat is being cut and piled up into stacks, when, after being dried, it will serve for the winter's fuel. The peats in the Lewis

are broad and thin, and not so brick-shaped as those on the mainland further south. All around wears a sombre aspect. Miles and miles of bog and moorland, without tree or bush to break the long undulatory lines which rise and fall like the waves of the sea.

At length, as we reach the top of a slight rise, we see before us the object of our visit, the stones appearing so thickly clustered together on the rising ground on which they stand, as to suggest the likeness to a cemetery. Leaving the vehicle a little beyond the sixteenth mile-



Plan of General Arrangement of Group.

stone from Stornoway, we ascend by a roughly causewayed roadway which leads from the main road to the top of the low hill upon which the stones are placed. On a closer inspection it is found that the general outline is cruciform, and at or near the intersection of the cross limbs is placed the largest stone, whilst around is a circle of tall stones. The stones are rough, and appear only to have received such dressing as would bring them to a suitable shape for erection; they are composed of the rock of the island, the Laurentian gneiss, which, in geo-

View from North-East.

logical record, is the oldest known. In colour it is greyish, with occasional flesh-coloured patches. The stones are monoliths, and are all upright.

The upper parts of the stones are covered with a greyish green lichen, the lower parts being comparatively bare. This is accounted for by the fact that a number of years ago the proprietor of the island caused the peaty ground around to be removed, which showed that the height was much greater than had at first appeared; the parts thus recently disclosed have not the heavy coating of lichen which the upper parts have; the line separating the two parts is very marked. From this the great age

of the stones may be inferred, as there has been an accumulation of peaty soil of about five feet deep.[1]

From a careful inspection of the stones the author found the number to be forty-eight. (The driver's remark on being asked the number was that they could not be counted over by different people and made the same.) The highest stone is about 16 feet, and the stones forming the circle are next to the central one in height, varying from about 8 feet to 11 feet. The others vary from about 7 feet to about 4 feet.

The longer limb of the cross is composed of two rows of stones placed about 27 feet apart, there being ten stones on the west side and nine on the east side. This is a very distinct feature in the arrangement, as there is thus an avenue leading to the circle. The circle consists of thirteen stones, and the western and eastern cross arms have each a single line of four stones, whilst the southern limb is composed of six stones; the whole with the central stone and one outside and close to the circle makes forty-eight. The general arrangement will be more readily understood from the accompanying plan, which is drawn approximately to scale. From careful observations with a pocket compass, the general bearing of the northern limb was found to be 30° to east of magnetic north; it was also found that, when a line was projected from the flat side of the endmost southern stone, it cut exactly the end stone of the western side of the northern limb; the latter stone measures about 11 feet in height. If the compass variation be estimated at 25° west (the latitude is about 58° 12′ north), it appears that the main axis of the group lies about 5° to *east* of true or polar north. Several of the stones besides the one already mentioned appear to have a *directive* tendency, notably the one next the circle in the eastern side of the northern limb; this stone, both from its pointed shape and flat form, leads the eye to the centre of the circle. The whole series, indeed, are arranged with their narrow faces pointing in the line of setting; this is easily noticed, as the stones are generally flat, thin, and slab-like. The circle stones have their broadest faces turned to the centre of the circle. The great stone is situated at or near the centre of the circle; it measures about 16 feet in height, with a breadth at bottom of 5 feet, at middle of 4 feet, and upper part 3 feet 6 inches; its thickness is 1 foot; its flat side faces the east. This stone must weigh about six tons.

The general dimensions of the group are as follows:—

Extreme length, 128 yards; length of northern limb, 85 yards; diameter of circle, 14 yards (this measurement is in a north and south line; from east to west the measurements gave 13 yards, so that the figure is slightly elliptical); length of southern limb, 29 yards; extreme breadth, 44 yards; length of western arm, 13 yards; length of eastern arm, 18 yards. The whole figure roughly resembles the Iona cross in outline. In or near the centre of the circle there is a hollow, roughly rectangular on plan, measuring about 7 feet long, the breadth at centre being 6 feet, and at ends 5 feet, narrowing, however, at the eastern end, so as to form a kind of channel leading outwards. The sides of this hollow are built of small stones, and four large stones are placed so as to break up the whole into two chambers. The direction of length of this hollow is east and west; the tall central stone already described being situated near to and facing its western end. It is said that a stone cover was found upon this hollow when first discovered. The hill upon which the stones are placed slopes downwards to the north; the ground on which the cross arms are placed is about level. Another circle of tall stones still stands about a mile to eastward, from which it appears that the peat has been recently removed.

From an examination of the stone circles of Arran, the late Dr. Bryce found that stone cists in some cases existed at the centres of the circles, and that the longer lengths of these cists, as also the longer axis of one elliptically-shaped series of stones, were all lying about north and south, or inclining rather to east of north.

In the Smithsonian Report for 1876 there is a description of mounds and lines of stones in Guatemala, the long sides and directions of which were about 5° to west of magnetic north; they vary from 2 feet to 6 feet in height. This would leave, after allowing for the easterly variation of the compass there, a probable direction of 5° or 10° to east of true or polar north. A certain similarity, therefore, appears to exist in the setting out of these groups, with a tendency to a direction east of north.

The country people called the place Callanish, not Callernish, as sometimes given, the meaning of the former name having been defined as "place of assembly for worship," whilst the latter is given as "bleak headland."[2] The title Fir Bhreige, or false men, is sometimes given to the group, from the apparent motion of the stones as the spectator changes his position when viewing them from a distance.

The erection of such circles as that of Callanish has been popularly attributed to the Druids, and according to this theory the Callanish circle would have been a religious meeting-place. Again, it has been supposed that they were tombs of warriors, and may have been erected by the early Norse rovers. Others look upon such groups of stones as places for judicial meetings, which might have been accompanied by religious ceremonies. From some recent scientific investigations at Stonehenge it appears likely that the stones there were erected for astronomical purposes.

The general impression which one gets from standing amongst the Callanish stones is that the long avenue was intended as an approach from the not far distant shore for a large body of people, who would thus converge towards the central circle.

W. J. MILLAR

[1] It is difficult to get reliable data as to the growth of peat-moss, but taking about 200 years to the foot, a depth of 5 feet would infer a period of about 1,000 years since the peat commenced to form. In Black's "Guide" it is stated that the stones rest on a causewayed base. As there was no trace of this at the time of the author's visit, seeing that there was a vegetable growth all around, some data as to rate of growth of the peaty soil might be got, as it is about twenty years since the excavation of the peat took place.

[2] See Smith's "Lewsiana."

OUR ASTRONOMICAL COLUMN

BIELA'S COMET IN 1879.—There have been suggestions as to sweeping ephemerides for the recovery of one or other portion of the disintegrated comet of Biela in the present year. It is not, however, easy to decide in what manner, or rather upon what assumptions, calculation can be brought to bear with the greatest chance of success. We know that in 1852 the observed positions of the two nuclei were such that they could be accurately connected with similar positions at the preceding appearance in 1846, by the application of the perturbations from known causes in the interim, and it is also certain that neither of the nuclei was in the calculated position at the next return but one in 1866, there having been no chance of finding the comet in 1859, from proximity of its geocentric track to the sun's place. In 1865-6 the comet was diligently sought for in and around the position it should have occupied by the elements of 1852, brought up to 1866 by the application of planetary perturbations during the two revolutions, with some of the most powerful instruments in our observatories, including the refractors at Pulkowa and Copenhagen. D'Arrest, after long search, was convinced that the comet, speaking collectively, could not have passed its perihelion within many days of the time predicted. The conclusion was inevitable that perturbation from some unknown cause must have taken place between 1852 and 1866, and that all clue to the future movement of the comet was for the time lost. In 1872 endeavours to find

the comet near its old track were equally unsuccessful, and it was not till the grand meteoric shower on the evening of November 27 in that year that further light was thrown upon the subject. As is well known, the meteors of that great shower were found to be moving in an orbit sensibly identical with that of Biela's comet in 1866. Intersecting, or at least passing very near to the earth's orbit on November 27, the comet must have been descending to a perihelion passage a month later, or about December 27·6; such at least would be the date when the meteoric shower would arrive at its least distance from the sun. In this fact appears the only ground upon which we can now work to obtain an idea of the probable position of the comet in the present year. If we apply Dr. Michez's perturbations from 1852 to 1866 to the late Prof. Hubbard's elaborately-determined elements of the south-following nucleus in 1852 (assumed to be identical with the principal comet in 1846), we find the following orbit for 1866:—

Longitude of perihelion	109	39	48	Mean equinox
,, ascending node ...	245	43	42	January 27.
Inclination to ecliptic	12	22	3	
Angle of excentricity	48	46	19·35	
Mean daily motion	529″·9157			
Revolution	2445·67 days.			

And bringing up the longitudes to the equinox of 1879 we have the following heliocentric co-ordinates to be combined with the X, Y, Z of the *Nautical Almanac* in the preparation of sweeping-ephemerides on different hypotheses as to time of arrival at perihelion:—

Time from perihelion.	*x*.	*y*.	*z*.
−50 days ...	+0·8145 ...	+0·7263 ...	+0·4119
40 ,, ...	0·6150 ...	0·7914 ...	0·3916
30 ,, ...	0·4041 ...	0·8379 ...	0·3621
20 ,, ...	+0·1755 ...	0·8593 ...	0·3218
−10 ,, ...	−0·0562 ...	0·8497 ...	0·2699
0 ,, ...	0·2855 ...	0·8053 ...	0·2070
+10 ,, ...	0·5025 ...	0·7261 ...	0·1352
20 ,, ...	0·6990 ...	0·6171 ...	+0·0578
30 ,, ...	0·8704 ...	0·4857 ...	−0·0218
40 ,, ...	1·0161 ...	0·3397 ...	0·1008
+50 ,, ...	−1·1379 ...	+0·1856 ...	−0·2510

If the meteoric cloud of November 27, 1872, was moving in the orbit given above, a revolution counted from December 27·6 in that year will bring us to about September 8, 1879, as the epoch of next perihelion passage. Assuming September 7·5 we should have the following sweeping-line for that date:—

Time from perihelion.	Right ascension.	North declination.	Distance from earth.	Intensity of light.
0 days ...	140°·2 ...	10°·8 ...	1·66 ...	0·47
−20 ,, ...	125·9 ...	17·4 ...	1·42 ...	0·57

It may, however, be regarded as by no means improbable that the perihelion passage of the body which caused the shower of meteors may take place much later, and a very close and extended search will be required.

Sweeping-ephemerides to the extent desirable would occupy too much space here, but they will be easily prepared in the manner indicated from the above co-ordinates.

It is impossible not to admit the justice of a remark made by M. Otto Struve at the Stockholm meeting of the German Astronomical Society, when urging further attention to this comet: "Kein Comet gebe mehr Ansicht, über die Natur der Cometen im Allgemeinen etwas zu erfahren, als der Biela'sche;" and if due preparation be made this year for an exhaustive examination of the heavens in those regions where it is possible any portion of the comet may be found, further light may be thrown upon what yet appear the mysterious agencies which have affected its constitution and motions.

GEOGRAPHICAL NOTES

IN the place of Prof. Geikie's lecture on geographical evolution which was promised for this month, the June number of the Geographical Society's monthly periodical contains the anniversary address by Mr. Markham on the progress of geography. This is followed by a short paper on the "Mardian Hills and the Lower Indravati in the Bustar Dependency," contributed by Capt. T. H. Holdich, R.E., who also furnishes a sketch-map of the region. As regards quantity, at any rate, the geographical notes show a great improvement on previous numbers, and many of them supply information of considerable interest. Attention may be especially called to Mr. Keith Johnston's remarks on the employment of elephants in African travel, and regarding his own movements, Russian topographical labours in the Kirghiz Steppe and in Turkistan, the Russian Trans-Caspian territory, recent topographical survey by the Russians from the Oxus to Herat, new maps of Afghanistan, and a singular cave-formation in Queensland. There is also a good summary of Lieut. Wheeler's survey work in Oregon in 1878, based on an account drawn up by Mr. T. W. Goad, who was himself an active partaker in the work. Under the head of "Proceedings of Foreign Societies," we find a report of the Inter-Oceanic Canal Congress up to May 23. The last thirteen pages of the number are occupied by notes on new books and maps.

MR. J. F. BROUMTON, the agent of the China Inland Mission at Kweiyang-fu, in the Kweichow province, recently accompanied Mr. Cameron, on his way from Yünnan to the sea-board, as far as Kweilin-fu, in Kwangsi. Their route lay through the regions occupied by the Miao-tsze, or aboriginal tribes, who are very numerous in the south-east of Kweichow, and practically independent of the Chinese. Mr. Broumton visited a place called Pa-tsia, near which there are many Miao-tsze, but they are very shy and do not mix with the Chinese, only coming to the town on market-days to buy cotton, cloth, salt, &c. Their villages consist of mud cottages, usually hidden among trees and situated in places among the hills, which are difficult of access. From what he saw, Mr. Broumton thinks that the Miao-tsze are thrifty and industrious, for their land seemed well cultivated and the people well clothed. There is another interesting class of people in the Kweichow province, viz., the Tsung-kia-tsze, who, it is thought, originally emigrated from Hunan and Kiangsi, and in course of time intermarried with the Miao-tsze. Now they are a distinct class, speaking a language differing from both the Chinese and the Miao-tsze. Like the latter, they do not bind their girls' feet, and they are described as a sturdy, hardy race and thriving agriculturists.

IN the annual statement of the British Museum, just presented to Parliament, we find a report by Mr. Major on the department of maps, charts, plans, and topographical drawings. We do not learn very much as to the nature of the accessions made during the year, but Mr. Major particularises a photographic reproduction of a hydrographical chart on parchment (dated 1385) in the Royal Archives at Florence, comprising the Atlantic as far as Cape Bojador, then the furthest point of geographical discovery southwards, to Syria and the Black Sea, on the east. On this chart, which is earlier by half a century than the effective discovery of the Azores by Diego de Sevill and other navigators, we find the islands of San Miguel and Santa Maria laid down, but with an illegible description, while the islands of San Jorge, Fayal, and Pico are described as Insule de Ventura and Columbia, and Terceira is named Insula de Brazi, so called from the Brazil wood with which it abounded, thus preceding its famous namesake in South America by a century and a quarter. The chart bears the following epigraph:—

"Gulielmus Solerij civis Maioricarum me fecit anno a Nat. Domini Mccclxxxv."

As considerable difficulty is often found in fixing the position of places in the interior of Australia, the following note of the distance in miles from Adelaide of each station on the overland telegraph line which terminates at Port Darwin on the northern coast, will be found useful:—Beltana, 355; Strangway Springs, 565; Peake, 636; Charlotte Waters, 804; Alice Springs, 1,036; Barrow's Creek, 1,207; Tennant's Creek, 1,354; Powell's Creek, 1,467; Daly Waters, 1,605; River Katherine, 1,771; Pine Creek, 1,825; Yam Creek, 1,854; Southport, 1,934; Port Darwin, 1,973. Considerable progress is being made with the trigonometrical survey of South Australia. We also learn that an exploring expedition from Queensland has just completed a flying survey across the northern portion of both colonies, large tracts of which are still practically unknown.

EXCELLENT news from Abbé Debaise has arrived in Marseilles.

THE Inter-Oceanic Congress has adopted, by 98 votes against 8, the proposal in favour of cutting the canal through the Isthmus of Panama, by the Bay of Limon, to Panama.

DR. MICLUCHO MACLAY, the Russian explorer, with an Italian, Chevalier Bruno, and Capt. Leeman, have sailed from Sydney for New Guinea, in the American schooner *Laddie*, F. Caller, chartered for a twelvemonth's cruise. 2,500*l.* has been spent on the equipment. The expedition is intended to be both scientific and commercial. New Caledonia, New Britain, and other islands are to be visited.

THE first part of Dr. Nachtigal's new work: "Reisen in Afrika," comprising his journey across the desert to Bornu, is about to be published by Messrs. Wiegandt, Hempel, and Parey, Berlin.

A TELEGRAM from Gordon Pasha to the Italian Geographical Society, announces that Capt. Martini, the leader of the Italian expedition which is going to assist the Marchese Antinori, has obtained permission to enter Abyssinia, that he had left Œdowa, and had landed at Massanah.

THE FIRST OBSERVATIONS OF SUN-SPOTS

AT p. 284 of NATURE, vol. i., the following paragraph occurs:—

"Dr. Kirkwood commences by reminding us that the most ancient observations of sun-spots of which we have any record, are those of the Chinese in the year 321 A.D.; the first notice of their detection by Europeans being found in the *Annals* of the Frankish Kings. A black spot, according to Adelmus, was seen on the sun's disk March 15, 807, and continued visible eight days. Similar phenomena were again observed from May 28 to August 26, A.D. 840. The year 1096 was also signalised by the appearance of spots so large as to be visible to the naked eye. The next date, in chronological order, is that of 1161, when a spot was seen by Averröes. Finally, on December 7, 8, and 16, 1590, 'a great blacke spot on the sunne' was observed at sea by those on board the ship *Richard of Arundell*. The foregoing are, we believe, the only undoubted instances in which these phenomena were observed previous to the invention of the telescope."

During the winter of 1877–78 the late Mr. Mayers, Chinese Secretary of the British Legation in Peking, purchased on behalf of the British Museum a large Chinese Encyclopædia, comprising 5,020 volumes, and containing the most valuable information, historical, literary, and scientific. Unfortunately, however, its records end with the *Ming* dynasty, A.D. 1628. Whilst preparations were being made for its shipment to London, a sub-section of this immense work, entitled "Natural Phenomena," was placed at my disposal for purposes of research. I resolved to confine my attention to obtaining records (1) of the droughts and famines that had visited China, and (2) of the sun-spots observed by the Chinese.

The records of the droughts and famines are most minute. The years, months, and districts affected are given in detail.

With regard to sun-spots [1] [black spots on the sun [2]] I found that from B.C. 28 to A.D. 1617 fifty-six observations were recorded, and that ten other observations of what I have translated sun-shadows,[3] four of them prior to the first sun-spot observation, were mentioned. These observations are exhibited in the annexed table, from which it will be seen that undoubted sun-spots were visible in China on three occasions previous to the year A.D. 321—the date given by Père Mailla in his "Annales de la Chine"—namely, in the years A.D. 301, 302, and 307. The solar phenomena observed in 807 and 840 are also mentioned in the Chinese record.

The remarks regarding the apparent sides of the sun-spots, &c., are literal translations of the Chinese text.

Year.		Moon.		Remarks.
B.C.	28 ...	3		
	20 ...	2	...	Black shadows.
A.D.	188 ...	1		
	300 ...	1		
	301 ...	9		
	302 ...	11–12		
	307 ...	11		
	321 ...	2		
	322 ...	10		
	342 ...	1		
	344 ...	10		
	345 ...	3		
	359 ...	10	...	Size of an egg.
	360 ...	4		
	361 ...	2		
	372 ...	11	...	Size of a plum.
	373 ...	3, 11	...	Size of an egg.
	388 ...	2	...	Two spots; size of plums.
	389 ...	6		
	395 ...	11		
	400 ...	11		
	499 ...	2	...	Three spots; size of peaches.
	501 ...	8		
	502 ...	1–2	...	Two spots visible.
	509 ...	8	...	Black shadows.
	510 ...	2	...	,, ,,
	513 ...	1–4	...	,, ,,
	577 ...	11		
	580 ...	2		
	807 ...	10		
	826 ...	3		
	832 ...	3–4		
	837 ...	11	...	Size of an egg.
	840 ...	2	...	Black shadows.
	841 ...	11		
	865 ...	1	...	Black shadows.
	874 ...	—		
	974 ...	1		
	1077 ...	2	...	Size of a plum.
	1078 ...	1, 12	...	,, ,,
	1079 ...	2	...	,, ,,
	1104 ...	10	...	,, date.
	1105 ...	10		
	1112 ...	4		
	1118 ...	11	...	Size of a plum.
	1120 ...	5		
	1129 ...	3		
	1131 ...	2	...	Size of a plum; visible four days.
	1136 ...	10–11	...	Size of a plum.
	1137 ...	2–4	...	,, ,,

[1] See the *Journal* of the North China Branch of the Royal Asiatic Society for 1878: "Droughts in China, A.D. 620–1643," and "Sun-Spots and Sun-Shadows Observed in China, B.C. 28–A.D. 1617."

[2] This is a literal translation of the Chinese text.

[3] The Chinese character translated "shadows" may also be translated "breath," "vapour," &c.

Year.	Moon.	Remarks.
1138 ...	2, 10	
1139 ...	2, 10	
1145 ...	6	... Black shadows and spots.
1160 ...	8	
1185 ...	1	... Size of an egg.
1186 ...	5	... ,, ,,
1193 ...	11	
1200 ...	8, 12	
1202 ...	12	... Size of an egg.
1204 ...	1	... ,, ,,
1205 ...	4	
1238 ...	10	
1276 ...	—	... Size of a goose's egg.
1370 ...	—	... Spots were frequently observed during this year.
1511 ...	5	... Black shadows.
1529 ...	2	... ,, ,,
1617 ...	—	

ALEXANDER HOSIE

British Consulate, Canton, April 1

NATIONAL WATER-SUPPLY EXHIBITION

HYDE PARK and Trafalgar Square experiences have very plainly shown that the simplest way to induce a clamorous populace to forget what they fancy they want, is to let them hold their meetings and pass resolutions. It is a matter of such very small exertion to hold up a hand in favour of a resolution compared with taking any personal trouble to see that any steps are taken towards carrying it into effect. Human nature is only in certain phases influenced by a man's occupation, and whether resolutions are passed by "labourers" or by "professional gentlemen," they stand much the same chance of being forgotten after the press has recorded that they have been passed. Last year the Society of Arts in loyal response to the request of its Royal President, held a conference to discuss the water-supply question. After two days' work a resolution was carried urging that a small scientific commission should be appointed to collect information and suggest further inquiries on the subject. Twelve months elapsed and a few days ago another conference was held, when it was made known that the only step taken with regard to that resolution was that just before the Conference it had reached the Lords of the Treasury. Last year the Society directed that a *résumé* and sort of index should be made of what had been done by Parliamentary inquiries and official reports with regard to water-supplies, and the result was a volume called "Notes on Previous Inquiries," which, though very incomplete, may serve as a basis for a larger and more comprehensive work. The very fact of the imperfections in these notes showed to those more immediately connected with their compilation the need of enlisting wider sympathies if anything of real value was to be printed. A letter in the *Times* of April 14 of this year mentioned that although the notes had been published for many months, "not a single word" had been sent in response to the request printed on the back of the title-page that suggestions or corrections should be sent to the secretary. The idea was then suggested of founding a permanent free museum for the purpose of keeping before the public mind those subjects, apart from the question of low rates only, which should be considered in arranging water-supplies. It was decided that a temporary exhibition should be first tried as an experiment and after some difficulties in finding it a *locale*, the management of the Royal Aquarium kindly arranged for the use of the south gallery for the purpose. This exhibition is now open and a handbook is issued. It is marked "under revision," and on the title-page attention is appropriately drawn to the fact that it is the *first* public exhibition of the kind.

This handbook, we are told, has been drawn up under great disadvantages in many ways. One great difficulty has been that the exhibition has grown beyond what seemed at first likely to be its extent, and entries for the handbook have come from time to time, though but slowly. This was, perhaps, to be expected in an exhibition, the first of its kind, which was, therefore, to some extent, an experiment; and that many should hold aloof till success was assured was but natural. Although this gradual growth is a matter that must be a satisfaction to those interested in spreading a knowledge of what a study of water-supply means, it has entailed much unexpected labour on the part of the management.

Among those who have helped in the scientific sections are—Col. Beaumont, M.P., Col. Bolton, Baldwin Latham, F.R.S., J. G. Symons, F.R.S., J. E. Gardner, F.S.A., Dr. Granville Cole, Prof. Wanklyn, Prof. G. Bischoff, W. Cooper, Joseph Lucas, F.G.S., A. T. Atchison, M.A., C. E. De Rance, H.M.G.S., F.G.S., J. B. Jordan, F.G.S.

The comprehensive scope of the exhibition may be gathered from the following list of the sections into which it is divided :—

Section I.—Rainfall.
,, II.—Geology and Hydrogeology.
,, III.—Collection and Storage of Water.
,, IV.—Suggested Development of Supplies.
,, V.—Distribution of Water.
,, VI.—Water Examination.
,, VII.—Filtering.
,, VIII.—Hardness.
,, IX.—Disease.
,, X.—Antiquarian.
,, XI.—Pollution.
,, XII.—Literature.
,, XIII.—

Class 1.—Appliances for Cooling Water in Summer.
,, 2.—Waters artificially Aërated.
,, 3.—Miscellaneous.

A scientific committee has been formed to draw up a report on the exhibition, especially to point out what defects should be remedied in future exhibitions of the kind, and it is announced that next week "demonstrations" will be given on the sections embracing scientific apparatus.

NATURAL SCIENCE DEGREES AT OXFORD

MANY of our readers have no doubt noticed the scheme which some *soi-disant* "friends of science" in authority at Oxford have brought forward professedly in the interests of science. One of the prime movers in the new scheme for the creation of B.N.S. and M.N.S. degrees is Canon Liddon, who insists that for the degree of Arts Greek shall be indispensable, but for the inferior degrees in science may be dispensed with. Since the meeting of congregation at which the scheme was discussed, there has been much correspondence in the *Times* on the subject, the letters of most importance being those of Canon Liddon and Prof. Odling. The former in his correspondence professes to have the interests of natural science purely at heart in the creation of the new degree, which, he maintains, would give facilities to a much wider class to obtain the stamp of the University than if Greek were insisted on, as he maintains must be the case with *the* degree of the university. The opposition of Prof. Odling and those who think with him, is not to the creation of a degree in natural science, but to any course that would degrade it in public estimation. He urges on the university the desirability of framing such statutes in reference to any such degree, as shall assure it a high place in general estimation, and shall more especially obtain for it the approval and sympathy of the cultivators of natural science. He considers it important to this end that the possession of a degree in natural science shall imply on the part of the student, first, general cultivation, and second, special knowledge in some branch of science. But according to the proposed innovation, if

such general cultivation is based on classical studies, the student cannot get the new degree, but must take the Arts degree, which *quoad* natural science must be held to be an inferior degree. But he shows that by the proposed statute the science graduate need know little of natural science, as he may take his degree in the School of Mathematics; thus he shows a degree in natural science might be confined to those who had never got beyond its rudiments; why, then, he asks, does not Canon Liddon propose a new degree in mathematics, and thus "assign one set of students a new decoration which will honourably represent their real attainments." Prof. Odling shows that many of those who in the debate insisted on Greek being necessary to a degree in Arts, admitted it was not necessary to a liberal education; and thus, a degree in Arts must be held as something different from a certificate of liberal education.

"If, then, it be once conceded, and the concession was made without hesitation, that Greek is not essential to a liberal education, and that the studies of mathematics and natural science and modern languages do constitute liberal studies, how is it possible," Prof. Odling asks, "to refuse a degree in Arts to those who, in addition to considerable acquaintance with Latin and German, are possessed of special attainments in either mathematics or natural science, and also of not inconsiderable attainments in the alternative one of these two subjects."

According to the proposed statutes, Prof. Odling concludes, the new natural science degree, while it will certify to an ignorance of Greek, will not certify to a knowledge of natural science.

In reply to Prof. Odling, Canon Liddon asserts that Greek "is an instrument of unrivalled delicacy for effecting the general training of the mental powers, and especially for imparting to them those habits of exactness and refinement without which it is impossible to reach the higher characteristics of an educated man." "An education which excludes Greek," he maintains, "is certainly less liberal than an education which insists on it." For the liberal education of the highest order, only, according to Canon Liddon, to be attained by learning Greek, the highest honour of the University should be reserved; to a lower degree of liberality attained through means of natural science, even with a training in Latin or German, an inferior honour can only be conceded.

At present we give these arguments and assertions without comment.

NOTES

AN influential committee has been recently formed for the purpose of obtaining subscriptions to procure a portrait of Dr. W. B. Carpenter, F.R.S., to be presented to the University of London as a permanent memorial of his long and assiduous labours on behalf of that institution. We need not say one word to commend the object of the "Carpenter Memorial Committee" to the practical consideration of our readers; Dr. Carpenter's services to science and to the London University are so well known, that we are confident the proposal of the Committee will meet with a satisfactory response. Earl Granville is chairman of the Committee, which contains many names eminent in science, as well as in other departments. The honorary treasurers are Sir John Lubbock and Dr. William Smith, to either of whom cheques and post-office orders should be made payable. Subscriptions should be sent to either of the honorary secretaries, J. G. Fitch, 5, Lancaster Terrace, Regent's Park, or G. Knight Watson, Society of Antiquaries, Burlington House.

WE take the following from the *Gardeners' Chronicle*:—"The *London Gazette* of the 24th inst. announces that Her Majesty has been graciously pleased to confer the appointment of Companion of the Most Distinguished Order of St. Michael and St. George on George Bentham, Esq. While we rejoice to find some official recognition made of the life-long services to botany rendered by Mr. Bentham, we regret that such recognition has been so tardy, and that it is so inadequate. Such distinctions are not as a rule highly prized by scientific men, inasmuch as they are not specially appropriate to them; but if paid at all, they should be prompt and adequate." Baron von Müller, Government Botanist of Victoria, has been promoted to the dignity of Knight Commander of the same order, and a well-deserved knighthood has been bestowed on Mr. Henry Bessemer.

WE regret to record the death at Halifax, Nova Scotia, of Prof. John James Mackenzie, at the age of thirty-two. After graduating from Dalhousie University, and passing several years as a teacher of mathematics and physics, he went in 1873 to Germany, where he underwent a thorough course of physical training at Leipzig. Here he received, in 1876, the doctor's degree, presenting an able dissertation on the absorption of gases by saline solutions, based on a most exhaustive and extensive series of experiments. The following year was passed in research in Helmholtz's laboratory at Berlin, where Dr. Mackenzie, among other results, succeeded in showing that in the relations hitherto supposed to exist between light and electricity, the optical phenomena observed were not due to electric tension itself, but probably in a secondary manner to the heat evolved. In 1877 he accepted a call to the Chair of Physics at Dalhousie University, Nova Scotia. At the commencement of a scientific career from which much was expected by his numerous friends, he was suddenly taken away by an insidious complaint induced a year since by the inhalation of the nitrous fumes from a Bunsen battery.

M. GYLDÉN has been elected a Corresponding Member in the Astronomical Section of the Paris Academy in place of the late Father Secchi.

WE notice the appearance in May of the German *Jahresberichte über die Fortschritte der Chemie* for 1877. The present volume forms the thirtieth of the series founded by Liebig and Kopp, and is at present under the editorial supervision of Prof. Fittica of Marburg, assisted by a corps of eleven German and Austrian chemists. It is by far the most important and the most extensive of all annual reviews, and affords to even a superficial observer an interesting glimpse into the variety and extent of the chemical discovery of our day. Of its 1,400 pages, 196 are devoted to theoretical and physical chemistry, 120 to inorganic chemistry, 714 to organic chemistry, 66 to analytical chemistry, 152 to technical chemistry, 104 to mineralogy, and 46 to chemical geology. Of the space devoted to organic chemistry—more than one-half of the work—364 pages are occupied with the chemistry of the aromatic series, 48 with animal chemistry, 47 with vegetable chemistry, &c. The index of authors contains over 1,750 names, and in comparison with the indices for 1867 (850 authors) and 1857 (720 authors) shows the rapid increase of late years in the number of those devoted to chemical research. Nine volumes of the *Jahresbericht* are now out of print, and complete sets are quoted at 800 marks. Individual volumes bring as high as 100 marks. German booksellers state that this rarity is occasioned in a notable degree by recent extensive purchases for public and private libraries in the United States.

DURING the past week Etna has been in active and increasing eruption. A very considerable number of new craters have opened, and that on both flanks of the mountain. The lava has reached many miles from the mountain, almost to the River Alcantara, laying waste the surrounding country. The village of Mojo has been destroyed, and others are threatened.

A volcanic eruption which has broken out in a mountain on the banks of Lake Balaton in Hungary, seems to have begun almost simultaneously with that of Etna, referred to in next note.

THE following are the most recent reports of earthquakes from various quarters:—From April 25 until May 2 repeated violent shocks were felt in the Senio valley in the Romagna. Several buildings were destroyed completely and many others damaged. The village of Palazzuolo suffered most, and the inhabitants left the dwellings and camped out in the fields.—Another series of shocks occurred at Shabka, in the Soroki district, Bessarabia; they were preceded by a subterranean noise similar to the report of a cannon, followed by a long rumbling noise. Twenty-four houses fell in; fissures appeared in the soil, from which water flowed out. Fifty-four trees were uprooted.—A third and fourth phenomenon of this nature were observed at Serajewo (Bosnia) on May 14 in the morning, and at Maramaros-Szigeth (Hungary) on May 18 at midnight. Altogether the volcanic phenomena in the Austrian Empire have been remarkable recently, and the signs of eruption shown by the Csobancz, one of the mountain cones on the shores of Lake Balaton, which has been extinct for centuries are no less so.—The last report which has reached us comes from Batavia, where, on April 4, a violent earthquake was observed. At Tjandjoer, some fifty miles from Batavia, a number of stone houses fell, burying many of the inhabitants beneath their ruins.—A Samarang paper states that the volcanoes in Eastern and Western Java are simultaneously in eruption. From the Smeru volcano a broad fiery stream of lava is making its way through a ravine to the sea-shore on the south, while at the other end of Java the Gedeh mountain is casting out an immense quantity of ashes, which spread themselves for miles round the neighbourhood.

AN exceptionally large meteor was observed at Herford (Westphalia) on April 25 at 8.30 P.M. The nucleus was nearly of the apparent size of the moon's disk, and its light was so brilliant that while the phenomenon lasted (*i.e.*, three seconds) no fixed stars could be seen.

THE Italian State Secretary for Public Buildings has sanctioned the plans submitted to him for the construction of an observatory on the summit of Mount Etna.

THE Anthropological Exhibition at Moscow seems to be one of great interest. It is contained in a vast building lent by the Minister of War, and used in winter for drilling soldiers, and the exhibition has been rendered as picturesque as it is scientific. A garden which has been arranged most artistically for the purpose presents, among other features, a very remarkable "palæontological valley." This is planted with lycopods, gigantic ferns, and other fossil plants; this forest is inhabited by models representing megatheriums, mammoths, ichthyosaurs, &c. On miniature mountains, the age of which is indicated by artificial geological sections, are shown *fac-similes* of Russian, French, Danish, and other tumuli. Besides this, an ethnological garden is peopled with models representing the principal human types, especially those of Russia. There is, besides, a remarkable anatomical and craniological exhibition. Altogether this is one of the most remarkable anthropological exhibitions ever brought together, and has been an immense success.

THE question of the definite location of the observatory for which a legacy of 700,000 dollars was provided by the late James Lick, has resolved itself into a selection of one of the three peaks of Mount Hamilton—Observatory Peak, 4,302 feet high; East Peak, 4,448 feet; and Middle Peak, 4,318 feet. At the suggestion, it is said, of Prof. Simon Newcomb, of the U.S. Naval Observatory, to whom the question was submitted, the trustees have referred the subject of a selection to Mr. S. W. Burnham, an amateur astronomer of some distinction. So soon as this decision is announced, the work of erection will be at once proceeded with.

A FEW weeks ago the fossil head of a *Rhinocerus tichorhinus* was found in Siberia, and is said to be in a very good state of preservation. The valuable object was presented to the Museum of Moscow University by the Siberian branch of the Russian Geographical Society, and will find a place in the Anthropological Exhibition at Moscow.

A NEW sensation is in store for visitors to Niagara; whether desirable or otherwise will depend on the tastes of the visitors. The "Niagara Falls Prospect Park Company" have ordered one of the largest-sized Brush machines and sixteen lamps, wherewith, by means of parabolic reflectors and otherwise, to throw light upon the descending water and upon the mist, "thus producing electric rainbows to order in the darkest night." It is also expected that a light can be placed behind the American fall, so as to throw rays out through the water.

THE death is announced of Karl Koch, formerly Professor of Botany in Berlin University.

WE hear that the Abbé Moigno, the editor of *Les Mondes*, who has just published a work in three volumes called "Les Splendeurs de la Foi," has disposed of his journal, and will proceed to Rome in order to lay before his Holiness the *comble* of his science. He may eventually be rewarded by being made a cardinal.

A VENERABLE relic of past engineering skill has been presented by the Earl of Lonsdale to the Patent Office Museum, South Kensington, where it may be seen by the public. This is a specimen of Heslop's Winding and Pumping Engine, a patent for which, numbered 1,760, was taken out in the year 1790. Heslop's engine, one of the immediate predecessors of James Watts's invention, was considered in the days of our great grandfathers to be an almost perfect machine, being superior to the atmospheric engine of Newcomen, even as improved by Smeaton. The present engine has been at work in the neighbourhood of Whitehaven for seventy-three years, having been erected at Kell's Pit for raising coal about 1795, afterwards removed to Castlerigg Pit, and thence to Wreath Pit in 1837. At the latter place it not only lifted coal out of the mine but worked a pump till last summer, when it was brought to London. The engine now at South Kensington is the last survivor of its race.

A TELEGRAM from New York, June 1, states that the States of Kansas and Nebraska have been visited by a tornado, by which about forty persons were killed and over one hundred wounded, while fifty buildings were destroyed, and the crops and other property greatly damaged.

MR. W. H. COFFIN writes us with reference to our note last week on the *conversazione* of the Institution of Civil Engineers. He states that the electric lamp for surgical use exhibited by him is an improved modification of M. Trouvé's "Polyscope Electrique," devised and constructed by Messrs. Coxeter and Son, the surgical instrument makers.

THE Municipal Council of Paris has resolved to adopt the cremation system on sanitary grounds.

AMONG various applications proposed by M. Planté for his secondary couples is that of electrical drilling. It is known that those high-tension currents (which he produces), when made to act on glass in presence of a saline solution, act like a graver or diamond, tracing grooves and making considerable hollows. Rock crystal may be thus attacked, spite of its hardness, and if it is not regularly engraved, it at least breaks into small fragments, and is ultimately disaggregated. Now, in America, black diamonds are used to attack hard rocks and effect the borings for mines. Might not these (M. Planté asks) be advantageously replaced by action of

the electric current in the way indicated? (The diamonds are very expensive and are gradually lost by being detached from the pieces to which they are fixed.) Platina electrodes would not be necessary, for it is not here the metal of the electrode that is altered, but the silicious matter, in presence of the saline solution. Metallic points or rods distributed suitably at the end of the drill-stem, insulated in part of their length and animated by rotatory motion, would bring the electric current to the surface of the rock to be pulverised. The progress recently realised in the production of electricity by mechanical means might facilitate this application.

IF perpetual motion be defined as that of a body which, after having received an impulse, continues to move indefinitely in virtue of its inertia alone, it is, M. Plateau considers, realisable. He introduces a foreign force of constant nature to destroy resistance, instead of (as in the case of a pendulum) restoring motion which resistance has withdrawn. Thus, conceive a horizontal disk movable round a vertical axis fixed to the centre of its under surface. A small hemispherical cavity is made on the upper face. A motor force of rapid rotation is got from a reservoir below the lowest water of a river, giving a uniform intense flow by a lower orifice. Before letting the water act on the disk, a top, previously set in very quick rotation, is deposited with its point in the middle of the hemispherical cavity; then the top is covered with a glass bell jar, which is fixed with its axis coinciding with that of the apparatus. The disk with the bell jar is then set rotating by means of the water in the same direction as the top. After a certain time (it may be supposed) the movements of disk, top, and inclosed air will be equalised; then the top will no longer experience resistance at its point, for the support turns as quickly as it and in the same direction; nor will it, from surrounding air, for this also has the same angular velocity. Thus we should have the curious spectacle of a top remaining indefinitely in equilibrium on its point, presenting a case of perpetual motion in the sense defined. Of course the water would have to be let off after action on the apparatus, also the surplus water of the reservoir.

WE have received from Messrs. Dent and Co. an interesting summary of the principal works executed by that house since its foundation in 1814. The last noted is the commencement in 1879 of the great galvanic chronographic apparatus of the Imperial Observatory of Japan.

TWO other volumes of the "Natural History Rambles" series have been sent us by the S.P.C.K.—"Mountain and Moor," by Dr. J. E. Taylor; and "Lakes and Rivers," by Mr. Groom Napier.

THE Asiatic Society of Japan are showing considerable activity in the issue of their publications, for another number of their *Transactions* has lately come to hand. This opens with some curious notes on the analysis of bamboo-shoots, which are much used as an article of food in Japan. Dr. Dwars arrives at the conclusion that the shoots examined at that period of their development must be considered a nourishing vegetable, and that they may even rival the cauliflower and asparagus. Mr. Satow supplies the first of a series of papers on ancient Japanese rituals, as well as some instructive notes on the vicissitudes of the Church at Yamaguchi from A.D. 1550 to 1586.

A NOTABLE change has taken place in the Jardin des Plantes of Paris, and should be noticed by foreigners. All the galleries and houses are open every day from one to four without any ticket of admittance being required from visitors. The plant-houses only are closed on Sunday.

A MUNICIPAL SCHOOL has been recently established in Paris for apprenticeship in the work of wood and iron.

A PART of the buildings of the Universal Exhibition has been purchased by the French War Office for the use of the aëronautical school at Meudon. It will be utilised for building and inflating balloons.

THE large Giffard Captive Balloon is ready for inflation, and the gas will be passed into it as soon as the state of the weather will permit the operation to begin.

THE additions to the Zoological Society's Gardens during the past week include a White-thighed Colobus (*Colobus bicolor*) from West Africa, presented by Dr. H. Hart; two Silky Marmosets (*Midas rosalia*) from South-East Brazil, presented by Mrs. Hector; a Capybara (*Hydrochœrus capybara*) from South America, presented by Mr. H. B. Whitmarsh; a Puff Adder (*Vipera arietans*) from West Africa, presented by Surgeon F. Speer; a Brown Hyæna (*Hyæna brunnea*) from South Africa, an Argus Pheasant (*Argus giganteus*) from Malacca, purchased; a Michie's Tufted Deer (*Elaphodus cephalophus*) from China, deposited; an Axis Deer (*Cervus axis*), born in the Gardens.

PREHISTORIC INVESTIGATIONS IN AUSTRIA[1]

I. *Lower Austria.*—At Mount Calvary, near Pellichsdorf, on the Marchfeld, a plain east of Vienna, explorations conducted by F. Heger, from June 26th, to July 28th, 1878. A great number of urns, pateræ, &c., of peculiar forms, not known from any other locality. Although broken by pressure, thirteen were more or less susceptible of reconstruction. Most of them were found in a space inclosed with strong beams of wood. A broken bronze armlet was also met with.

II. *Carniola.*—Explorations conducted by von Hochstetter and Ch. Deschmann, Superintendent of the Provincial Museum of Laibach.

1. Terszisce, near Zirknitz, July 16th, 1878, Prehistoric Fortified Station, and burial-ground, with human bones, more or less burnt, and many objects of bronze and iron, like those of the Celtic burial-ground of Hallstadt in Upper Austria.

2. Grad, near St. Michael, not far from Adelsberg, July 23rd, 1878. Separate skeletons, bronze objects, and Pre-Roman coins.

3. Slemschek, near Waatsch and Littai. Prehistoric Station of the "Hallstadt Period," with extensive burial-place. The graves are flat: some contain skeletons; others burnt remains. The latter are covered with heavy stone slabs, and contain large urns, of various forms, which have burnt bones within or underneath. Many objects, both ordinary and ornamental, of bronze, iron, amber, glass, bone, &c., were found, including a bronze helmet in excellent preservation. From July to October, 1878, about 200 graves were examined, mostly at the cost of the Provincial Museum of Carniola.

4. Dolle, near Gora and Waatsch. Separate graves, of the same character as those at Slemschek.

5. Vier, between Sittich and St. Veit, Lower Carniola. Above the village is a perfect ring-shaped earth-work; below it, on both sides of the high road a number of tumuli. Nearer St. Veit are flat graves, covered with slabs. This was probably the place of the *Acervone* of the Pentigerian Tables, or the Roman *ad Acervos*, which name, according to Prof. Müllner, is derived from these Pre-Roman tumuli.

6. Moratzch, near Heiligenkreuz. Flat graves and tumuli, August 1st, two skeletons were dug out, a male and a female, with earthen vases, iron knives, and a bone comb. These burials are probably later than those of Nos. 1-5.

7. Mariathal, south-east of Littai. Ancient castle surrounded with a rampart; also flat graves and tumuli containing skeletons August 2nd and 3rd, a male skeleton without arms, and with violently fractured skull was exhumed, together with many objects, including an elegantly ornamented urn, similar to those found at Slemschek.

8. Ober-Strascha, on the left bank of the river Gurk, above Rudolfsworth. Old ring-rampart and a few scattered tumuli.

1 "Prehistorical Investigations in Lower Austria, Carniola, and Bohemia." By F. von Hochstetter, President of the Prehistorical Commission of the Imperial Academy, Vienna. (Imperial Academy of Sciences, Vienna, Meeting, January 16, 1879)

9. Gradische, near Tepliz, Lower Carniola. Ancient castle with rampart.

10. Gsindeldorf, near Weisskirchen. Numerous tumuli, and traces of ancient dwelling-places; and some few bronze objects.

11. Landstrass, on the River Gurk. Many tumuli.

Besides the above localities of prehistoric dwelling and burial places, six others are known, but not yet explored.

12. Kreuzberg Cave, near Laas. This is very extensive, difficult to get at, and abounding with bones. In four days more than 2,000 bones of *Ursus spelæus*, besides more or less perfect skulls of the Bear, were taken out, belonging to at least from 40 to 50 individuals and possibly to a hundred and more. Most of the bones were scattered, but some remained together, so that a perfect skeleton was obtained for the Imperial Mineralogical Museum. Besides bones and teeth of the cave-bear, remains of *Gulo spelæus* and of a Marten (near *Mustela foina*), also cervical vertebræ of *Lupus*, and coprolites of *Hyæna* were found in this cave.

13. Jellenza Cave, near Tepliz, Lower Carniola. Excavations, August 5th, 1878, showed that this cave had been inhabited by Man.

III. *Bohemia*.—Of late years many antiquities have been met with about Hradischte, near Beraun, probably dating from the Marcomans and their predecessors the Boyans, who lived here apparently for centuries. Their burial-places, the tumuli near Lisek, and the old cemetery near Althütten, with its urns, have to be further explored. T. R. J.

SCIENTIFIC SERIALS

American Journal of Science and Arts, May.—Some experiments in cross-breeding plants of the same variety are here described by Prof. Beal, having been suggested by Darwin's book. The plants were Indian corn and black wax beans.—Prof. Young records observations of the spectrum of Brorsen's comet made on April 1 and 2. He is quite positive that the middle band of the spectrum now coincides sensibly (to a one-prism spectroscope) with the green band of the hydrocarbon spectrum.—Dr. Southworth demonstrates this theorem: If a hydrated salt be dissolved in a given volume of water, the volume of the solution will exceed the original volume of the water by a bulk equal to the bulk of saline water contained in the salt dissolved.—The first portion of a paper by Prof. Norton, on the force of effective molecular action, appears in this number, and the remaining papers deal mostly with geological subjects of more local interest, the Fox Hills Group of Colorado, the Hudson River age of the Taconic schists, the Wappinger Valley limestone of Dutchess County, N.Y., the Huronian series of Northern Wisconsin, the mineral locality in Fairfield County, Connecticut, &c.—Mr. Peters gives observations on the planet he discovered on March 21.

Annalen der Physik und Chemie, No. 4.—Herr Kayser here arrives at the conclusion that the velocity of propagation of sound-waves is independent of the intensity of the tone. His final method (two others, with use of Kundt's dust-figures, having been rejected) was to note the phases of vibration of a piece of mica at the top of a vertical glass tube used for resonance to a tuning-fork above it, set vibrating with different intensities by electric means. Water could be admitted laterally at the bottom of the tube, so as to obtain the maximum resonance. As the water-stopper is displaced, the same figure of vibration always returns whenever the displacement has reached half a wave-length. Herr Kayser finds the velocity of sound in free space 332·5m., calculated by Kirchhoff's formula from velocity in tubes, and making therein $\gamma = 0{\cdot}0235$. (The case of explosion-waves is excluded from consideration, these being quite distinct in kind from sound-waves.)—Herr Wiedemann, in extension of a former research, takes up a number of points relating to torsion; repeated torsion in the same, or in opposite direction, permanent torsion of a wire often twisted a certain amount, influence of weighting during permanent and during temporary torsion, influence of oft-repeated weighting, rotation of molecules, action of vibrations, &c.—Herr Auerbach, considering (from the physiological, psychological, physical, and musical stand-points) what is the absolute number of vibrations required for production of a tone, thinks it is probably about *twenty*.—Herr Schmidt furnishes a new table of gas densities.—Herr Zöppritz continues his papers on hydrodynamic problems in relation to the theory of ocean currents.—Herr Sohncke replies to an objection by M. de Lapparent to his new theory of crystalline structure.—We have elsewhere referred to Herr Elster's researches on the electromotive forces which occur in free water jets.

Atti della R. Academia dei Lincei, March.—We note here the following:—On the secular variation of the magnetic needle at London since the year 1580, by Mr. Jenkins.—Researches on Cinchonine, by Prof. Fileti.—On the atmospheric disturbance of February 24 and 25 last, by S. Respighi.—On prenite and laumonite from the mines of Montecatini, by Prof. Bechi.

Reale Istituto Lombardo di Scienze e Lettere. Rendiconti. Vol. xii. fasc. vi.—We note here the following:—Influence of manures on the combustibility of tobacco, by S. Cantoni.—Considerations on the palatine bones, by Prof. Verga.—Some studies with reference to physiology and the expression of attention in man, by Dr. Riccardi.

Fasc. vii.—Rigid suspension bridges, by S. Clericetti.—On the area described by an invariable line moving in a plane according to a determinate law, by Prof. Bardelli.—On arithmetical hemiteria, by Prof. Maggi.—Some reflections on a recent note of Jamin, on the theory of dew, by Prof. Cantoni.—Reflections on the theory of dissimulated electricity, by S. Serpieri.—A steel yard densimeter, by Dr. Chistoni.

SOCIETIES AND ACADEMIES

LONDON

Royal Society, May 8.—"On the Results of the Magnetical Observations made by the Officers of the Arctic Expedition 1875-76," by Staff-Commander E. W. Creak.

1. After leaving Portsmouth the first magnetical observations were made at Godhavn, Disko. On arrival at winter quarters, observatories were constructed where observations of the three magnetic elements and hourly observations of the differential declination magnetometers were made during the winter.

2. The diurnal variation or inequality of the declination formed one of the chief objects of interest at the winter quarters, as, although the period was remarkable for frequent magnetic disturbances, and an absence of brilliant auroras, no connection could be observed between appearances of that phenomenon and the movements of the declinometer magnet. This accords with the remarks of previous observers within the region comprehended between the meridians of 60° and 90° W., and north of the parallel of 73° N.

3. It has been established that 8 A.M. and 1 to 2 P.M. are the hours of the greatest easterly and westerly deflection of the declinometer magnet in middle latitudes. At the winter quarters, Discovery Bay, the westerly extreme was reached at 10 A.M., the easterly at 11 P.M.

4. An analysis of the disturbances of the declinometer magnet showed that the disturbing force never ceased, that it was at a minimum about the solstice, and a maximum at the equinox, and was greater during the day than the night.

5. Comparing the days of principal disturbance at Kew and at the winter quarters' observatories, it was found that for the most part the disturbances occurred on the same days. The two greatest disturbances or "magnetic storms" occurred on February 19 and March 25-26, 1876, during the same hours of Greenwich mean time as at Kew, but the magnets were often in opposite directions from the normal at the two stations.

6. An important result obtained was the evidence of but small secular change having occurred in the inclination and force since the observations of Kane and Hayes in 1854 and 1861 respectively. The declination is, however, more decidedly changing, especially about Godhavn, the needle moving towards the east as in England.

May 15.—"Note on a Recent Communication by Messrs. Liveing and Dewar," by J. Norman Lockyer, F.R.S.

In my paper of last December[1] I called attention to the importance of discussing Young's observations of the chromospheric lines in connection with the spectra of the metallic elements. In subsequent communications I have given preliminary results of this discussion so far as it has already proceeded.

Since my paper was read Messrs. Liveing and Dewar have, in a paper printed in the last number of the *Proceedings*, given a table which professes to state the number of times various lines in certain metals were seen by Young in connection with certain reversal phenomena observed by themselves.

[1] *Proceedings*, No. 191, p. 172.

The statements, however, made in this table with regard to the visibility of certain lines in the chromosphere do not appear to be in accordance with Young's published tables, and as Messrs. Liveing and Dewar have in a still later paper drawn theoretical conclusions from these statements, I think it desirable to call attention to the fact, in order to prevent any confusion which might otherwise arise.

It will be sufficient to refer to two cases.

I. Messrs. Liveing and Dewar state that two lines of aluminium, the wave-lengths of which they give as 6245 and 6237, have each been seen by Young eight times.

According to Thalén's measurements, which are the best that we possess, there are no lines of aluminium in these positions. He gives, however, lines at 6244·0 and 6234·0.

Young, moreover, states that he saw reversed a strong line (clearly shown in Ångström's map to be an iron line) at 6245·4, and a line which he does not ascribe to any element at 6237·3, which is more than three divisions of the scale from the position of the aluminium line.

II. In the case of potassium, Messrs. Liveing and Dewar give two lines at wave-lengths 4044 and 4042 as having been seen by Young three times. I know of no potassium lines at the places given; Young, moreover, has recorded the reversal of no potassium line in this region. What Young distinctly states he saw, was the reversal of the iron line at 4045·0, which is one of the most marked iron lines in the spectrum of the sun. To this reversal I referred in my paper of December 12.[1]

It is perfectly true that there are two potassium lines in this region: they were not mapped by Thalén, and they were only seen as a single line by Lecoq de Boisbaudran[2] and the wave-length, given as 4045, as his dispersion was limited, did not enable us to determine its true position with reference to the Fraunhofer lines.

Last year, however, I not only stated the double nature of this line on photographic evidence,[3] and pointed out that both components were absent from the spectre normal, but I gave their wave-lengths as 4042·75 and 4046·28 (positions which will only find the last place of decimals altered, even if it be altered, in the revision of the map now being proceeded with), and on the strength of them announced the existence of potassium in the sun. Messrs. Liveing and Dewar do not state whence their wave-lengths were derived, neither do they refer to my communication.

It would appear therefore not only that the reference to Young's work in many cases is founded upon some misunderstanding, but that a higher degree of accuracy than that employed by Messrs. Liveing and Dewar is necessary to determine such coincidences.

I may state generally that my eleven years' work on this special branch has led me to the conclusion that all statements of coincidences between metallic and solar lines with a lower degree of accuracy than that employed by Thalén and Young are to be avoided when possible, as they may be worse than useless, they may mislead. Indeed, though the map on which I am working is on twelve times the scale of Ångström's, it would be better if it were larger; and when I say this I must add my tribute of admiration of the accuracy of the work of those who have preceded me, notably Ångström, Thalén, Cornu, and Young, with whose work I am more familiar, as it is expressed in wave-lengths.

May 29.—"Note on the Spectrum of Sodium," by J. Norman Lockyer, F.R.S.

I have lately been engaged in studying the spectrum of sodium under new experimental conditions. In anticipation of a detailed communication I take leave to state that the vapour given off from the metal after slow distillation in a vacuum for some time shows the red and green lines without any trace whatever of the yellow one. Hydrogen is given off in large quantities, and at times the C line and the red "structure" are seen alone. After this treatment the metal, even when red-hot, volatilises with great difficulty.

Linnean Society, May 1.—Lieut.-Col. Grant, C.B., vice-president, in the chair.—Mr. Edw. S. Morris exhibited a quantity of the berries, whole and ground, of the *Coffea liberica*, grown by him near Monrovia.—A living example of the rare and curious *Welwitschia mirabilis*, reared at Kew, was shown and commented on by Mr. W. T. Thiselton Dyer.—The chairman also called attention to a series of the teaching diagrams illustrating the "Anatomisch-physiologischer Atlas der Botanik," now being issued by Dr. Arnold and Carolina Dodel-Port, of Zurich.—A paper on nutrition in its relations to the fertilisation of flowers, by Mr. Thos. Meehan (Philadelphia, U.S.), was read. His observations chiefly refer to *Wistaria sinensis*, *W. frutescens*, *Catalpa syringæfolia*, and *Limina perenne*, from which he deduces that the struggle for power between the growth or vegetative and the reproductive forces decides fertility. He further suggests that the perfection of the polleniferous organs, and consequent potency of pollen, is dependent on phases of nutrition involved in this struggle. Thus in the above-mentioned plants it is seen that potency in pollen—the main element in the reproductive force—operates only when there has been some check given to the force of vegetative growth.—The Rev. G. Henslow read some remarks on Mr. Meehan's contribution, these in the main supporting his views. He states, with regard to the different facts and interpretation of experiments, that results however accurate and true for one country may be very different for another, as has been shown to be the case with *Escholtzia*. We cannot, therefore, be too cautious in presuming that because a phenomenon may invariably occur in our experience it must necessarily do so everywhere and at all times. He recognises five degrees in the effects of the reproductive force—1. Entire abeyance when no flowers are produced. 2. Flowers abundant, but pollen remains a mass of tissue, as in *Ranunculus ficaria*. 3. Flowers produced with good pollen, but no seed set as in *Escholtzia*. 4. Fruit produced only at definite places, as extremity of raceme, or at definite periods, as late in summer. 5. Flowers and fruit occur in abundance as in "tree" *Wistaria*, or freely growing branches of ivy.—A paper on the structure of the Pouched Rats, of the genus *Heteromys*, by Dr. J. Murie, was read in abstract. The anatomical structure and other peculiarities have been worked out and a comparison with other forms given, along with remarks on the sub-family Heteromyinæ generally.—The Secretary read a note by Dr. M. Masters, on the occurrence of a Restiaceous plant in Cochin China, an interesting fact in the geographical distribution of the group.—Messrs. T. E. Brown (of Adelaide), Richd. Rimmer, and P. O. Shanessy (of Queensland), were elected Fellows of the Society, and two Foreign Members were chosen to fill vacancies.

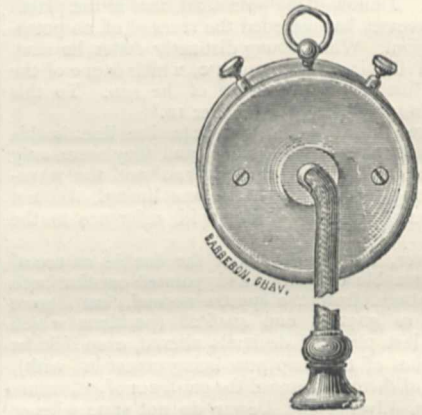
Geological Society, May 14.—Prof. P. M. Duncan, F.R.S., vice-president, in the chair.—The following communications were read:—Further observations on the pre-Cambrian rocks of Caernarvon, by Prof. T. M'Kenny Hughes, F.G.S. The author divides these into (1) the volcanic series, (2) the felsitic series, (3) the granitoid series. He traces the former of these, consisting of coarser and finer varieties, from Caernarvon to near Port Dinorwig. Beyond these come the felsite series, which is overlapped by grits and conglomerates as far as the Bangor Road, north-east of Brithdir. Above the latter comes the "volcanic series," well developed in the neighbourhood of Bangor. The author is of opinion that the Cambrian conglomerate, with associated grits, may be traced in the edge of the older massif from Twt Hill, Caernarvon, to Garth Point, Bangor, and that the beds in each of these places and near Brithdir, recently described as separate, are identical; also that the bed with purple fragments near Tairffynnon and the Bangor Poorhouse are only Cambrian conglomerate faulted down. Further, he considers that the strata of the above three series are fairly parallel throughout, and that they only form three subdivisions of one great series.—Notes on the structure of the palæozoic districts of West Somerset, by A. Champernowne, F.G.S., and W. A. E. Ussher, F.G.S. The authors confirmed the general accuracy of Mr. Etheridge's views as to the structure of North Devon and West Somerset, but differed from him in ascribing the limestone of Cannington Park to the carboniferous, both on account of lithological character, the fossils in Taunton Museum, said to be obtained from it, and the latitude of its position with reference to the carboniferous limestone of the Mendip, South Wales, and the steep and flat Holmes. They described four traverses made by them in West Somerset. 1. From Dulverton to Dunster, in which, proceeding northwards, the following beds were encountered:—Culm-measures faulted against Pilton Beds (upper Devonian), Pilton Beds faulted against Pickwell-Down sandstone (base of upper Devonian), Pickwell-Down sandstones becoming slaty in passing into Morte slates (middle Devonian) and troughed in them by faulted synclines, Morte slates passing into Ilfracombe slates (overlying Hangman grits) near Cutcombe, Hangman grits, evidently

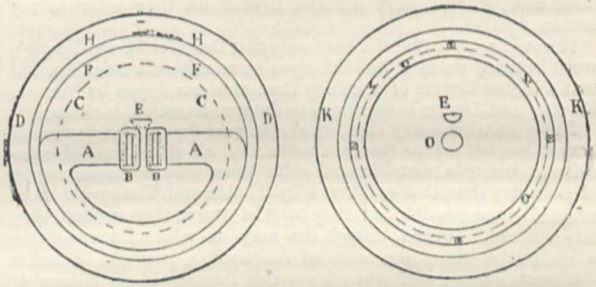
[1] *Proceedings*, 191, p. 172.
[2] "Spectres Lumineux," texte, p. 48.
[3] *Proceedings*, No. 186, p. 280.

faulted against Foreland grits, as no representative of the Lynton beds is present between Oaktrow and Timberscombe. In traverse 2 the fault between the Hangman and Foreland grits is proved by the presence of the Lynton beds in the valley west of Luccot Hill and their conformable infraposition to the Hangman series, and abrupt termination by fault against the Foreland grits of Porlock and Oare Hills. At Oare a patch of schist of the Lynton zone was noticed resting on the Foreland grits on the north side of the fault. The 3rd traverse in the Tone Valley gave the following succession of beds :—Culm-measures on Pilton beds ; Pilton beds with grits, much flexured, on Olive slates with *Lingula* and grits with *Cucullæa*, conformably overlying Pickwell-Down grits, which make a conformable junction (following the feature) with the underlying quartziferous slates of the Morte series (middle Devonian) ; the latter were observed between Huish Champflower and Clatworthy ; but, as the middle Devonian slates appear to extend considerably northward in the Brendons, they were not traversed beyond Clatworthy. The 4th traverse from West Quantockshead to Cannington Park proved the composition of the Quantocks along that line to be grits, in places associated with schistose shales, apparently belonging to the Hangman series (middle Devonian) ; whilst the palæozoic inliers, in the triassic area of Bridgewater, are unlike the Quantock rocks in character. The limestones of Asholt and Hollwell, associated with slates of the Ilfracombe series, are very similar to varieties of the South Devon limestone, and are quite unlike the limestone of Cannington Park.—The Whin Sill of Teesdale as an assimilator of the surrounding beds, by C. T. Clough, F.G.S. Owing to the general absence of mechanical disturbance, the author is of opinion that "the Whin consists in part of altered sedimentary beds, that it partly represents beds which were once in the position it now occupies, that it did not make room for itself simply by thrusting aside these beds, but also by incorporating them into itself." He proceeds to describe sections at Caldron Snout, Cronkley Fell, Noon Hill, &c., which seem to him inexplicable on any other theory. The author discusses objections on chemical grounds, holding that the general uniformity in chemical composition of the Whin may be explained by supposing the absorbed beds to have permeated a large mass of the Whin, as an alloy does melted metal. He thinks the explanation may be extended to other intrusive masses.—On the silurian rocks of the valley of the Clwyd, by Prof. T. M'Kenny Hughes, F.G.S. The author gives a preliminary sketch of the silurian rocks of the southern and western part of the Clwyd Valley. He describes first some beds below the horizon of the Denbigh grits at Ffriddfawr which agree very well in their characters with the base of the Coniston grit, and others near agreeing with the passage-beds between these grits and flags. He next describes sandstones in the Clywedog Valley, the equivalents of the lower grits ; and lastly, at Bod Renail, flags, &c., the Pale States, which contain graptolites, and are thus to be identified with the graptolitic mudstones of the Lake-district. Thus he is of opinion there is a basement-series here for the Silurian, corresponding in all its details with that in the Lake-district.

Zoological Society, May 20.—Prof. W. H. Flower, F.R.S., president, in the chair.—Mr. Sclater called the attention of the meeting to several animals and other objects of interest observed by him during a recent visit to some of the zoological gardens on the Continent.—Prof. Owen, C.B., read a paper in which he gave the description of a portion of the mandible of a large extinct kangaroo, proposed to be called *Palorchestes crassus*, from the ancient fluviatile drift of Queensland.—A communication was read from Mr. M. Jacoby, containing descriptions of new species of coleoptera of the family *Halticidæ*.—Mr. Sclater read a paper (the fourth of the series) on birds collected by the Rev. George Brown, C.M.Z.S., on Duke of York Island, and on the neighbouring parts of New Britain and New Ireland. The present collection contained fifty-nine specimens belonging to forty-two species, of which several were believed to be new to science.—A communication was read from Prof. Garrod, F.R.S., containing a series of notes on the anatomy of the Gelada baboon (*Gelada rueppelli*), based on the examination of a specimen that had died in the Society's Gardens. Prof. Garrod came to the conclusion that *Gelada* must be considered as a distinct generic form, more nearly allied to *Cercopithecus* than to *Cynocephalus*.—Lieut.-Col. Godwin-Austen read some notes on and gave a description of the female of *Ceriornis blythi*, Jerdon.

Physical Society, May 10.—Prof. W. G. Adams in the chair.—New Member, Mr. J. Kestrell Evans.—Mr. Wollaston explained the construction of Gower's improved form of Bell's speaking-telephone. The older form, made of wood or ebonite, is open to the objections that it has a very weak voice, soon gets out of adjustment from changes of temperature, and requires a twisted hand-wire which is liable to break. Gower's form has a comparatively loud utterance, is constant, and does not require to be held in the hand, but may be laid on a table or hung on a wall, a speaking-tube leading from it to the operator's ear or mouth. The "call" for attracting attention is also within the Gower telephone itself, whereas in the hand telephone it is an auxiliary apparatus. Every organ of the old telephone has been modified to form the Gower. The magnet A A in the figure in the Gower is of a horse-shoe form, very powerful, the two poles being brought very close together, and each pole is mounted with a small coil of fine wire, B B ; the diaphragm C C is much thicker and longer than the Bell diaphragm, the case, D D, is of brass, to expand equably, and a speaking-tube is fitted to the front of the diaphragm. F F is the interior and K K the exterior circumference of the box. The call, E,





consists of a musical reed attached to the diaphragm so as to be opposite a small slit in the latter. To sound the call it is only necessary to send a sharp puff of wind up the speaking-tube, and the reed gives out a note which is heard throughout a room at the distant end. Speaking and cornet music was transmitted by the instrument exhibited, between the third storey over the hall and the meeting. It was very distinct and audible several feet from the receiver. Speaking done some thirty feet from the transmitter was also sent. Conversation was likewise carried on while considerable noise was being made in the room. Prof. Macleod remarked that the timbre of this telephone was very good. —Prof. Barrett then gave an account of some attempts which he had made to overcome the induction clamour on telephones caused by the ordinary telegraph currents on neighbouring wires. He had tried recently the Bell telephone on a line from Dublin to Armagh, ninety-five miles long, but the induction noises completely stifled the speaking, whereas the Edison transmitter gave good results. The clamour could be got rid of either by neutralising the induction currents, or by eliminating the noises from the speech. He had taken the second line of experiment. Since the vocal currents differ from the induction ones in potential and period, he attempted to make the latter discharge across from the line to earth by fine needle points, and from a heated spiral of wire, in a vacuum, leaving the vocal currents to

pass on to the receiver, but without success. Also since the vocal currents are alternately positive and negative, whereas the induction ones are of one sign, he tried to avail himself of the difference in discharging power of positive and negative currents, but without success. He then tried to take advantage of the difference of period or duration of the currents, the induction currents being longer. He therefore tried to break up the induction-currents by interposing a rapidly revolving current interrupter, and to make the sections of the musical note obtained *interfere* with each other by means of an acoustic interference-tube, but practically failed in this also. He mentioned these facts for the benefit of others who may be going over the same ground. Mr. Wollaston pointed out that a perfect cure for induction on underground wires consisted in twisting the going and returning wire of the telephone circuit round each other.—Mr. Wilson then read a paper on the divisibility of the electric light by incandescence. By Joule's law the amount of heat developed in a circuit of resistance, R, by the passage of a current $C = C^2R$; where R is the resistance of generator and connections, r, added to the resistance of the light emitter or incandescent wire, P. Therefore since by Ohm's law $C = \frac{E}{R}$ we have—

$$C^2 = \frac{E^2}{(r+P)^2}, \text{ and } C^2P = \frac{E^2P}{(r+P)^2}.$$

From this equation the value of P may also be determined. C^2P is the amount of heat developed in the incandescent wire. He infers that the smaller the mass of the wire the higher the temperature generated in it, therefore the mass of the wire should be diminished until the fusing point of the metal is almost attained. The question of divisibility resolves itself into our being able to divide a single incandescent source into a number of smaller ones giving the same total illumination. The author concludes that this can be done by arranging the subdivided sources in "multiple arc" or parallel circuits, provided the total mass, length, and sectional area of the united sources be the same as in the original single source. The objection that increased radiation from the various sources would diminish the first total of light and heat can be met by making the smaller wires still smaller than is theoretically required so as to generate more heat. The author regards the "voltaic arc" as probably falling under the same law, the mass, however, being smaller in this case. —Dr. Coffin then exhibited a Trouvé polyscope, which consists of a small, hand, incandescent platinum wire electric light, designed for illuminating the more inaccessible cavities of the body in surgical examinations. The current is supplied by a Planté secondary battery, and the light is half inclosed in a small silver reflector fitted with a convenient handle. The apparatus is portable. Dr. Coffin found that it was open to several objections which he has remedied. Firstly, the heat generated made the lamp so hot that it could not be held to the body for more than a very short time. He overcame this by making the reflector of double silver plates, and circulating water between by means of india-rubber pipes and a bulb which can be worked by the patient himself, thus serving to distract his attention from the operation. Secondly, the secondary battery exhausts itself in twenty minutes, and the light therefore goes out, while from twelve to twenty-four hours are required to recharge it. Dr. Coffin has superseded it by a Leclanche battery of eight elements, made by Messrs. Coxetter and Sons, in which the carbon pole is replaced by a copper plate faced with platinum, and no porous diaphragm is employed. This gives a constant light for hours.

Anthropological Institute, May 13.—Prof. W. H. Flower, LL.D., F.R.S., vice-president, in the chair.—Mr. Hyde Clarke read a paper on the ethnology, mythology, and philology of races of early culture: Babylonians, Etruscans, Egyptians, Japanese, &c. Pursuing his former investigations, he now produced the comparative philology of Akkad, Coptic, Etruscan, Lydian, Phrygian, Thracian, Carian, &c., copiously illustrated. He showed the relationships of these among each other and with the Ugro-Altaic languages, Georgian, the Himalayan, Naga, Kolarian, and other Indian languages; Basque, the Pomo, Hidatsa, and other American languages. All these he further showed to be related to the numerous languages now spoken in the more advanced highlands of Central and Western Africa, as Mandingo, Bornu, Pulo, Timbuktu, Houssa, Ashantee, &c. By reference to these larger stocks he conciliated the divergences which appeared on the intercomparison of other languages. Thus he illustrated many disputed points in the Akkad grammar of M. Lenormant, and the alleged relations with the Finnic. In treating the murology of the subject Mr. Clarke referred to the marked differences between the Koord, Persian, Armenian, and Eastern Aryans, and the Germanic and other Western Aryans. His conclusion was that the so-called Eastern Aryans are descendants of the pro-existing Turanians, having merely acquired an Aryan language, and are to be assimilated to the Georgian and other white Turanians, to the Assyrians, and the Semites. To them he assigned the Etruscans and Lydians. If the Aryans were to be regarded as descended from High Asia, then the white Turanians may have descended from High Africa, and they were the authors of the early culture. When their power fell, although in Europe and Western Asia they were replaced by the Aryan migrations, yet in other regions they were extirpated by the black and brown (or red) natives. Abyssinia, in conformity with its own legends, was to be regarded as one of the last centres of this ancient empire, and the Himyarite as one of the last invasions under Semitic leaders. To the earlier epochs he assigned the American migrations and the mound-builders, when he considered the Pomo as the possible language. Tracing a like conformity in a primitive mythology as in philology, the author marked out a Turanian epoch of Greece and of Rome, and explained the relation between Etruscan and Norse mythology by the existence of a Turanian epoch of culture among the Germanic nations.—Mr. A. L. Lewis communicated a paper entitled "Notes on some Irish Antiquities." He observed that the country round Dublin, while considered by Irish antiquaries to be comparatively destitute of rude stone monuments, nevertheless contained as many as some of those districts in England where they were most plentiful. In the island of Howth, to the north of Dublin Bay, are the remains of a dolmen called Finns Quoit, the cap-stone of which measured no less than 15 feet long by 6 feet in thickness. South of Dublin, in the ground of Mount Venus, seven or eight miles from the city, is a stone 20 feet long by 3 feet thick, leaning against one 8 feet high. At Killiney Station, on the road to Bray, are remains known as the Druids Altar and Druids Chair. The finest dolmen is in Carrick mines where five upright stones support a capstone 17 feet long by 14½ inside, and nearly 5 feet thick, forming a chamber 10 feet square. In construction these remains resembled those known as the Trevethas Stone in Cornwall. Of tumuli in Ireland the largest sepulchre is probably that known in the New Grange tumulus situated between Navan and Drogheda. Its peculiarities were noticed by the author and contrasted with the remains at Gavr Inis, in Brittany, and with the cuneiform chambers at Wayland Smith, at Wellon, near Bath. Remains that have been observed in the burial-ground of the Abbey Church of Slane, near Navan, were next described, and the paper concluded with some interesting observations on the well-known round towers of Ireland, and with novel suggestions as to their origin and purpose.

Royal Microscopical Society, May 14.—Dr. Beale, F.R.S., president, in the chair.—This was the first meeting in the Society's new room.—Papers were read by Mr. A. W. Waters, F.G.S., on the occurrence of recent Heteropora; by Mr. J. Davis, on a new species of Cothurnia; and by Mr. Wenham, on homogeneous immersion objectives.—The exhibits included photographs of blood-corpuscles, by Dr. Treadwell; Rutley's petrological microscope, by Mr. T. W. Watson; and various microtomes, by Mr. Crisp, &c.—Five new Fellows were elected, and eight nominations read for the next meeting.—The second scientific evening of the session, held on May 21, was very numerously attended, many objects of novelty and interest being exhibited, together with apparatus, amongst which were oil-immersion objectives, by Zeiss and Powell and Lealand.

Photographic Society, May 13.—J. Glaisher, F.R.S., in the chair.—Mr. C. Bennett read a paper in reply to the discussion on a previous paper read by him, on gelatine emulsions. He stated that he still held the opinion that when an emulsion was lightly salted with silver bromide, the particles were fine, and remained so during long emulsification—as also the converse with heavily salted specimens. With respect to the light admitted for working his extremely sensitive emulsion, he found that four square feet of four thicknesses of deep ruby glass were preferable to one square foot of one thickness.—Mr. T. S. Davis, F.C.S., read a paper on preparing small quantities of gelatine emulsion, advocating the admixture of the silver and bromide salts in powder to the gelatine solution instead of previously dissolving them.—Mr. W. S. Bird read a paper on

the photography of vision, showing from researches made by M. Kuhne and Prof. Boll, that a visual purple pigment existed in the eye, and a theory therefrom of a result similar to that in photography, viz., a fixation of an image by physical changes in certain minute rods and cones found in some membranes of the retina, the experiments recorded tending to the old theory that the eye of a deceased person or animal retained the last visual impression.

Statistical Society, May 20.—Mr. Wm. Newmarch, F.R.S., vice-president, in the chair.—The paper read was by Mr. John B. Martin, M.A., banker, of Lombard Street, "On some Effects of a Crisis on the Banking Interest."

EDINBURGH

Royal Society, June 2.—Sir C. Wyville Thomson, vice-president, in the chair.—The following communications were read:—On the carboniferous volcanic rocks of the basin of the Firth of Forth: their structure in the field and under the microscope. Second paper, by Prof. Geikie.—Additional observations on the fungus disease affecting salmon, by A. B. Stirling, Conservator of the Anatomical Museum (communicated by Prof. Turner).—On the form and structure of the teeth of *Mesoplodon layardi* and *M. sowerbyi*, by Prof. Turner.

PARIS

Academy of Sciences, May 26.—M. Daubrée in the chair.—The following papers were read:—On the refraction of obscure heat, by M. Desains. With a view to getting lenses which will cause to converge to a point rays from the beginning and end of the dark spectrum, he tries to follow and recognise in dark spectra a given group of rays, spite of differences in the refringent and dispersive powers of the bodies employed, so as to reach the absolute value of the refractions of dark rays of given length in different diathermanous bodies. Hence may be calculated the radii of lenses of flint and crown glass, *e.g.*, which will give the convergence sought.—Chemical researches on the formation of coal, by M. Fremy. He concludes that coal is not an organised substance; it has taken plant impressions readily, because of its bituminous and plastic nature. The plants which produced coal seem to have first undergone *peaty fermentation*, which destroyed all vegetable organisation, and the coal was formed at expense of the peat, by a secondary action, produced by heat and pressure.—Determination of the difference of longitude between Paris and Berlin, by MM. Lœwy and Le Clerc. Astronomers of the two countries made simultaneous observations in contiguous tents, but with instruments and methods of their own choice. The principal differences of method are indicated. From the French observations (in one series of which M. Lœwy was in Berlin and M. Le Clerc in Paris, in the other *vice versâ*), the ultimate value of the difference of longitude with Cassini's meridian was 44m. 13·99s. (careful tests were applied). This showed a difference of 0·13s. with the German's result, which the authors think due to a slight variation of the optic axis in one or other of the instruments of either mission. From the various longitudes effected in Europe, several values of the longitude between Paris and Berlin may be deduced indirectly, and the authors hope, by discussing these numbers, to arrive at the true value.—On the distribution of work to a distance by electrical means, by M. Tresca. This relates to experiments made at some sugar works. A Gramme machine driven by a steam-engine, set in action another Gramme machine 400 metres or 650 m. off (as desired), and this latter rotated a drum with cable, which worked a double plough. An effective force of 3 horse-power was thus transmitted. The (copper) wire was formed of nine strands 1 mm. diameter, giving a section of 7 square mm. The first Gramme rotated 1,123 times per minute, the second 890.—On earthquakes which occurred in the East from the seventh to the seventeenth century, by M. Tholozan. According to the data obtained, Persia seems to have been most frequently attacked (the other countries are Mesopotamia, Egypt, Syria, Arabia, and Magreb); but one cannot draw very exact conclusions from the records. M. Tholozan, however, is able to contradict von Hoff's assertion that from the beginning of the thirteenth to the second half of the seventeenth century there was almost complete cessation of earthquakes in Syria and Judea; and Quatremare's, that the north-east of Africa has been almost always exempt.—M. Gyldén was elected Correspondent in Astronomy in room of the late P. Secchi.—On the characteristics of functions, by M. Jordan.—On a new representation of imaginary quantities, by M. Dupont.—New demonstration of the law of reciprocity, in the theory of quadratic residues, by M. Schering.—On the development of cot. x, by M. Le Page.—On the fluorescence of salts of earthy metals, by M. Soret. The liquid was placed in a quartz vessel, on which was concentrated, with a quartz lens, the light of the induction-spark passing, *e.g.*, between cadmium electrodes.—On the determination of calorific wave-lengths, by M. Mouton. The method was that of M. Fizeau, freed from the uncertainty resulting from ignorance of the law of dispersion of double refraction of the plate employed in calorific radiations.—On a peculiar mode of transmission of sound to a distance, by M. Decharme. One may, by a purely mechanical process, transmit 5, 10 . . . metres, the different sounds of a vibrating plate, a tuning-fork, or a stringed instrument, by putting these in communication, by means of metallic wires not stretched but in spiral, with suspended sheets of Dutc metal or tin (the fastenings are with wax).—On the diffusion of lithia and its presence in sea-water, by M. Marchand. He claims to have found lithia in sea-water before M. Bunsen did.—On the salts of guanidine, by M. Jousselin.—Experimental researches on the physiological signification of the terminal nervous plexus of the cornea, by M. Ranvier. The arrangement seems simply relative to the transparence of the cornea. The nerves themselves are nerves of general sensibility.—On the metamorphosis of cantharides (*Lytta vesicatoria*, Fab.), by M. Lichtenstein.—On the body-cavity of sedentary annelids, and their segmentary organs; some remarks on the genus Phascolosoma, by M. Cosmovici.—On the *Taenia giardi*, and on some species of the group of Inermes, by M. Moniez.

VIENNA

Imperial Academy of Sciences, March 20.—The following among other papers were read:—On *Cerianthus membranaceus*, a contribution to the anatomy of the Actinia, by Dr. von Heider.—Action of salt solutions on aldehydes (continued), by Prof. Lieben and Herr Zeisel.—On the formation of a rational plane curve of the third order on a conic section, by Prof. Weyr.—On the passage of light-rays in a homogeneous ball, by Prof. Lippich.—On the chemical composition of pyroxilin and the formula of cellulose, by Prof. Eder.—On the relation between heat-radiation and temperature, by Prof. Stefan.—Studies on ellagic acid, by Prof. Barth and Dr. Goldschmiedt.

April 3.—On the methods of investigating the polar actions of the electric current in striated muscle, by Prof. Hering.—On the polar actions of the electric current in muscles deprived of nerves, by Dr. Biedermann.—On phosphate of zinc, by Herr Demel.—On the solution of dynamical problems by means of Hamilton's partial differential equation, by Dr. Hocevar.—Contribution to a knowledge of copper chloride, by Herr Rosenfeld.—Geological description of North-east Thessaly, by Herr Teller.—On some points in geography and geology of European Turkey, by Dr. Boué.—Researches on the diffusion of salt solutions, by Herr Schulemeister.—On resorcindisulpho-acid, by Herr Tedeschi.—Action of melting caustic soda on aromatic acids, by Herren Barth and Schreder.—On derivatives of a phenoldisulpho-acid, by Herren Barth and Schmidt.—On a local influence on the magnetic observations in Vienna in the period 1860–71.

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