THURSDAY, MAY 21, 1885

THE BRITISH MUSEUM CATALOGUE OF LIZARDS

Catalogue of the Lizards in the British Museum (*Natural History*). By George Albert Boulenger. Vol. I. *Geckonidæ*, *Eublepharidæ*, *Uroplatidæ*, *Pygopodidæ*, *Agamidæ*. Second Edition. (1885.)

IT would be difficult to name any order of vertebrates more urgently in need of cataloguing than the lizards. The last general work on the group published in any country was Dr. J. E. Gray's Catalogue, which appeared forty years ago, only six years after the completion of the volumes devoted to lizards in Dumeril and Bibron's great work on Reptiles. The additions made in Dr. Gray's Catalogue were considerable, but many of them were of doubtful value. Thus of fourteen new genera therein added by him to the family of Geckoes alone, but three survive in the present edition, the remainder swell the synonymy.

Mr. Boulenger's Catalogue is a boon to herpetologists and to biologists generally, not only because it places within their reach in a few handy volumes descriptions that have hitherto been widely scattered, but also because the classification proposed, whether it be generally accepted or not, is a distinct advance upon the artificial system hitherto in vogue. It is to be hoped that lizards so closely resembling each other as do, for instance, *Gongylus*, *Ablepharus*, and *Euprepes*, will no longer be classed in three distinct families solely because of trivial differences in the form of the nasal shield and in the development of the lower eyelid. At the same time, as naturalists have but rarely access to a collection of lacertilian skeletons, it is to be regretted that a few diagrams have not been added to the present catalogue, to show the cranial characters and the forms of the vertebræ, clavicles, &c., upon which Mr. Boulenger's families are founded.

A considerable change in some well-known reptilian genera is proposed in the present work, and it is probable that the union, for instance, of *Stellio* and *Trapelus* with *Agama* and of *Bronchocela* with *Calotes* will not be universally acceptable. But no change appears to have been proposed without valid reasons, and the tendency to excessive multiplication of genera on insufficient grounds has become so serious a nuisance in zoology that a diminution in the number is welcome. It is satisfactory to find, on comparison with the catalogue of 1845, that whilst the species attributed to the *Geckonidæ* have increased from 97 to 270, the genera have only augmented in number from 40 (or if *Eublepharis* and *Uroplates*, now placed in other families, be excluded, 38) to 49, whilst the *Agamidæ* which, in the earlier list, comprised 79 species, distributed amongst no less than 34 genera (35, including *Hatteria*) now contain 202 species, but only 30 genera. But six new generic names are proposed by Mr. Boulenger in the present work, and only three of these are used for generic groups not previously recognised, the others being intended to replace terms that are inadmissible.

It is almost impossible to form an adequate opinion of the descriptions and synopses in a catalogue of this kind without testing them extensively, and the only thorough test is to try, by means of them, to identify unknown forms without having a series of specimens of allied species at hand. Most museum publications are deficient in this respect, because the writers do not make sufficient allowance for the difficulties under which those who have occasion to identify animals find themselves. An example or two may be taken from the present work. In the synopsis (p. 114) of *Hemidactylus*, one of the largest and most difficult genera of Geckoes, two groups of species are distinguished, the one by having the "free distal joints of all the digits remarkably short," the other by having them long. In a museum, with other species for comparison, this is a good distinction, but away from any specimens except the one that he is endeavouring to identify it is difficult for a naturalist to tell whether the joints of the lizard he is examining are remarkably short compared with those of other forms. Again, in *Draco* (p. 254) several species are distinguished by having the snout longer or shorter than the diameter of the orbit, but it is not stated how the snout is measured. It is but right to say that such instances appear exceptional in the present catalogue, and that it is very rare to find a work in zoology from which similar examples might not be taken.

One of the chief desiderata in books like the present is accuracy as to localities. The museum catalogues of a past age left much to be desired in this respect, and their shortcomings have had a pernicious influence on the progress of a study of wide biological and geological interest, that of the geographical distribution of animals. It will probably be a long time before all the erroneous localities are weeded out, but it is satisfactory to note the great improvement that has taken place in British Museum catalogues of late years. Where so much care has been expended on the subject as is shown in the present work, it appears almost ungracious to point to such trifling shortcomings as appear, though a few mistakes have naturally crept in. Thus the locality for *Acanthosaura* (*Oriocalotes*) *Kakhienensis* is not in the Khasia hills as stated at p. 305, but Ponsee, in the Kakhyen hills, on the borders of Yunan. Again, considering the extensive collections that have been made of late years throughout Bengal, it is very extraordinary, if *Hoplodactylus duvancelii* and *Gonyocephalus bellii* really occur in the province that neither of them has been rediscovered, and the locality should not be recorded without doubt.

Altogether the present volume quite maintains the level that the best recent museum catalogues have led naturalists to expect. Why it should be called a "second edition" is not clear. A comparison of the two editions resembles an antiquarian research. It is necessary to recall a state of zoological knowledge as extinct as the dodo before the conditions under which the so-called first edition was produced can be understood. When the head of the zoological department in the British Museum could propose to divide reptiles into two sections, one called *Squamata*, comprising the orders of lizards and snakes, and the other, called *Cataphracta*, consisting of tortoises, crocodiles, and amphisbænians, on the ground that the former were clad with scales and the latter with plates, the knowledge of the animals classified was evidently in a rudimentary stage. As if the classification

thus proposed was not sufficiently startling, it was gravely suggested (p. 2) that the five orders of reptiles were "analogous" to similar subdivisions in birds and mammals; the lizards as "climbers" representing the *Insessores* in the former and the *Primates* in the latter, serpents being "carnivorous" corresponding to *Accipitres* and *Feræ*, Emydosaurians (crocodiles) because they are "aquatic" to *Anseres* and *Cete*, tortoises in virtue of being "large-footed" to *Gallinæ* and *Ungulata*, and *Amphisbænians* for no particular reason to *Grallæ* and *Glires*. It is doubtful whether the authorities of the British Museum would not have done wisely by leaving this farrago of nonsense, one of the last echoes evoked by the once popular quinquennial system of Vigors and Swainson, in well-merited oblivion, and in not calling attention to it by suggesting a comparison between the work by Dr. Gray and that by Mr. Boulenger. However great may be the changes in zoological classification during the next forty years, the difference between the views now held and those that may prevail in the future will scarcely be so revolutionary as that which exists between the first and the second edition of the British Museum Catalogue of Reptiles.

THE SILVER-LEAD DEPOSITS OF NEVADA

The Silver-Lead Deposits of Eureka, Nevada. By J. S. Curtis. 4to. 200 pp. (Washington, D.C., Government Printing Office, 1884.)

THE remarkable mineral district which is dealt with in this memoir is situated in the eastern part of the State of Nevada, about the centre of the dreary region known as the Great Basin, between the Great Salt Lake of Utah and the Sierra Nevada range of California. The business centre of the town, or "mining camp," of Eureka is about 90 miles south of the Palisades Station, on the Central Pacific Railway, with which it is united by a narrow-gauge branch railway. The principal mines situated about Ruby Hill, about 1½ miles west of the town, extend for about a mile along the contact of a limestone, supposed to be of Cambrian age, with an underlying quartzite. The quartzite forms the axis of a steep anticlinal arch, which has been modified on one side by a great fracture known as the Ruby Hill fault, and between this and some secondary fractures, an enormous mass of crushed limestone is included, containing the mineral deposits, or ore bodies proper, which are essentially cave deposits, the hollows between the limestone fragments, which are of all sorts of shapes and sizes, being filled with products of the oxidation of galena, pyrites and mispickel, such as sulphate, carbonate, and arsenate of lead, and brown iron ore, in addition to the unaltered minerals in smaller quantities. The chief mineralogical find of these mines has, however, been of Wulfenite or molybdate of lead, which has been produced in considerable quantity, both in detached crystals of great beauty and interspersed through the mass of the other minerals. As a whole, the ores contain about 33 per cent. of lead, 30 ozs. of silver, and about 1¾ ozs. of gold per ton. These ore bodies are of every possible form and size, from small strings up to masses measuring upwards of 100 feet in all directions; but in spite of this great irregularity of form, they are generally connected with systems of fissures or channels, and it is by following these fissures that most of the great discoveries have been made.

Although mines extend for nearly a mile along the hill, the most valuable portions of the deposit are included within a length of about 500 yards at the north-western end belonging to the Eureka and Richmond Mining Companies; and, as the largest development of ore has been on or near the boundary dividing the two properties, disputes as to the ownership of different masses have been followed by litigation culminating in a law-suit which in some way recalls the famous Torbane Hill case of the Scotch courts; the principal mining and geological experts of the United States, when called in as witnesses, being about equally divided in opinion as to whether the zone of limestone containing the ore was a lode or not. In the first judgment the affirmative view prevailed, and was maintained on appeal, although the case appears to have been ultimately decided upon considerations of previous agreements as to boundary lines between the two companies rather than on technical definitions. The absurdity of attempting to apply precise definitions to such essentially irregular objects as mineral deposits has never been so well demonstrated as in this famous case.

As regards the origin of the ores, the author considers them to have been deposited by hot springs constituting the final episode of a period of volcanic activity, evidence of which is found in the neighbourhood, though not in the immediate vicinity of the mines. A large number of assays of the limestone and quartzite rocks enclosing the deposits have been made, proving them to contain silver of the value of from fourpence to twenty-two pence per ton, which, however, in the author's opinion shows conclusively that the materials for the ore could not have been derived from any of the sedimentary formations.

The systematic assaying of the rock has been attempted to be utilised as a method of discovering ore bodies, as have also experiments upon variations in electrical activity, but as yet without practical results, although a curious coincidence has been observed in the indications given by the two methods.

The yield of precious metals of the Ruby Hill mines between 1869 and the date of the author's report, 1883, has been about 15,000,000*l.*, the value in the proportion of about one-third of gold to two-thirds of silver, in addition to about 225,000 tons of lead. Both the smelting and desilverising of the ore are done on the spot, the latter being effected by the inverse Pattinson process of Luce and Rozan, in which the lead is crystallised by injecting steam, and the liquid lead is run off from the impoverished crystals. This is perhaps the largest application that this process has yet received.

The lower workings of the mines, although they have been extended to a depth of 1200 feet, have not as yet led to any discoveries comparable with those made between 300 and 700 feet below the surface. The author, however, considers the chances of finding ore in depth to be favourable.

Taken as a whole the volume is a very interesting one, and is well illustrated, although for practical purposes the scale of the plans and sections is rather small, and

the description of the underground workings is scarcely sufficient to enable the reader to appreciate exactly the value of the author's theoretical conclusions.

H. B.

OUR BOOK SHELF

Den Norske Nordhavs-Expedition, 1876 to 1878. XIII. Spongiadae. Ved G. Armauer Hansen. 25 pp., 7 plates, 1 map. (Christiania, 1885.)

THE thirteenth report on the zoological collections of the Norwegian North Sea Expedition treats of the sponges, and is by one who, though well known as a student of other branches of zoology, has not, we fancy, been hitherto known as a spongologist. We do not know whether we may not associate with this fact the somewhat alarming percentage of new species which he describes; of the forty-five enumerated, thirty, or two-thirds of the whole, are new; many of the species, among which it is interesting to note there is a new Hyalonema, *H. arcticum*, are very briefly described; on the other hand, the figures, as in other parts of this report, are well executed, and will be of considerable assistance in the detection of the species by other workers. The author was, unfortunately, unable to obtain any preparations in which he could trace out the canal system, or the structure of the soft parts, and he has, therefore, confined himself to an account of the spicules. With regard to these he has, we are glad to note, made use of the stenographic system which was invented by Dr. Vosmaer; any and every proposition for abbreviating the descriptions of species ought to be tested, for the abundance of "literature" is a very threatening danger to science. It is not likely that all the methods that have been from time to time suggested will be found to be useful; no one, for example, has followed the two methods proposed by the late Prof. Garrod, or that adopted by Prof. Jeffrey Bell in the description of species of starfishes; on the other hand, Dr. Herbert Carpenter has taken up and improved the method suggested by Prof. Bell for the species of Comatulids, and will, we understand, adopt it in his forthcoming *Challenger* Report. The chief objections to formulæ as applied either to species, or spicules, or other organs, are, of course, that a particular method has to be learned, and that, if it is too brief, it tells us too little. The latter, for example, is true of the Owenian method of formulating the dental characters of Mammalia; it tells us that, while *Gymnura* has eight premolars above and below, *Erinaceus* has six above and four below, but it does not tell us which are missing in the latter. If we desire to register our knowledge on this point, we must make use of the more elaborate system devised by Prof. Flower and Dr. Dobson. As to the former objection, we must bear in mind that some spicules have had such names as floricomo-hexradiate, or patento-ternate, applied to them, and we can well imagine that a formula may well be accepted as a not unpleasant alternative.

The Hunterian Oration. Delivered at the Royal College of Surgeons, by John Marshall, F.R.S., &c. (London: Smith, Elder, and Co., 1885.)

NOT only the wide range and perennial importance of the work of John Hunter—the surgeon and anatomist whom the clear judgment of Buckle places second only to Aristotle among inquirers into organic nature—but also the fertility of human ingenuity, is shown by the fact that, for nearly a century, every year has seen some eminent surgeon discourse with more or less variety and freshness upon the life and achievements of this graet man.

The novelties of Mr. Marshall's treatment of the well-worn theme are, first, recounting the life of his hero backwards in successive decennia from his grave to his cradle; and, secondly, bringing Hunter into the modern world of science, and imagining the way in which he would be affected by modern methods and modern results. No doubt he would be delighted to see the splendid collection which has grown out of his "Hunterian Museum," but whether he would be more pleased or puzzled by the technics of histology and the elaborate machines of a physiological laboratory may perhaps be doubted.

An orator must be an eulogist, and in this case there is ample room for praise; but it would be a valuable contribution to criticism if Mr. Marshall, or some equally qualified man, would discuss Hunter's achievements as an anatomist, compared with Meckel and Cuvier; as a surgeon, with his contemporary Pott, and his successors Astley Cooper and Brodie; as a physiologist with Haller and Bichat; and as a naturalist—on the broad ground which includes human and "comparative" anatomy, normal and morbid structure, "the physiology of disease" (to use Hunter's own phrase), as well as that of health—with the only successor he has had, or, we may predict, ever will have, the illustrious Johannes Müller.

To such a critic might be suggested as shades in the intellectual portrait, Hunter's neglect of the aid of magnifying glasses such as were used to good effect before him by Leewenhoeck and Grew; his want of learning and cultivation, with a certain consequent narrowness of mind; and such occasional obscurity of language as may not unfairly be taken to imply some obscurity of thought. "Definitions," he says, "of all things on the face of the earth are the most cursed." But may not the use of terms without definition sometimes excuse a choleric word?

After the most exacting criticism, there is no question that Hunter's name would remain one of the glories of this country—to be mentioned next to those of Harvey, Newton, and Darwin. It is therefore most fitting that his fame should be kept green by the annual piety of successive orators, and of these Mr. Marshall is a worthy compeer.

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 insure the appearance even of communications containing interesting and novel facts.*]

Notes on the Action of the Wimshurst Induction Machine

AN interesting notice on the different influence-machines now in use occurs in NATURE, vol. xxviii. p. 12. Of these ingenious instruments, that lately devised by Mr. Wimshurst is likely to recommend itself beyond others, on account of the ease with which it may be excited, even in a damp atmosphere, and the high tension of the electricity discharged from its accumulators.

The following remarks lay no claim to originality, but they may nevertheless afford some interest to those who would witness its effects at a small pecuniary outlay; indeed its construction is well within the powers of the amateur mechanic.

Makers advertise sparks of fabulous length from comparatively small machines, but dense discharges of 4½ inches may be obtained under favourable circumstances from disks of 15 inches diameter, if care be taken adequately to insulate the collecting apparatus. It is obvious that an *unassisted* spark of 9 inches cannot be produced from plates whose minimum air-spaces of insulation do not exceed 3½ inches. The weakest part of insulation in these machines is usually between the metal inductors and the attachments of the driving-gear and spindle. In the dark, beautiful brushes of light flash across these spaces, and thus they point where the electricity leaks away from the

accumulators. The tendency to form these brushes may be much diminished by cementing a small disk of sheet caoutchouc over the inner ends of each metal-inducing strap.

The machine in full work presents several points of interest, the explanation of which, perhaps, is not very obvious. The first I would notice is, that although 15-inch plates will scarcely give an *unassisted* spark of more than 1⅛ inches in length, the interposition of a trifling condenser, showing only a coated surface of 6 square inches, will entirely change the character of this spark, the almost continuous stream of short sparks giving place to fewer, zigzag, snapping, 4-inch discharges, of much increased density and brilliance. The attachment of a condensing tube, constructed as follows, will be found a valuable addition to such machines as collect separately the positive and negative electricities.

About 18 inches of thin glass combustion-tubing of ¾-inch diameter is taken. Within, and at 4 inches distance from each end, a space of 2 inches is coated with tinfoil, leaving a space of 5 inches or so of clear glass between them. Two similar pieces of foil are fixed by a thin coat of gold-size on the exterior of this tube. They superpose the inner pieces of foil, and act as the outer coats of two small Leyden jars united as it were in one. These outer coatings are connected by a strip of tinfoil. The inner coats are placed in contact respectively with the plus and minus collectors of the machine, by means of thick brass wires thrust through caoutchouc plugs. The wires are so bent that their ends may drop into suitable holes, from which they may be at any time detached.

A thin coat of spirit lac-varnish spread within and without much favours the insulation of the tube.

Thus arranged, bright angular sparks of 4 or more inches in length will pass between the knobs of the discharger at *every three-quarter turns* of the handle.

Another point of interest offers itself when the knobs of the discharger are placed beyond their usual striking distance. In such a case the spark very frequently passes within the tube from coating to coating, quite silently, and with an optical illusion of comparative slowness of transit. When first I noticed these bright flashes of light, they suggested the form of an undulating fire-ball, and this brought to my remembrance the often-described but obscure phenomenon of "ball-lightning." I could not, however, detect any real retardation of the discharge by a somewhat rough experiment with the ordinary spark-wheel.

When two large jars are connected with the machine the disruptive discharge of 4 inches is accompanied by a sharp report, like that of a small pistol. I was not prepared for the fact that such a noisy discharge made to pass through the condensing-tube is quite silent, just as if it flashed through a partial vacuum. It may also be noted that the spark through the tube may be made much to exceed the length of the discharge in the ordinary way.

The last point I now mention, and concerning which I should value the remarks of Mr. Wimshurst, or any other competent electrician, is the increasing intensity of charge taken up by the metal inducers, or sectors, as they pass each other between the point of their contact with the earth through the metallic brush and the next following comb-collector. In the electrophorus such a contact is required once between the delivery of each spark; whereas in the machine here used, having perhaps twenty-eight sectors, a contact is given only once in seven inductive processes.

It will be found that well-varnished jars, without the usual wooden tops, are much the most efficient. Nevertheless, even these sometimes become so highly charged, that the electricity will force itself over their edges, doubling back, as it were, over a distance of 5 inches.

A pretty, but somewhat trifling experiment may be made by attaching two jars of unequal capacities to the collectors. Thus a jar of half a pint capacity placed on one side may be flanked by a quart jar on the other. Here the small jar, if the coatings be not too distant from the lip, will discharge itself three different times, whilst the large jar is getting sufficient tension to strike, say, at 3½ inches. Both jars will then discharge together across the upper knobs. It may thus be shown that four half-pints of electricity make one quart of the same, as in liquid measure.

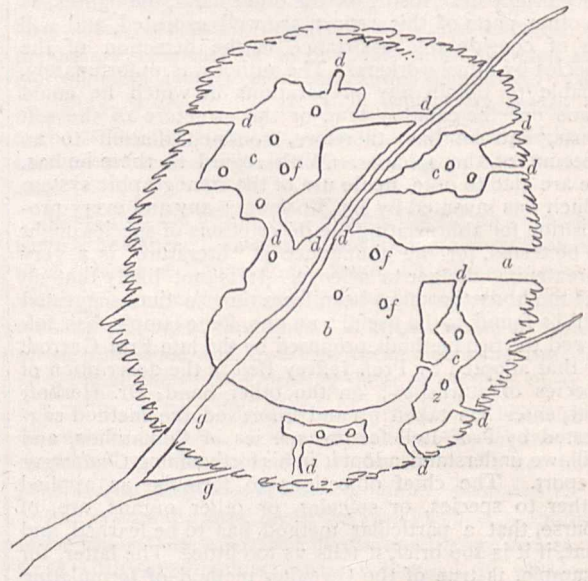
G. B. BUCKTON

Nesting of Micropternus Phæoceps

IN continuation of the communication from my friend, Mr. Wm. Davison, regarding the nesting of woodpeckers in ants' nests, published in NATURE (vol. xxxi. p. 438), perhaps the following notes of mine may be of interest:—

Camp Meplay, Thoung-yeen Valley, Tenasserim, April 20, 1882

This morning, in going from my camp to the Meplay Forest Reserve, I had to pass through several densely overgrown phonzohs.[1] While making my way along with some difficulty, I startled a brown woodpecker (*Micropternus phæoceps*) from a small pyingado tree (*Xylia dolabriformis*). Looking up into the branches I saw a large ants' nest, in the centre of which appeared a circular hole so exactly like the borings made by woodpeckers ordinarily in the trunks of trees, that I sent up a Karen boy who was with me to ascertain whether it was possible the Micropternus had been boring into the ants' nest, as, I had heard was the bird's curious habit. The ants' nest was only about ten feet above the ground, placed in a fork of the pyingado, two small branches of which passed clean through it. Climbing up, putting in his fingers and then a twig, my Karen follower announced that there were two eggs. Leaving the nest alone for the time being, in the evening I returned by the same route, and was able not only to cut off and carry into camp the whole nest as it was; but I managed to secure also the hen bird as she flew from the eggs. Arrived in camp, I got the two eggs out, and then very carefully made a cross-section through the



a, entrance tunnel made by woodpecker; *b*, retort-shaped nesting-chamber of woodpecker; *c*, excavations made by the ants; *d d d* ..... *d*, entrances to them; *f f f* ..... *f*, tunnels made by the ants; *g g*, fork of pyingado branch—one twig passing through the egg-chamber excavated by the woodpecker.

ants' nest so as to divide the boring made by the woodpecker longitudinally.

The accompanying is a rough diagrammatic sketch of the appearance of the cross-section of the nest as hollowed out by the woodpeckers. The ants' nest was a large, spherical, solid mass of leaves and clay, the leaves outside being arranged one over the other something like the tiles on the roof of a house, but riddled in many places with the entrance tunnels made by the ants—a small black and red species of *Myrmica*, the trivial or specific name of which I do not know. It is probably closely allied to the *Myrmica* mentioned by Sir J. Lubbock in his "Ants, Bees, Wasps" as having been described by Sykes in the *Trans. Ent. Soc.*, vol. i. Very few of the ants

[1] The wild hill-tribes of Burmah and Tenasserim have a wasteful system of cultivation called "toung-yah." Yearly, in February, the heads of families in a village choose, each head for himself, a spot of well-grown, often virgin forest, generally on a hill-side, and within as convenient a distance of the village as is obtainable, cut down all the trees big and small, and allow them to dry during the hot months of March, April, and May, and towards the latter end of the last month set fire to them. The ashes thus obtained from the timber forms a splendid manure for paddy, and *toung-yah* rice is preferred by the Karens to ordinary *quin* (field) rice. The "toung-yah," or clearing after the paddy has been gathered in, is abandoned, and in two or three months, under a hot sun and excessive moisture, becomes an inaccessible jungle, full of thorny bamboos, creepers, and elephant grass. Such deserted *toungyahs* are called *phonzohs*, and are not again cultivable for from ten to fifteen years.

remained in the nest, and the few that were about seemed agitated and stung virulently. Probably the mass of them had been driven off or eaten by the woodpeckers. The tunnel the latter had made was about two inches in diameter and four inches long, bored horizontally in, and ending in an irregular-shaped egg-chamber about ten and a half inches in cross diameter, but narrowed by the branch of pyingado which pierced the nest through and through, and crossed the egg-chamber diagonally. The bottom of this chamber alone was smooth, but there was no lining, and the two translucent white eggs of the woodpecker had rested on the bare boards, so to speak, of the ants' house. In the excavations *c c c* made by the ants themselves there were neither eggs, larvæ, nor pupæ; probably these all had been removed when the woodpeckers invaded the nest.

CHARLES BINGHAM,
Deputy Conservator of Forests, British Burmah

Henzada, British Burmah, April 12

Staminody of Petals

The cases of staminody of petals not being very frequent, it may be of interest to draw the attention of the readers of NATURE to such a modification as observed in Fuchsia.

The places of the four petals of the flower examined are occupied by four almost colourless filaments of an average length of three-fifths of an inch. Each of them bears on its top a nearly circular dark red lamina of three-tenths of an inch diameter. These laminæ are so strongly vaulted as to have the shape of a segment of a globe, the hollow side being turned outward, the convex inward. At the base of the lamina, *i.e.* at the top of the filament, a short protuberance is seen, resembling in external shape the lower part of an anther. This anther occupies the concave side of the lamina and is consequently turned outward. Though the anther of one of the petals is only slightly developed, yet it may be admitted as a matter of fact that, instead of petals, this flower has produced four stamens, whose anthers bear a petaloid appendage. A microscopic examination, namely, showed not only the peculiar composition of the anther-wall, but also the presence of pollen-grains.

Of the stamens, properly so called, the outer whorl is present, but the inner one is only represented by two of the four. One of these two is inserted in the ordinary way, viz. at the base of the petal. The second, however, has grown together half way up with the petal's filament; there it has, in consequence of a spiral turning, arrived at the back side of the petal, whence it bends obliquely outward. By this union the impression is created of a stamen rising from the back of the (modified) petal, concealing its anther in the lamina's concavity. This occurrence brings to recollection the case of *Monarda fistulosa* as cited by Maxwell T. Masters from Turpin ("Vegetable Teratology," p. 298), with this difference, however, that what is probably only adhesion is mistaken for petalody, whilst the case above described offers an antheroid petal grown together with a true stamen.

J. C. COSTERUS

Amsterdam, May 4

Catalogue of Fossil Mammalia in the British Museum, Part I.

IN the review of the above work in a late number of NATURE (vol. xxxi. p. 597) the reviewer entertains such a complete misapprehension of my system of naming the premolar teeth of typical heterodont Eutherian mammals that I must beg space to correct it.

The reviewer asserts that this system is untrue because it implies that in general with a smaller number than the full complement of four premolars the diminution must have commenced with the first, proceeded with the second, and so on. In reality it implies nothing of the kind, and if he had taken the trouble to turn to pp. 152 (No. 39,732) and 174 (No. 48,787) he would have seen instances where I have mentioned the absence of the middle teeth (*pm.*2 and *pm.*3) and the retention of the terminal teeth (*pm.*1 and *pm.*4). Similarly in the "Palæontologia Indica," ser. 10, vol. iii. p. 48, I have adopted the same system for the incisors, and have shown that in *Hippopotamus* it is *i.*2, and not *i.*3, that disappears in some species.

I am well aware that in many of the Insectivora and Chiroptera there is often great difficulty in deciding on the homology of the individual premolars when these are reduced in number; and the reviewer might have noticed that in the former order I have not ventured to definitely determine the position of any tooth in advance of the last premolar. Among the Chiroptera I have considered the three premolars of *Vespertilio* (p. 13) as homologous with the last three of the typical series, as there is apparently no evidence to the contary; the small size of *pm.* 3 indicates, however, that an allied genus may retain only *pm.* 2 and *pm.* 4; but the minute size of the one tooth in advance of *pm.* 4 in *Rhinolophus* has induced me to regard it as *pm.* 3, although it may be *pm.* 2.

The advantage of the system employed in the "Catalogue" is well instanced when we contrast the premolar dentition of *Canis*, and *Lepus* or *Theridomys;* the homology of the last tooth of this series (and there is only one in *Theridomys*) being at once seen, whereas it is entirely lost if we employ a method like that used in Dr. Dobson's "Catalogue of Chiroptera," where the actual first tooth in each genus is called the first of the series. I claim for the system adopted by myself every advantage in those cases where it is possible to determine the homology of the individual premolars in any form in which the number does not exceed four; and even in cases where such determination is not absolutely certain, the error can be but very slight, and does not lead to the utter confusion caused by the system (or, rather, the want of system) which I presume the reviewer would prefer.

When we come to those mammals in which the number of premolars is more than four, my system fails; and, in view of this, some German writers have adopted the plan of numbering the premolars the reverse way—*i.e.* terming the premolar next the first molar *pm.* 1, and then counting towards the incisors. Although this system would be advantageous if we could always be sure of the division between the premolars and molars in homœodont mammals; yet it has several disadvantages, and has not, therefore, been adopted.

In reference to the suggestion of your reviewer, that instead of making a catalogue of the fossil Mammalia in the collection of the British Museum (as I was instructed to do by the Museum Authorities), I should have made one of all the known species of fossil Mammalia, any person having the slightest pretence to any knowledge of the present state of mammalian palæontology would have at once known that it would be utterly useless to attempt any such work at the present time, when new species and genera are being made almost daily, and a host of those already made are as yet but empty names.

As a minor matter, I may mention in regard to the lower jaws of *Crossopus*, alluded to in the review, that their identification rests solely on the authority of Prof. Sir R. Owen, and that perhaps I have acted in a too conservative spirit in admitting them.

Harpenden Lodge, May 2 RICHARD LYDEKKER

Fossil Insects

"THE Earliest Winged Insects of America; a Re-examination of the Devonian Insects of New Brunswick in the Light of Criticisms and of New Studies of other Palæozoic Types," is the title of a *brochure* by Mr. S. H. Scudder, of Cambridge, Mass., recently published.

These Devonian insects are fragments of five wings; a sixth is now dropped, as "too imperfect for any satisfactory discussion," though in 1881 its description filled about two quarto pages. These insects have been, since 1865, so often discussed that their literature is a rather voluminous one. A number of far-reaching conclusions elaborated by the author would have to be abandoned if the determination of the insects should be proved incorrect. This I endeavoured to do in *Bull. Mus. Comp. Zool.*, viii. No. 14, Cambridge, 1881, and in NATURE, xxiii. p. 483. The principal aim of the author's new paper is to show that my determinations are erroneous. Concerning his statement that I have studied in nature only the (in most cases poorer) reverses, I may remark that his paper gives nothing more, after his study of the obverses; even less for Gerephemera.

These Devonian insects have been decidedly unfortunate from the very outset. Eminent palæontologists denied their Devonian origin, and put them to the Carboniferous or to the "Ursa Stufe" of the sub-Carboniferous. One of the insects, *Xenoneura antiquorum*, said to possess a stridulating organ on the wing, caused an unusual sensation. Poetic palæontologists were delighted to be introduced by this insect to the sounds of the Devonian woods. Now these woods are silent again, except in some text-books. "It does not appear reasonable," said the author, "to maintain

my former hypothesis of a stridulating organ." Everybody acquainted with such organs will be of his opinion.

Another insect, *Homothetus fossilis*, was said to have a small basal vein, considered to be homologous with the arculus of the Odonata, and therefore to form a connecting link between Neuroptera and Pseudoneuroptera. A new synthetic family, Homothetidæ, was proposed. But now a re-examination of this wing convinces the author "that he had been mistaken about this arculus." It does not exist at all.

The third insect, *Platephemera antiqua*, was determined by me as the apical half of the wing of a gigantic dragon-fly. As this is the only species claimed now by the author to belong to the Ephemeridæ, he defends vigorously his determination by four objections:—(1) "In no dragon-fly, living or fossil, is there found beyond the nodus between the mediana and margin, more than a simple longitudinal vein, the marginal vein." If the author will examine any Odonate wing *from below*, he will find such a vein, which is the prolongation of the subcosta, bent on the nodus to the marginal vein, and running close to it. Near the nodus it is more widely separated in larger species. (2) "The reconstruction of the wing, after the dimensions given by Dr. Hagen, would, on the most favourable showing, make a wing of ridiculously extravagant appearance." But such forms occur in living species of Tramea, Rhyothemis, &c." (3) "The narrowing of the second cubital space is a common feature in Ephemeridæ (six genera after the Rev. Mr. Eaton's plates are quoted); and, as this varies in different species of the same genus, it seems to be a very unimportant matter." I had purposely stated *suddenly narrowing*, and *this* does not exist at all in Ephemeridæ, namely *not in the six quoted* genera, and cannot therefore vary in the different species of the same genus. It exists in Odonata. (4) "The sector subnodalis does not run unbroken to the tip, as in all dragon-flies I have examined, but is lost in reticulation shortly before the margin." This last-quoted character is a very common feature in dragon-flies (Tramea, Rhyothemis, &c.). Only *very exceptionally* this sector runs unbroken to the tip in the large sub-family of Æschnidæ (*cf.* De Selys's "Revue des Odonates d'Europe," p. 122).

As all objections have been proved *to be incorrect*, and only based upon insufficient knowledge of the venation of Odonata and Ephemeridæ, Platephemera belongs by the simple evidence of facts to the Odonata. The new proposed family of Palephemeridæ dies unborn, and the conclusions made from Palephemera are without value.

The fourth species, Gerephemera, gives much trouble to the author, and he is now inclined to bring it into the same group with the Protophasmida. As only a part about 4 mm. broad can be said to exist in both figures (Brongniart and Scudder) which could be compared, and as this part contains only a few sectors running to the margin, the relationship of Protophasma to Gerephemera is not at all obvious. The reverse of Gerephemera contains more than the author has seen. The basal part of a hind wing to the sector trigonali inferior, the basal part of a front wing with the same sector, and some veins belonging, probably, to another (front?) wing. The part figured and described by the author belongs, probably, to the other hind wing. No student of Odonata will be in doubt that Gerephemera belongs to this family, perhaps near Isophlebia. His statement "that the superior origin of the branches of the sector medius is entirely inconsistent with an Odonate hypothesis, and is the most salient point in the wing," is directly recognised as an error by looking at the figures in De Selys's "Monograph Caloptérygines" (*cf.* Cleis, Vestalis, Neurobasis, &c.). This statement is only surpassed by the emphatic repetition "that the marginal would then be an elevated, and the mediastinal a depressed, vein, *which combination is never the case.*" This statement is just the contrary to what exists in all Odonata—unless it is preferred to examine the wings from beneath.

There exists still no monograph of the Sialidæ; therefore it is impossible to make conclusions and form new families for the other three Devonian species. The opinion on the Devonian insects given by Rev. A. E. Eaton (NATURE, vol. xxiii. p. 507) is still very just: "Palæontologists have adopted a ridiculous course with regard to some insect fossils. Whenever an obscure fragment of a well-reticulated insect-wing is found in a rock, a genus is straightway set up, and the fossil named as a new species. The species is then referred to the Ephemeridæ, and is immediately pronounced to be a synthetic type of insects at present distantly related to one another in organisation. This enunciation of synthetic types is often nothing less than a resort at random conjecture respecting the affinities of animals which the writer is at loss to classify. I thought that the Ephemeridæ had served quite long enough as an asylum for fossil cripples. I wished to intimate gently, that refuse of other groups of insects should be henceforth shot elsewhere."

Cambridge, Mass., March 12 H. A. HAGEN

High-Level Stations

IN NATURE, vol. xxxii. p. 17, I find the abstract of an address by Mr. Omond, on "Ben Nevis." There are many points of interest, but I regret that one was not mentioned—viz. the exceedingly rapid decrease of temperature with elevation from Fort William to the Ben, anything nearly approaching, in middle latitudes, being only found on the Brocken, and all high-level stations of the Alps showing a much smaller decrease. At the Brocken, as well as at the Ben, the great difference from the Alps is not in summer, but in the colder months of the year. The reason seems to lie in the nearly constant winds, which bring air from below, which is cooled by ascension. The cases of great dryness of the air with descending currents in anticyclones in the colder months of the year, when isolated mountains are often much warmer than the valleys,[1] are comparatively rare in the North of Scotland, but frequent in the Alps, and certainly must and do have a great influence on the mean temperature. Where they are frequent, as in the Alps—especially the eastern—the mean amount of decrease of temperature with elevation must be slower.

I think all meteorologists will concur with me that the greatest points of interest in the Ben Nevis station is the study of the meteorological phenomena near the centres of cyclones, as no high-level station in the world is so favourably situated as this for this study. A. WOEIKOF

St. Petersburg, May 1 (13)

Rainbow Phenomena

YOUR correspondent Mr. C. Croft (NATURE, No. 811, p. 30) has noticed phenomena which are perfectly familiar to students of physical optics. The internal bands of colour within the primary bow are the "supernumerary" bows due to diffraction. They were described by Langwith in the *Philosophical Transactions* for 1722: a partial theory of them was given by Young in 1804, and a complete theory by Sir G. Airy in 1836. The illumination of the sky in the regions within the primary and without the secondary bows, and also the relative darkness of the space between the two bows, Mr. Croft will find the desired explanation in any elementary treatise on optics; Osmund Airy's Geometrical Optics may be cited as giving a good account of these matters. The particular bow seen by Mr. Croft appears to have been of unusual brilliancy; did he notice any of the radial streaks, which I described in 1878 as frequently accompanying rainbows? SILVANUS P. THOMPSON

Finsbury Technical College, May 16

Aurora

LAST night at about 10.30 to 10.35 p.m. there was a well-marked aurora visible from here. It did not last long, the bright bands fading rapidly into a general glow towards the north. The wind, which was easterly yesterday, has gone round to north-west to-day with tendency to rain and low temperature.

J. P. O'REILLY

Royal College of Science for Ireland, Stephen's Green, Dublin, May 14

Red Hail

MR. W. H. MITCHEL, of Newry, has sent me the accompanying note, which he thinks may be of interest to the readers of NATURE. C. EVANS

Downshire Hill, Hampstead, N.W., May 18

On May 7, Mr. R. A. Mullan, solicitor, of Newry, was driving in a gig near Castlewellan, co. Down, when he was overtaken by a shower of hail. To his surprise he observed that some of the hail-stones—perhaps one in a hundred—were of a

[1] This is well explained in the "Handbuch der Climatologie" of T. Hann. See also my paper in the *Zeitschr. f. Meteorologie*, 1883, pp. 211, 241.

decided red colour, the rest being white, as usual. Taking up some that fell in the gig, Mr. Mullan found that the colour was not merely superficial, but pervaded the substance of the hail-stone, and, on melting, they stained the fingers. He did not think, or had not the means, of preserving any of the water resulting. Has the like been observed before?

Spectral Images

MR. BIDWELL'S notice of spectral images (NATURE, vol. xxxii. p. 30) calls to mind certain phenomena I witnessed while riding in a railway train in Kentucky last October. The fence of the railway consisted of posts of about 6 inches in diameter, and twenty paces apart, connected by wires. The posts had newly been painted green. I was seated on the right side of the carriage, face forwards; the speed fully twenty miles an hour, with the sun behind my right shoulder, when looking at the posts on the left side, brightly illuminated by the sun, I observed that each post had the appearance of a twin post immediately in advance of it—touching it—of a red colour. To make myself sure that I was not deceived by some abnormal affection, I called the attention of a niece of mine to the phenomenon, and she saw it quite as well as I did. Another niece, however, failed to make it out. I am under the belief that the red post was the complementary colour of the green one, appearing the instant after the latter had been seen, and though apparently in advance in space of the green post, really was seen later in time. The fact of both being apparently seen simultaneously, is accounted for by the well-known law of retinal images lingering on vision. HENRY MUIRHEAD

Cambuslang

THE NEW OUTBURST OF LAVA FROM VESUVIUS

YESTERDAY, May 2, up to two o'clock, Vesuvius appeared to be in its natural state of activity, such as persisted with slight variations for some considerable time. At that hour the lava, which was at some height within the cone of eruption, forced a way out at its base, traversing the plain of old lava filling the crater of 1872, and producing a rent about one quarter the way down the great Vesuvian cone. This rent represents the extension outwards of a volcanic dyke that has been in process of formation for over two years. A visitor during that period who walked around the southern rim of the 1872 crater, might have noticed a fissure varying from a few inches up to 2 feet wide, and extending inwards across the crater plain, until lost beneath the *ejectamenta* of the cone of eruption. From this fissure issued a powerful current of hot air, and in part of its course an abundance of HCl. This latter was indicated by the continual decomposition of the scoria and ash in its immediate neighbourhood, so that a large patch of yellow dust filled with the unattached pyroxene crystals was a point of bright colour in the black scoria-covered lava-plain. The lava at first actually issued, or, more properly, welled up from this fissure, but its point of exit was soon lowered by the cutting down of the outer slope. The lava soon commenced to flow down the cone with considerable rapidity, forming two distinct parallel streams averaging fifty metres apart, so that in the evening the landscape was lit up by these two brilliant streaks of fire. This morning I started early, and ascended on foot to the eastern side of the two streams, though often inconvenienced by the hot wind and exhalations blown off the lava. The streams take origin close together, and no doubt conjoin, but are covered by scoria—a vast quantity of *lapillo* and ash that has been slipped downwards and forward, forming a rough annular space which would require a drawing to explain. At the upper end of this we have part of the great cone slipped down, showing in section the dyke, which I may call hollow; we have a fissure which was filled by lava, and which consolidated and adhered to its sides, forming *salbam;* but before the central part solidified, the general level was lowered, and it drained away, leaving the dyke divided in two by an empty space. At 2 p.m. to-day the streams of lava had the following dimensions at their exit:—

	Eastern		Western
Breadth	about 1½ metres	...	About 2½ metres
Depth	estimated at 1 metre	...	at 2 metres

Rate of flow on both, about 1 metre per second.

The output therefore equals for the eastern stream about 90 cubic metres per hour, or 2160 cubic metres in 24 hours, whilst that of the western stream represents 300 cubic metres per hour, or 7200 in 24 hours. The two streams, therefore, represent an output of 9360 cubic metres during the 24 hours, from May 2 to 3, at 2 p.m. This quantity would equal a deposit of rock of about 1 km. long, 9 m. broad, and 1 m. thick, which is rather an under-estimation of what now lies on the side of the mountain, for the two streams had at the hour of observation traversed more than two-thirds of the *pedimenture*. The amount of lava represents far more than what occupied the chimney above the level of the lateral opening, and the mechanism of the increased quantity extruded I have gone into fully in a paper read last week before the Geological Society. The cone of eruption only now gives forth vapour, its stone-throwing propensities being stopped by the lowering of the magma level. In consequence of the want of support of its inner walls by disappearance of the fluid column, these are rapidly crumbling in, and the craterial inner cavity much increased in size. In the same way a breach has been made in the line of the dyke by falling in of that part of loose materials immediately above it.

This change in Vesuvius will no doubt be put down in history as an eruption, and possibly a relationship sought between contemporaneous earthquakes, or some other phenomena. It is nothing more nor less than the final giving way of part of the cone before a dyke that has been working its way out for years.

I send you these few notes after a long day's climb, exposed to great changes of temperature and mephitic vapours. I ask, therefore, that this will be taken as an excuse for these rough and ready notes, which I thought your readers would be interested to have quickly.

Naples, May 3 H. J. JOHNSTON-LAVIS

EXPERIMENTS WITH COAL-DUST AT NEUNKIRCHEN, IN GERMANY

IN a former article on this subject which appeared in NATURE of Nov. 6 last (p. 12), I described the apparatus employed by the Prussian Firedamp Commission in making their experiments, and at the same time I gave an account of four experiments that were seen by Mr. Wm. Thomas Lewis and myself.

No official account of these experiments had been published at that time, but quite recently Herr Hilt and Herr Margraf have made a joint report in the name of the Commission. As this report is intended to be only a preliminary one, it does not give the whole of the details of each experiment, but it shows as far as it goes that everything has been conceived and carried out in a spirit of liberality and thoroughness.

At the outset Herr Hilt states that the uncertainty which seemed to surround this important question, and in particular the peculiar views that had been enunciated by MM. Mallard and Le Chatelier, who reported upon it to the French Commission du Grisou,[1] had induced him to address a letter on the subject, dated December 15, 1883, to the Prussian Wetter-Commission, urging them as a matter of duty to take it up and investigate it by a series of large-scale experiments. The French Commissioners, referred to, stated at the end of their report that "they considered it established that coal-dust in the absence of fire-damp does not constitute an element of

[1] *Annales des Mines*, Janvier—Février, 1882.

danger." "It may, however, play an important part in aggravating the consequences of a firedamp explosion." I had myself keenly felt how difficult it would be after a verdict of this kind, emanating from such high authorities, to make further progress in the work of convincing practical mining men of the truth of the views I had previously advocated in the pages of the Royal Society's *Proceedings*. For that reason, and in the absence of some powerful weapon wherewith to meet the French Commissioners with some chance of success, I have hitherto desisted from doing battle with them, although I have been satisfied they were in error from the first. The required weapon has been provided by Herr Hilt, the spokesman of the Prussian Commission, and may now, I think, be made use of without much fear of future contradiction.

Speaking of coal-dust from Pluto Mine, in Westphalia, Herr Hilt says, as the outcome of a long series of practical experiments on the largest scale yet attempted: "Es kann keinem Zweifel unterliegen dass mann mit dieser Staubsorte bei Verlängerung der Strecke und Streuung auch der Flamme eine beliebige Länge würdegebenkönnen. Ganz ähnlich erhält sich der Staub von Neu Iserlohn." Or: "There can be no doubt that with this kind of dust the flame could be lengthened out to any desired extent, provided the gallery and the layer of dust on its floor were made equally long." "The dust of Neu Iserlohn behaves in exactly the same way."[1]

After carefully examining the details of this report, I think it not improbable that many, if not most, of the other twenty-four kinds of coal-dust that were subjected to experiment would have given results similar to those which led to the foregoing remarks had they been employed in the same state of minute subdivision. Differences in chemical composition do not appear to have as much effect in controlling the length of flame produced by a given dust under a certain set of conditions as the comparative fineness of the particles of which it is composed. In order to show the effect of fineness Herr Margraf has divided the dusts into five classes, as follows:—

Number of Dusts in each Class.	Designation of Class.	Length of Flame produced by firing 230 grm. of powder in cannon next floor, the floor being strewn with coal-dust for a length of 10 m.
Five, beginning with Pluto	Very fine	... 21 to 31 m.
Twelve, ending with Camphausen	Fine	... 13 to 21 m.
Four	Medium	... 12 to 15 m.
Five	Coarse ..	... 6 to 12 m.

Some experiments were also made with dust passed through sieves having meshes of various widths, which showed that the finer the state of subdivision, the longer was the corresponding flame.

From this it is obvious that before anything definite can be ascertained regarding the influence of chemical composition, it will be necessary to reduce the dusts to a uniform standard of fineness. Herr Margraf proposes to do this by passing them through a sieve with meshes 1 mm. wide. I am afraid, however, that some more exact method of effecting a separation of the very fine from the moderately fine particles will have to be resorted to before a satisfactory result can be looked for. A current of air ascending slowly at a uniform rate would be a better means than any conceivable kind of sieve.

I have on several previous occasions pointed out that when a colliery explosion has been begun in a dry mine the coarser particles of coal-dust are winnowed from the finer ones by the blast of air which sweeps through the workings in advance of the flame. It seems to me that under these circumstances experiments made with any other than the finest particles of each kind of dust can serve no practicable purpose whatever, and that any general conclusions drawn from them must necessarily be misleading. It is further highly probable that this is the rock upon which the French Commission was shipwrecked.

They had ascertained by actual experiment that, as the coarser particles of any given dust were removed by sifting, the flame produced under the same set of conditions became longer and larger in proportion to the fineness of the remaining dust. Yet they failed to carry the argument to its legitimate conclusion. They appear to have been misled either by too much speculation, or by the negative results of their experiments, due, it may be, to the smallness of the scale upon which they were made. They finally pronounced coal-dust to be an element of very secondary importance in colliery explosions, thereby allowing a splendid opportunity to slip from their grasp. The Prussian Commissioners were not slow to take advantage of the opening thus afforded them. Thanks partly to the large scale upon which they have set to work, partly to the natural fineness of Pluto and Neu Iserlohn dust, they have been fortunate in obtaining a series of positive results which amply confirm those previously obtained with the somewhat smaller apparatus belonging to the Lords of Committee of Council on Education set up in this country under the auspices of the Royal Society (No. IV. paper, "On the Influence of Coal-dust in Colliery Explosions," *Proc. Roy. Soc.*, 1881).

The dust brought from Camphausen Colliery does not appear to stand very high on Herr Margraf's list, and yet, since the publication of the memoir, that colliery has been devastated by one of the most violent explosions on record, in which it is admitted, I believe, that coal-dust, and not fire-damp, was the principal agent of destruction. Are we to conclude from this that the nine dusts which lie between Pluto and Camphausen in the order of relative danger are equally liable to produce a flame of indefinite length under like favourable conditions? and, if so, is it not obvious that the experiments are not as reliable as might be wished, since they fail to tell us so?

Before concluding, I might mention that Herr Hilt refers to and agrees with a remark made by MM. Mallard and Le Chatelier to the effect that the method of experiment followed by Sir Frederick Abel and myself when using the apparatus described in my first paper was "too little exact" to determine accurately what percentage of gas is required to render a mixture of coal-dust and air inflammable. My earliest experiments here referred to were made with the view of finding, if possible, some rational explanation of great colliery explosions which up to that time appear to have baffled every attempt to grapple with them, and were not intended to form a kind of counterpart on the large scale of the exact eudiometric processes resorted to in the laboratory. At the same time I may state, however, that, so far as I have been able to ascertain by reading and observation, the methods then employed will compare not unfavourably, as regards exactness, with any that have succeeded them, not excluding those of the Prussian Wetter-Commission.

W. GALLOWAY

[1] It may be instructive to compare this conclusion with the second sentence of No. 1 paper, "On the Influence of Coal-dust in Colliery Explosions," *Proc. Roy. Soc.*, 1876; the second last sentence of No. 2 paper, *ibid.*, 1879; the conclusion of No. 3 paper, *ibid.*, 1881.—(Abstract).

THE FAUNA OF RUSSIAN CENTRAL ASIA

UNTIL within the last thirty years Turkistan has been unknown to science, and what is now ascertained concerning its fauna and flora is for the most part inaccessible to the scientific world because written in Russian. Not that autoptic writers of eminence upon the zoology of the country are numerous. They do not number a dozen, the names most conspicuous being Prjevalsky, Alpheraky, Bogdanoff, Severtsoff, and especially Fedchenko. Prjevalsky's routes do not touch mine, except in the Kuldja

region, where also Alpheraky travelled, and collected Lepidoptera, with a list of which he has favoured me. To Bogdanoff and Severtsoff I am indebted for information not previously published in English, whilst in connection with the immense work that bears Fedchenko's name I have had the valuable help of Madame Olga Fedchenko, who both accompanied her husband on his scientific journeys and, after his lamented death, edited his works. When I add that I have before me proofs of between three and four thousand species of fauna and flora, in about twenty lists with introductions, the scientific reader will not need to be told that in the compass of a single article I can but touch the fringe of the subject. I have ventured to think, however, the readers of NATURE might be interested in a plain statement that would give some idea of the little-known fauna of Turkistan, as well as indicate what I hope to publish shortly in fuller form.

The part of Russian Central Asia through which I recently travelled, and with which this paper will be mainly concerned, lies between the Oxus and Irtish Rivers, and between the 38th and 50th parallels of north latitude, which region comprises vertically all altitudes from the salt plains, 600 feet above the sea, to the mountain plateaus of the Pamir, 15,000 feet high.

The species of mammals in Turkistan exceed 80 in number. Among them may be mentioned 7 species of bats, the long-eared hedgehog, and the white-clawed bear. To these must be added the badger, otter, and other *Mustelidæ*, including three species of marten. Of the last I was able to secure some skins and skeletons, which are now in the British Museum. The wolf abounds; also a wild dog; 3 species of fox; the tiger, snow-leopard, cheetah, and other cats. The salt-plains are frequented by the souslik, and many other rodents, including the hairy-nosed porcupine. To these should be added the Persian gazelle, the Saiga antilope, the Siberian ibex, and the Maral stag. I saw at Kuldja and Tashkend specimens of the skull and horns of the Thian Shan sheep, which is bigger than a donkey. The horn is more than four times the length of the skull, and the head complete weighs upwards of 70 lbs. The yak is kept by the Kara-Kirghese. The Russians, too, as an experiment, have introduced some cross-breeds into the plains.

The birds of Turkistan number nearly 400 species, to which may be added 27 frequenting the Pamir. The diurnal birds of prey, such as vultures, eagles, hawks, &c., number 36 species, some of which the Kirghese train for hunting. Of nocturnal birds of prey there are 9 species of owls. There are thirteen species of crows, and no less than 40 of the finch family, including a new species of sparrow. The thrush family is represented by the blackbird, black-throated, misletoe, and some other thrushes. There are more than 40 of the warbler family, many of them being known in Western Europe, such as the greater nightingale, the bluethroat, redstart, redbreast, and others. Six species of the titmouse family are found in Turkistan, only one of which, however, the well-known oxeye, is common also to England. Two species of dipper are found throughout the country, and other small birds are the Nepalese and European wrens, the Syrian nuthatch, and no less than 10 forms of wag-tails. Of pipits there are 7 species, and 14 of larks. The hoopoe I saw when coming south from Sergiopol, and again in the streets of Vierny. Other Turkistan birds are the bee-eaters, the three-toed woodpecker, the ubiquitous cuckoo, and the wonderful Pallas's sand-grouse, which last, some twenty years ago, invaded Europe in such an astonishing way.

Among gallinaceous or game birds are found in Turkistan the black grouse, the capercailie, four species of partridge, the quail, Mongolian pheasant, pea-fowl, and common cock. Of the swan, goose, and duck tribes there are nearly 30 species. Wading-birds, again, are found in great variety, and among them a red-billed curlew, thought at first to be a new species. It has red legs, and a remarkably long red beak, bent at the end, and well adapted for picking up worms from between the pebbles of the beds of the mountain streams it frequents.

Reptiles are represented in Turkistan by 33 species of lizards, vipers, and tortoises. Of the last I tried to bring for the Zoological Gardens a species (*Homopus horsfieldi*), and it travelled asleep with me some hundreds of miles from Tashkend, but on approaching Odessa it was found to be the sleep of death. Almost all the serpents are non-venomous. Of amphibians there are five species, including the edible frog and green toad.

The fishes of Turkistan are composed half of European and half of Asiatic forms. The European forms belong principally to the lower course of the Syr-daria, Amu-daria, and part of the Zarafshan, whilst certain genera belong exclusively, so far as is known, to the high mountainous countries of Central Asia. The total number of Turkistan species probably exceeds fifty. Of these twenty-five at least belong to the carp family, and there are taken besides sturgeon, trout, pike, barbels, gudgeon, rudd, roach, bleak, bream, loaches, and perch. The fishes of the Zarafshan are particularly noticeable. Of fifteen species found therein not less than five belong to genera met with in numbers in Kabul, Kashmir, Nepal, and the Himalayas. To one of these genera belongs the *Marinka*, remarkable for its poisonous eggs. The greatest find, however, among the ichthyological fauna of Turkistan has been the *Scaphirhynchus*, of great importance, not only from a zoological, but also a biological point of view, on account of the extreme smallness of its eyes and the rudimentary condition of its air bladder. This fish, and certain geological questions connected therewith, was referred to in NATURE in connection with a letter on the Oxus that appeared in the *Times* on January 7 last.

If for Mollusca we enlarge our area to take in Kashgar and Ladak, then we have in "Central Asia" thus formed 93 species known up to the present time, the land snails being scarce in the desert plains as compared with the larger number and more peculiar forms in the mountain regions. Among the fresh-water Mollusca the predominant feature is the large number of air-breathing species which live in stagnant water, and the almost total absence of the genera living in running water. It has been suggested that this scarcity may be due, as in Switzerland, to the low temperature and stony bed of the rivers.

Among the 50 species of Crustacea known in Turkistan there was not discovered for a long time a crayfish; but Madame Fedchenko informs me that one of a variety new to the species hitherto known in Russia has been recently found. Among the Crustacea inhabiting the fresh waters of Russian Central Asia a very large number of West European species is found, and the new species are, in the majority of instances, very similar to the commonest in Central and Southern Europe.

Of the 16 families to which European spiders are said to belong, all, except two groups very limited in number, have their representatives in Turkistan. The 146 species known there belong to 55 genera, which constitute approximately one-half of the total of European genera. The *Tarantulæ* are remarkable in that there are found in the Zarafshan Valley forms which in Europe are met with in countries far apart from each other, and have been reckoned as different species. The most widely distributed form is that with the lower part of the abdomen quite black; next comes the form with coloured edges; and, finally, that with the lower part almost entirely orange. The scorpions of Turkistan are identical with those met with in Trans-Caucasia, and the distribution of one species (*Solpuga intrepida*) is remarkable. First found in Spain, it was seen later on the Indersk Mountains, then in the Zarafshan Valley, besides which specimens of this harvestman have been found in Vierny.

The animal is reckoned poisonous, and its bite has in certain cases been followed by death, although nothing is yet known of its poison-apparatus.

The species of Turkistan beetles are estimated at 1000. I have before me a list of 500, some of them as yet unpublished. Amongst the most remarkable is the *Copris tumulus*, the largest specimen measuring one inch and three-quarters long.

The hymenopterous fauna of Turkistan is not yet fully worked out, but I may observe that of *Mellifera* there are known 438 species, and of *Sphegidæ* upwards of 150. As regards the latter, the valleys of Ferghana and the Zarafshan do not present many specialities. On the other hand, the Kizil Kum desert abounds in new species and even genera, sharply distinguished from known species both in the form of the body and in the beauty and size of the individuals. There is, moreover, a remarkable similarity between the species belonging to the Kizil Kum and the Egyptian sands. Of *Scoliidæ* 30 species are known, whilst of *Mutillidæ* 18 species have been treated by Gen. Radoszkovsky, who informs me that Gen. Komaroff, now military governor of the Trans-Caspian district, has quite recently made scientific explorations between Askhabad and Merv, and that among the insects collected by him about Askhabad are six speces of *Mutillidæ*, four of which are marked as new, and one as a new genus. Of 36 species of ants collected in Turkistan, 7 only were new. The Formicidæ of the region seem to be very similar to those of South Europe. This is not astonishing, since the mean temperature of a Turkistan summer differs little from the mean summer heat in Southern Europe, and this case only proves once more that, in general, countries with summers alike have greater similarity with regard to fauna and flora than countries lying under identical isotherms with different summers. This peculiarity is evident with regard to Formicidæ, because, for example, in Italy and Turkistan they have an identical summer; and though the winter in Turkistan is long and cold, it does not appear to have much influence over the ants, which are protected therefrom. European species which live in trees and woods appear to be in most cases absent from Turkistan. Of the new Turkistan species one *Ischnomyrmex rhaphidiiceps*) is specially interesting, as closely allied to two species inhabiting countries between the tropical and subtropical zones of the southern hemisphere. It is remarkable, therefore, to meet with a species of the same genus in the temperate zone of the northern hemisphere, and it may be presumed that these last have existed in Turkistan since the Tertiary period. I have yet to mention *Chrysidiformes*, of which 53 species have been found in Turkistan, and among them 2 new genera and 15 new species.

Before passing from hymenopterous insects I may mention that, though saw-flies are not numerous in the Zarafshan Valley, yet there is one form particularly remarkable, for, with a normal male, related to the group *Selandridæ* is a female without traces of wings. Affected by this absence of wings, the thorax undergoes important changes, and appears greatly swollen, and all the females generally have the appearance of little bags. Its relation to this family is said to be astounding, since it is the only example of the wingless form in the whole family of saw-flies. All the other specialities of structure, however, as well as the wings of the male, confirm it.

One of the first lists made of the butterflies and moths of Turkistan enumerated 367 species, of which 122 species were of *Microlepidoptera*. The great majority (284) were caught in the oases and hilly districts between 750 and 4500 feet above the sea; 41 species also were taken on mountains up to 8000 feet high, and 28 species from 8000 to 13,000 feet. Mr. Alpheraky, of Taganrog, has furnished me with a list in manuscript of 377 species of Lepidoptera collected by him in 1879 in the district of Kuldja and the surrounding mountains; but even these two lists together, I am told, give only an incomplete enumeration of the Lepidoptera of Turkistan, which contains a large number of new forms.

As we travelled from Tashkend to Khojend dragon-flies were so numerous that we caught several specimens by extending a butterfly-net from our carriage. The neuropterological fauna, however, of Turkistan is only partially known. Mr. MacLachlan has treated upwards of 60 species, most of them European in character, and many of them belonging even to Western Europe, whilst there is also an unimportant mixture of the Indian element.

There is a mingling again of the Indian element in the orthopterous fauna of Turkistan, but the Indian species are much fewer than the European. This fauna is particularly like that of South Russia, and it contains a large number of West European species. The non-European species are from South Asia, among which are a few from more distant countries, particularly from Africa. The total number of species known in Turkistan exceeds 70. Among them should be mentioned two locusts, and a third called locally *Prus*. Ravages of the former have been complained of in the neighbourhood of Perovsk and of the "*Prus*" in the Zarafshan Valley.

Of *Hemiptera* I have no list of species, but I saw a fine collection at Tashkend, made by Mr. Oshanin.

I come, lastly, to *Cestodes*, or intestinal worms. Of 47 species known in Turkistan, 2 are found in man, 3 each in the dog and sheep, 2 each in the cat and goat, and 1 each in the horse, ox, and marmot; 30 are found in birds, 2 in reptiles, and 1 in fishes. Of all the Vermes the most interesting is what the Bokhariots call the *Rishta* (*Filaria medinensis*). The parasite is found at Bokhara and certain adjacent towns in the water of stagnant pools, which the natives drink, and suffer in consequence from the *rishta* disease. The worm develops under the skin, lengthening at the rate of about an inch in a week, until an abscess is formed, through which the head (as is said) of the parasite appears. The problem, then, is to extract the animal entire. Native specialists insert a needle, and one end is drawn out by the fingers of the right hand, whilst those of the left press the adjacent part. Russian medical men wind off the animal on a reel, so much as comes out daily without force, till the whole, commonly three feet in length, is extracted. If, however, the worm should break, thousands of fresh germs are liberated from the broken part, and the illness continues for several months. I met with an unsuccessful case at Samarkand, and was given by the doctor some pieces of the *rishta*, which I brought in spirits to London.

The appearance of the worm is of a milk-white colour, resembling cooked vermicelli, and it can be stretched like a piece of elastic. The investigations of Prof. Fedchenko brought to light some very interesting facts concerning the *rishta*, the first of which was that the germs of the parasite cannot live in very fresh water, which is in keeping with the fact that the parasite appears only in those places where the people are forced to use standing water. The *rishta* is the last of the Turkistan fauna that I can mention here, but I hope within a few weeks to publish fuller particulars, through Messrs. Sampson Low and Co., in a new work entitled "Russian Central Asia, including Kuldja, Bokhara, Khiva, and Merv, with Appendices on the Fauna, Flora, and Bibliography of Russian Turkistan."

HENRY LANSDELL

FIELD EXPERIMENTS AT ROTHAMSTED[1]

THE above Report, forwarded to us, bears the name of no publisher, and is not priced. It therefore may be taken as a private issue, copies of which can only be

[1] "Memoranda of the Field Experiments conducted on the Farm and in the Laboratory of Sir John Bennett Lawes, Bart., at Rothamsted, Herts., June, 1884."

had by application to Sir John Lawes at Rothamsted Park, St. Albans.

The task of reviewing matter of so condensed a character as this is by no means easy. Ever since 1840, Sir John Lawes has carried out field and stall experiments on a scale well worthy of a national enterprise. Elaborate papers by this most enterprising of experimentalists, and his equally well-known coadjutor, Dr. T. H. Gilbert, have poured forth from Rothamsted during the entire memory of the present generation. During the last twenty-five years the scientific staff presided over by Dr. Gilbert has consisted of two, and sometimes three, chemists, and as many competent assistants, a botanical assistant, two to four computors and record-keepers, besides laboratory men. From 1847 to 1884 ninety-six memoirs have been contributed upon subjects bearing upon the soil, the plant, the atmosphere, drainage water, and rainfall, utilisation of sewage, animal nutrition, feeding-materials, manures, the occurrence of fairy rings in pastures, &c., &c. There is, in fact, scarcely a topic of agricultural or pastoral life which has not been investigated at this great English Agricultural station, and that through the enterprise of one man.

The Memoranda commence with a summary of rainfall and drainage extending backwards to 1851. Not only is the local rainfall given for each month over a period of nineteen years, but also the amount percolated through gauges of 20, 40, and 60 inches in depth of soil, the amount evaporated, and the amount retained by capillary attraction in the soil. Thus, as a general summary of the total rainfall, we find 45·3 per cent. percolated through 20 inches depth of soil, 47·4 per cent. through 40 inches of soil, 41·9 per cent. through 60 inches of soil, as indicated by rain- or drain-gauge, while the remainder is accounted for by evaporation or retention in the interstices of the soil. The averages obtained by unremitting observation from 1851 to 1870 are used in comparison with subsequent years, as in the case of the last completed record from September, 1882, to August, 1883. The three last columns of the tables given are devoted to the nitrogen removed in solution by percolation of drainage-water calculated in pounds per acre, by which we see that, at the depths above-mentioned, from 36 to 44 lbs. of nitrogen per acre are annually carried down from the upper layers of the soil to a depth of 5 feet and more.

One of the most attractive series of experiments, extending now over a period of thirty years, is that carried out upon permanent grass-land in the Park at Rothamsted. Space forbids more than a most cursory sketch of these experiments. Like all the Rothamsted investigations, the first aim is practical and comparative. The questions asked are as follows:—What is the effect of various applications to grass land? Which gives the largest return? What is the effect upon the herbage of continuous and of varied treatment? What is the effect upon the soil of long-continued privation and of long-continued *feeding* with simple and combined dressings? The investigation is at once chemical, physical, and botanical, and the change wrought in the character of the herbage of various contiguous plots of natural pasture, as well as upon the soil to a great depth, is most remarkable.

Perhaps the chief interest in the experiments upon crop cultivation will still centre around wheat. Broadbalk field, on the Rothamsted estate, is unique, so far as treatment and cropping goes. In 1839 this field carried a crop of turnips, manured with farm-yard dung; in 1840 it was barley; in 1841, peas; in 1842, wheat; in 1843, oats; all the four last crops being unmanured. The field was, therefore, according to all farming rules, in an exhausted state when the first experimental crop of wheat occupied it in 1844. Every year since 1843 has this field carried wheat, and, with some exceptions, nearly the same description of manure has been applied to each plot. In this field the visitor, during the present summer, will see the forty-second wheat-crop growing without manure of any description upon the unmanured portion of the field, still keeping up a wonderfully uniform yield of about thirteen bushels per acre—or about the average yield of wheat-lands in the United States of America. This is a striking fact for those who fear the eventual exhaustion of our soils. Equally startling is the result from the continued use of nitrate of soda year after year. This fertiliser is looked upon by many landlords and agents with suspicion as a stimulator and exhauster of the soil; and yet after forty-one years application of nitrate of soda, and nothing else, we have the astounding result of an average of 23½ bushels per acre, or double the yield of the unmanured plot. And, although it is true that the yield of the unmanured and nitrate of soda plots is less upon an average from 1868 to 1883 than it was from 1852 to 1867, yet it is equally true of the plot manured with 14 tons of farmyard manure annually; and this falling off is therefore probably due to a succession of bad seasons, more than to any actual exhaustion of the soil. Another striking fact brought out in these experiments is the excellent results achieved by applications of artificial fertilisers as contrasted with those obtained from farm-yard manure. In the latter case, where 14 tons of dung have been annually applied to the wheat-plot for forty years in succession, the very satisfactory yield of 33½ bushels per acre has been obtained over the entire period. When, however, a well-compounded mixture of artificial fertilisers has been applied, a larger yield has been obtained. For example, 200 lbs. of sulphate of potash, 100 lbs. of sulphate of soda, 100 lbs. of sulphate of magnesia, 3½ cwts. of superphosphate, and 600 lbs. of ammonia salts, have given upon an average over the same long period 36 bushels per acre year by year. We must not draw these remarks to a conclusion without at least noting the interesting experiments upon barley, the leguminous crops, clover sickness, root crops, and potatoes. The memoranda close with a synopsis of a series of experiments upon rotations of crops commenced in 1848 in order to test the effect of growing crops in rotation, instead of continuously, and so to arrive at precise results when a system of mixed farming is pursued with and without manures, and in conjunction with sheep farming.

JOHN WRIGHTSON

RECENT EXPLORATIONS OF THE PAMIR

THE third fasciculus of the *Izvestia* of the Russian Geographical Society contains three very interesting papers, by D. L. Ivanoff, on the Pamir, being the results of the expedition of MM. Ivanoff, Putyata, and Bendersky, already mentioned in NATURE. The first of these papers deals with the journeys of the members of the expedition; the second contains the author's views on the orography of the Pamir; and the third gives a description of the flora, fauna, and inhabitants of this "Roof of the World." Leaving aside the purely geographical part (M. Ivanoff's papers should be translated into English), I shall sum up the most important orographical results arrived at by the author, as also his observations on the natural history of the Pamir.

As to its limits, so variously determined by geographers, M. Ivanoff places them—rightly in my opinion—as follows:—The Alay Mountains in the north, the Hindukush in the south, and the Kashgar Mountains in the east. As to its western limits, the following remarks ought to be made:—The whole of the highlands on the upper Amu-daria must be divided into two parts—the Eastern Pamir and the Western. The Eastern Pamir is a very high plateau, intersected by numerous valleys, rivers, and lakes, with an average height above the sea-level of 12,000 feet (from 10,000 to 14,000). These valleys are either separated by chains of mountains

or by low swellings which mostly reach only from 1100 to 1500 feet above the level of the surrounding valleys, and very seldom 3000 feet. The slope of these swellings above the valleys is so gentle that water-sheds only 1100 to 1500 feet high are often twenty to fifty miles distant from their foot. These high valleys strictly correspond to what the inhabitants call "Pamir." "Pamir" signifies, in fact, "a flat roof," and when the inhabitants want to describe it in more detail, they add: "broad valleys between low mountains, so high, however, that nothing but grass may grow on them; where there is nothing," they say, "and the earth is like the palm of the hand, that is the Pamir." So they describe what a geographer would call a High Plateau. This plateau has, on the whole, the shape of a great horse-shoe, in the middle of which are situated the mountains of the Murghab and Alichur. This does not imply, however, that there are absolutely no mountain-ridges on the plateau; no *angehaufte Gebirge*, as Karl Ritter would say. The Pamir chain of mountains which runs east-north-east between the Pamir and the Alichur rivers in the south belongs to this category. It rises above the Great Lake as a stone wall 3500 to 5000 feet high; but it has its foot in the 10,000-feet-high valleys which surround the lake, and belongs to the category of the *angehaufte Gebirge*. Several other lower chains, such as the Alay, Trans-Alay, Riang-kul, Murghab, Alichur, and Vakhan, run in the same direction over the surface of the great plateau, and have the same character.

As to the Western Pamir, which might be described as the mountainous Pamir, it has quite another character. The whole of the plateau sinks towards the west, but, at the same time, numerous chains of mountains make their appearance. We have there, according to Ritter's classification, an Alpine country. The rivers, which flow lazily in the east, become rapid, their valleys narrow; crags, rocks, and hills confine them; the routes become difficult, and the mountain-passes very rare. The rich prairies of the east disappear also, giving place to forests, and, lower down, to agriculture, which rises as high as 8000 feet in the north and 10,000 feet in the south. Even the inhabited valleys are mere mountain-gorges. It is obvious that, under such conditions, the real western limits of the Pamir cannot be determined with exactitude; and we consider M. Ivanoff very near the truth when he says that the Western Pamir merges into the Alpine highlands of the Darwaz, Shugnan, and Badakshan. The limits are thus far more undefined in the west than in the north and east. The author considers, thus, that the Shugnan and Darwaz ought not to be included in the Pamir proper; they might be considered rather as a highland which has risen at the intersection of the eastern with the north-western ones of the Hindu-kush (as border ridges?). The Pamir would thus appear as a mighty plateau about 170 miles long, 200 miles wide in the meridional direction, and covering nearly 34,000 square miles.

As to the much-spoken-of meridional upheaval of the Bolor, M. Ivanoff points out that there are absolutely no traces of upheavals having a direction either from north to south, or even towards north-north-west or north-north-east. On the contrary, all his observations on the stratification of rocks—and they are numerous—show that the stratification follows the direction either of east-north-east (that of the whole Central Asian plateaux), or north-west, that is, that of the Hindu-kush. The same is true with regard to longitudinal valleys, which always follow a direction towards north-north-east. As to the Kashgar Mountains, still unexplored, they seem to represent a repetition of shorter chains running towards north-west, and arranged in *échelon*.

If this opinion of M. Ivanoff is confirmed—and it most probably will be, as it pretty well corresponds with the broad lines of the structure of the Central Asian plateaux, as also with what is already known as to their structure—we shall have definitely to renounce seeking for meridional chains in this part of Asia. We have already been brought to renounce them in North-Eastern Asia, where I believe I have proved that neither the Great Khingan nor the Kuznetzki Alatau, nor even the Sikhota-alin, have this direction. On the contrary, we will perceive that the Pamir is only the highest terrace of a series of plateaux extending throughout the central parts of Asia in a north-eastern direction from the source of the Amu to Behring Strait.

But let us return to M. Ivanoff's papers, and to his observations on the flora and fauna of the Pamir. The high valley of the Alay already belongs to the Roof of the World. It is covered with rich prairies, the chief elements of which are Gramineæ. Nearer to water you find a thick growth of *Carex physodes*, which has given its name, *Riang*, to so many parts of the Pamir highlands. Numerous species of Papilionaceæ, many of them relations of the flowers of our European meadows, give a pleasant aspect to the steppes of the Alay in June. The same character—a mixture of the vegetation of the steppes with that of cold climates and highlands—is found also on the Eastern Pamir as you advance further south. But it is sufficient to descend into the valleys of the west to find immediately a far richer flora and, very soon, corn-fields.

The animals inhabiting the Pamir are also a mixture of those of the steppes with those of Alpine regions. The tame yak (*Bos indicus*) is met with the well-known "arkhars." Although their horns are scattered in great numbers on the Pamir, they are far from disappearing, and M. Ivanoff has seen numerous herds of from 100 to 150, and considers that they ought to be counted by thousands in the neighbourhood of the Great Lake. In the mountains the "kiiks" (*Capra*, probably *sibirica*) are numerous, but very difficult to approach; the brown bear is common, and M. Ivanoff's men killed four of them. The wolf of the steppes unavoidably accompanies the herds of arkhars. The yellow marmots (*Arvicola caudatus*) are very numerous; the steppes of the Pamir are their true dwelling-places, and the expedition has met also with great numbers of small Siberian hare, which is common on the Issyk-kul. The Indian goose, the *Syrrhaptes* of the high steppes, the *Megaloperdix tibetana* in the rocky hills, and the *Perdix chukar*—this last met with only once at a height of 14,000 feet—are especially worthy of notice.

As to the climate of Pamir, it is, of course, very severe. The winter reigns in full for seven months. As to frosts, there is hardly one single month without them, and even on July and August nights the expedition experienced frosts of 6° below zero. There are places on the Pamir where snow rarely reaches a great depth, but, its distribution depending mostly upon the prevailing winds, there are places where it falls in thick layers. As to the rivers, even the Murghab freezes for some time.

The true inhabitants of the Pamir are the Kirghizes, namely, the Kara Kirghizes, who belong to four different stems—Teit, Gadyrsha, Nayman, and Kiptchak. The chief settlements are situated in the valleys of the Northern and Southern Ghezia, about the Riang-kul, on the Ak-baital, the Ak-su, the Alichur, and in the basin of the Kokui-bela. They are found also on the Upper Tagarma. These Kirghizes are very much like those of the Alay, but a special feature of them—very rare, on the whole, with the Mongolian race—is that they continually suffer from tooth-ache; perhaps it depends upon the climate; at any rate, common disease—an inflammation of the eyes—obviously depends upon the clouds of salt dust raised on the Pamir by the western winds. They spend the winter, at a height of 11,000 to 12,000 feet, in the same tattered *kibitkas*, that they inhabit in the summer, and know nothing of the warm dwellings erected for the winter by the Alay Kirghizes.

In the summer they ascend to the hilly tracts, reaching about 14,000 feet, in order to save their cattle from the mosquitoes. Though living chiefly on milk produce, they still are dependent upon the inhabited countries of the west, for they are accustomed to the use of bread. The other race inhabiting, if not the Pamir itself, then its outskirts, are the Tadjiks. In the high valleys of the Shugnan, the Roshan, the Darwaz, and the Karategin, they occupy the narrowest gorges of the mountains, trying to escape there from the persecutions of their khans, who are themselves vassals to the neighbouring larger states like Bokhara, Kokan, or China. Being Shiites, they are still more persecuted by their Sunnite rulers. Their dwellings are miserable hovels built of rough stones. Broad wooden platforms, under which fowls and young goats are kept, are divided into numerous compartments, which might be called rooms, each of them having its special destination as a kitchen or as a room for weaving, and so on. Notwithstanding the surrounding poverty, one feels comfortable in their poor hovels, the walls of which are decorated with numerous clay pillars, niches, and a variety of paintings very artistically made by the women, who have found the means of fabricating even boxes from clay mixed with husk. The pottery, all made by women without instrumental aid, is striking in the artistic feeling infused into its fabrication. Their fields are not less striking by the incredible labour which has been spent in clearing them from millions of stones. There are "fields" not larger than a common-sized table, cleared with effort, or artificially made by the side of a mountain stream. They keep some cattle, and, during the summer, mount with it to higher tracts. The Pamir is visited by many *savdagars*, or traders, from Kashgar, Badakshan, or Ferghana, who supply the Kirghizes and Tadjiks, at very high prices, with manufactured produce, receiving in exchange their own produce.

M. Ivanoff remarks that the small preliminary map published in the *Izvestia*, to illustrate the explorations of his expedition, is still incomplete, and does not quite correctly represent the results of his investigations. The larger completed map will therefore be welcomed when it appears. P. K.

NOTES

A MEETING of the General Committee of the Darwin Memorial Fund was held last week at the rooms of the Royal Society, Prof. Huxley, President, in the chair, when it was stated by the treasurer, Dr. Evans, that, after payment for the statue and other expenses, a balance of about 2200*l.* would remain. The following resolutions were then passed :—"That the statue of Darwin be made over to the Trustees of the British Museum in trust for the nation." "That the balance of the fund, after payment for the statue and medallion and incidental expenses, be transferred, under the name of the 'Darwin Fund,' to the President, Council, and Fellows of the Royal Society in trust to invest the same in or upon any stocks, funds, or securities authorised by law as investments for trust moneys." "That the President and Council of the Royal Society apply from time to time the dividends and interest of such investments in such a manner as shall to them appear best calculated to promote biological studies and research." "That a list of subscribers and a statement of the accounts be printed and circulated, together with the resolutions now passed, and that a woodcut or some other representation of the statue accompany the statement." The statue, by Mr. Boehm, R.A., has been placed in the great hall of the British Museum (Natural History), Cromwell Road, and arrangements for its unveiling will be made shortly.

THE vacancy created by Prof. Bayley Balfour's retirement from the Regius Chair of Botany in the University of Glasgow, which we announced some time back (NATURE, March 12, p. 441), has been filled by the appointment of Mr. F. O. Bower, F.L.S., Lecturer on Botany in the Normal School of Science, South Kensington. Both as a teacher and by his important researches in the morphology of Gymnosperms and the Vascular Cryptogams, Mr. Bower has rapidly assumed a leading position amongst the younger generation of botanists, and the loss of his services to the Normal School is much to be regretted. Mr. Bower is an M.A. of Trinity College, Cambridge.

THE Goldsmiths' Company has contributed one hundred pounds towards the fund which is being raised for the family of the late Henry Watts, to which we have already drawn attention in these columns.

THE Court of Assistants of the Fishmongers' Company has unanimously resolved that a grant of 2000*l.* be made to the Marine Biological Association of the United Kingdom—1000*l.* to be paid this year, and the remainder in annual sums of 200*l.* during the next five years.

THE subject of Mr. Romanes's Rede Lecture on June 2 will be "Mind and Motion."

THE subject of Prof. W. G. Adams's British Association address will be "The Electric Light and Atmospheric Absorption."

AT a meeting of the directors of the Ben Nevis Observatory held on Thursday last week, it was agreed to add a printing press to the establishment, for printing each day the hourly observations, with a view to their distribution among the more distinguished meteorologists and prominent meteorological institutions in different parts of the world.

THE verdict of the jury who considered the case of the Usworth Colliery explosion, whereby forty men and boys were killed early in the present year, is important as marking what appears to be the commencement of a new era in the history of these phenomena. It is probably the first expression of opinion from a public body of this class to the effect that coal-dust and a small percentage of fire-damp can play the part that has hitherto been usually ascribed to fire-damp alone. They found that the explosion was caused by a shot, the fire of which acted upon "*the coal-dust and a small percentage of gas.*" The convenient and time-worn "outburst of gas" theory, which consigned the helpless miner to the vicissitudes of chance, and exonerated colliery owners and their agents from all responsibility, seems on the point of giving way before its rival the coal-dust theory, which points out an easy means of preventing great explosions of this kind. The latter theory has doubtless a hard battle still to fight against prejudice and ignorance, but it has all the advantages of youth and vigour on its side, and is supported by a number of facts which appear to be incontrovertible.

THE Russian Geographical Society has just issued a programme of climatological and phenological observations, which, it is to be hoped, will be adopted by numerous observers. The number of plants and animals enumerated is smaller than in most similar programmes, it being the aim of the Society to make the task of the observers as easy as possible. A new feature of this programme are observations on the condition of the snow covering the ground, the time of its appearance and thawing, the rise of water in the rivers at the melting of the snow, &c.

M. FAYE has been continued on the roll of teachers of the Paris Polytechnic School, in spite of his having passed the time of incapacitation by old age. The exception has been grounded by the Minister of War on the plea of continued services rendered to science. A banquet has been given to the worthy astronomer by his admirers on this occasion.

THE Sanitary Congress opened yesterday at Rome.

IN the Spanish Congress on Monday, Señor Castelar called attention to Dr. Ferran's experiments in inoculation against cholera, and asked the Minister of the Interior to give a subvention to enable Dr. Ferran to continue his experiments on a larger scale. The Minister, in reply, said he was unable to do so at present, but as soon as it lay in his power he would grant a sufficient sum, although, in his opinion, Dr. Ferran's experiments had not yet reached a sufficient degree of certainty to prove a complete success. He added that a commission of medical men would be appointed to visit Valencia and other towns in order to study the experiments that are being made. In reference to this subject Dr. Cameron, M.P., writes to the *Standard* that the Under-Secretary for Foreign Affairs has promised to instruct the British Minister at Madrid to send home translations of any reports bearing on the system of inoculation with cholera virus attenuated by artificial cultivation, as a protection against Asiatic cholera, discovered by Dr. Ferran, of Valencia. This having come to the notice of Dr. Ferran, that gentleman has sent Dr. Cameron a telegram giving the results up to date of a great test experiment which is at present being conducted by him, under the eyes of scientific commissioners at Alcira, a town near Valencia, where an epidemic of cholera is raging. According to Dr. Ferran's telegram the population of Alcira is 16,000, and since the first of the present month 5432 of its inhabitants have been inoculated with his protective virus. That would leave the number of those not inoculated about 10,500; or, accepting 16,000 as an exact figure, precisely 10,568. Of the 10,500 persons who are not inoculated, cholera has attacked 64, and proved fatal to 30. Of the 5432 who have been inoculated it has, according to Dr. Ferran, attacked only 7, and proved fatal in no single case. In other words, since the commencement of the experiment on May 1, one person out of every 163 has been attacked among the uninoculated population, and one person in every 352 has died of cholera; while among the inoculated population only one person in 776 has been attacked, and not a single person in the entire 5432 has died of the disease. Dr. Ferran concludes his telegram by expressing the desire that a British Commission should be sent to Alcira to verify these results.

THE floating dome presented by M. Bischoffsheim to the Observatory at Nice is now finished, and has been on exhibition in Paris during the past week. It is intended to cover a colossal telescope; it is 22 m. in diameter inside, and has a circumference of 60 m., or 2 m. more than the dome of the Pantheon. Instead of rendering it movable by placing it on rollers, according to the ordinary method, it is closed below by a reservoir for air, which rests on the water in a circular basin. This system of suspension is said to be so perfect, that in spite of its great weight, a single person can turn it completely round the horizon. To provide against the water freezing, it has been proposed to dissolve in it a salt to the point of saturation, but it is feared that this may cause corrosion of the apparatus. Frosts, however, are rare in Nice, and special experiments on this subject will be made.

ON Friday night the House of Commons agreed, without a division, to a motion by Sir John Lubbock for a select committee to inquire whether, by the establishment of a forest school, our forests and woodlands could be rendered more remunerative. The proposer pointed out that, while our interests in the subject were greater than those of any other country in the world, as we had 2,800,000 acres under wood in Great Britain and about 340,000,000 in the Colonies, yet this was almost the only country without a forest school. He referred to the effect of scientific forestry in the Landes in France, and in India, where the net forest revenue fifteen years ago was only 52,000*l.*, while, since the establishment of a forest department, it had risen to over 400,000*l.* per annum. As a result of neglect of the science in this country, students for India had to be trained at Nancy, a school of course specially adapted for French requirements, and the forests in our Colonies and other possessions (Cyprus and the Cape, for example) had to be put under the control of foreigners, as there were no Englishmen trained for the work. Sir John Lubbock, however, declined to commit himself to the establishment of a Government school; it could not be left altogether to private enterprise, because a school necessarily required access to a considerable area of forest. He thought it worthy of consideration whether some intermediate system might be adopted which would enable some one or more existing institutions to benefit by national forests. Mr. Gladstone, whose interest in arboriculture is well known, could not bind the Government to the establishment of a School of Forestry, although he recognised the universal ignorance on the subject prevalent amongst land agents and others in England. He distinguished the circumstances in India, where there are important facts connected with the climate, and with the due supply of moisture in the atmosphere, which are not present in this country. The School of Forestry, moreover, he said, which was established by the Indian Government in England, was open to every one who could pay the fees. There was also the difficulty that forests of large extent are rare here, and that they are kept, not for purposes of profit, but of landscape beauty, or pleasure and sport. In conclusion he said the Government gave their hearty approval to Sir John Lubbock's proposal, reserving, at the same time, their freedom with regard to the recommeudations which the committee might make.

A TRANSLATION of Prof. Cremona's well-known work on the "Elements of Projective Geometry," by Mr. C. Leudersdorf, of Pembroke College, Oxford, will shortly be published by the Clarendon Press. It is hoped that this may be useful to students of a subject which has been, comparatively speaking, neglected in this country, although much attention has been paid to it on the Continent. The opportunity has been taken to considerably enlarge and amend the book. All the improvements to be found in the French and the German editions have been incorporated, and a new chapter on "Foci" has been added. The text has been carefully revised throughout, and has received many additions and elucidations, some due to the author himself and others to the translator.

ON the night of Friday the 15th inst. one of the most terrible storms ever witnessed in Vienna occurred there, by which shrubs, trees, and even houses were wrecked; and the cold accompanying was so severe that several persons exposed to it during the night were found frozen to death in the morning. In the Paris *Bulletin International* of the morning of the 16th it is reported that 139 millimetres of snow fell at Vienna. In all parts of Austria and Hungary snow covers vineyards and fields, where the crops were in an advanced condition, and incalculably great damage has been done. The festivals of Pancratius, Servatius, and Boniface, the Ice Saints of 1885, will long be remembered in this part of Europe.

WE have received the report of the Rugby School Natural History Society for the past year. That portion of it which relates to the Temple Observatory at Rugby has already been noticed in these columns. The editors observe that it appears to be a law of the existence of the Society (like that of the animalcule *Amœba proteus*) that an infusion of life into one part produces a corresponding decline in another. For some years the botanical, geological, and archæological sections absorbed all energy, but now there is a decided movement towards zoology and a decline in those sections once most vigorous. A fair start

has been made with some zoological collections; the aquarium, however, has proved a failure, and the vivarium labours under the disadvantage of never being reached by the sunlight. Several short and interesting papers are published with the report.

THE Russian Government has sent an official of the Education Department to Vienna to study the State commercial and industrial schools of Austria, these establishments being regarded as models, and the Russian Government intending to organise similar ones.

THE Fish Culture Department at the International Inventions Exhibition has proved a great success and attracted a large concourse of visitors. During the past week many important additions have been made, including a magnificent model of a Fish Culture Establishment exhibited by Mr. T. J. Mann, and a series of oyster beds, demonstrative of the process of breeding and fattening oysters. A special feature has been made of oysters this year in the Aquarium, where they are to be seen in numerous varieties imported from various quarters of the globe. In close proximity to them are exhibited various dredges and implements used in this particular fishery.

THE Count Lütke Medal of the Russian Geographical Society has been awarded this year to a work which deserves a special notice. It is Prof. N. J. Zinger's work on the determination of time by means of corresponding heights of different stars (translated in German by H. Kelchner, and published at Leipzig with a preface of O. W. Struve, under the title: "Die Zeitbestimmung aus correspondirenden Höhen verschiedener Sterne.") The determination of time with great exactitude, for telegraphic determinations of longitudes, by means of easily transportable instruments, has already occupied the Pulkowa astronomers. W. Struve and W. K. Döllen proposed very skilful methods of observations. The latter had proposed to determine the time by means of a special Repsold's circle from two passages of two stars in the prime vertical. The exactitude reached by this means was from 0·05 to 0·06 of a second; the circle had to remain in an unaltered position for no more than five or six minutes; but the whole observation took about forty minutes. Prof. Zinger's method, which is a further development of the work begun by Maupertuis, Olbers, Hauss, Delambre, and Knorre, consists in making two successive observations of two stars chosen for that purpose, at the same altitude, by means of any instruments which may not be divided with great perfection, but whose level would only show the changes the telescope may undergo when directed on two different azimuths. This method was met first with some coolness, on account of the difficulty of finding two stars which would culminate soon after one another at the same altitude. But M. Zinger has shown that even with a moderate telescope it is easy to have two stars easily found and pretty well seen at daylight which pass at the same altitude at an average of no more than nine minutes one after another. His tables render the task of finding such stars very easy, there being in moderate latitudes no less than 160 pairs of stars appropriate to that purpose. As to the ease and accuracy of the method, it is sufficient to say that time is determined with a probable error of no more than 0·04 of a second in no more than half an hour, without even making use of the divisions of the Repsold circle, and with only one reading of the microscope. For several years Prof. Zinger's method has been submitted to a very extensive test by Russian astronomers. So we learn from Gen. Koversky's analysis of it, published in the last "Annual Report" of the Geographical Society, that, when determining by means of light-signals the difference of longitudes between Pulkova and Parlovsk, and using a very plain instrument prepared by M. Brauer on M. Zinger's principles, the difference has been determined with an error of only one-fiftieth of a second. M. Pyertsoff, in Mongolia; Gen. Stebnitzky, in the Caucasus, who considers the determinations of time from corresponding heights of two stars quite as accurate as that deduced from zenithal distances taken with a Repsold circle, but far shorter and easier; the Russian officers in Bulgaria, who have determined with telegraphic signals the longitudes of thirty-seven places in less than seventy evenings, spending no more than three hours each evening for a determination which gave the longitude with an error of only 0·04 to 0·02 of a second; the measurements around Omsk in 1878; those of M. Gladysheff in the Transcaspian, and of M. Mionczyorski on the Ural in 1882–84—all these have been made on the same method of Prof. Zinger, which has now become the most familiar one with Russian astronomers. The measurements are usually made with a Repsold's circle, which is ready for work half an hour after the astronomer has arrived at the place whose longitude he proposes to determine; and in chronometrical expeditions five minutes to a quarter of an hour of a bright sky give the possibility of measuring the longitude with an accuracy quite sufficient for geographical purposes.

THE additions to the Zoological Society's Gardens during the past week include a Macaque Monkey (*Macacus cynomolgus* ♀) from India, presented by Mr. James Fleming; a Common Badger (*Meles taxus*), British, presented by Mr. C. Ethelstone Parke; a —— Wild Ass (*Equus tæniopus* ♂) from the Island of Diego Garcia, Chagos Archipelago, presented by Mr. F. D. Lambert, jun.; a Common Squirrel (*Sciurus vulgaris*), British, presented by Mrs. G. A. Smith; four Red-faced Weaver Birds (*Foudia erythrops*) from South Africa, a Grenadier Weaver Bird (*Euplectes oryx*) from West Africa, presented by Mrs. Herman Kuhne; a Dominican Kestrel (*Tinnunculus dominicensis*), a —— Bittern (*Ardetta* ——), three Martinican Doves (*Zenaida martinicana*), two Moustache Ground Doves (*Geotrygon mystacea*), a Tuberculated Iguana (*Iguana tuberculata*) from the West Indies, presented by Dr. A. P. Boon; two Harvest Mice (*Mus minutus*), British, presented by Mr. G. W. Oldfield; two Demeraran Cock of the Rocks (*Rupicola crocea* ♂ ♂) from Demerara, presented by Mr. T. C. Edwards-Moss; two Mute Swans (*Cygnus olor*), British, presented by Mr. J. W. Gibson; a Horned Lizard (*Phrynosoma cornutum*) from Texas, presented by Master C. A. Greeven; three Common Vipers (*Vipera berus*), British, presented by Mr. W. H. B. Pain; four White-faced Tree-Ducks (*Dendrocygna viduata*), a White Gannet (*Sula piscata*) from Brazil, deposited; a Dark Green Snake (*Zamenis atrovirens*), South European, purchased.

GEOGRAPHICAL NOTES

THE following message from Col. Prjevalsky, dated Lob Nor, March 15 (probably O.S.), is published in the *Invalide Russe*:—"During the last autumn and winter we visited Eastern Zaidam as far as Lob Nor. The middle range of the Kuen Lun, hitherto unknown, has been examined with sufficient care. The ancient route leading from Khoten to China has been found and thoroughly explored. We have also discovered three enormous snow peaks, to which we have given the names of Muscovite, Columbus, and Enigmatical. The most elevated point of the first-named is Mount Kremlin, of the second Mount Djinri, and of the third the Crown of Monomachus, which are all of a higher elevation than 20,000 feet above the sea. The Thibetan plateau, skirting the middle Kuen Lun, has an average height of 4000 feet. No inhabitants were met with except in the Southern Zaidam. Further to the west the flora and fauna of the desert are extremely poor. In the month of December the cold was so intense that the mercury froze. We passed the month of February and the first fortnight of March at Lob Nor. We are just about to set out again, with the intention of crossing Cherchen, for the purpose of reaching Kiria, in the district of Khoten. During the three months of summer we shall traverse Northern Thibet, if the Chinese do not oppose us, and in the autumn we shall return to our own Turkestan. We are all in good health."

THE last issue of the *Izvestia* of the Russian Geographical Society (1885, 1) contains a very interesting paper, by M. Lessar, on "South-Eastern Turcomania," with a map, thirteen miles to an inch, of the region between Merv and Herat. This paper consists of a chapter on the occupation of Merv; a diary of the journey from Fol-otan to Penj-deh and in the Steppes; a geographical sketch of South-West Turcomania; and a translation of Sir Henry Rawlinson's note, by which M. Lessar's account of his first journey was accompanied in the *Proceedings* of the Royal Geographical Society, with a few remarks by the author. Capt. Abbot's remarks on South-West Turcomania and the Badhyz are also translated in an appendix. The geographical description of the region comprised between the oasis of Merv, the Murghab, the Borkhut mountains, and the Hari-rud, which region is described as "South-Western Turcomania," is especially worthy of notice, as a valuable contribution to the geography of the region.

THE Government of India has decided to appoint Mr. Ney Elias, one of the most distinguished of our Chinese travellers, and at present English Commissioner in Ladakh, to act as British Consul at Yarkand and Kashgar.

MR. HOLMAN BENTLEY sends to the *Times* news of the safe return of the Rev. G. Grenfell, F.R.G.S., in the Baptist Missionary Society's steamer the *Peace*, after a voyage on the Upper Congo River from Stanley Pool to Stanley Falls, a distance of 1060 miles. He has explored many of the tributaries on the way—the Mobangi to 4° 30′ N. lat., the Ukere to 2° 50′ N., and the Lubilanji to 1° 50′ S. The Mbura is navigable only for ten or twelve miles from its junction with the Congo, when cataracts bar the way. The Mobangi is a fine river, but the people are very wild.

IN a recent number of *Das Ausland*, Herr Habenicht, of Gotha, makes an important suggestion with regard to observations in Africa. He points out the dearth of accurate observations in latitude, longitude, and heights in the interior of that continent. For instance, with regard to the greater part of North Africa we are dependent on those of Vogel and Barth, while in South Africa those of Livingstone are almost the only ones we have. Even in the interior of the Cape Colony, the Orange Free State, the Transvaal, Namaqualand, the Kalahari desert, our knowledge of exact positions is still in the air. More is known of the central and lower Congo and the coast. To remedy these defects, Herr Habenicht proposes to geographical societies interested in African exploration that the field should be subdivided. Young men should be trained to make astronomical observations, barometrical measurements and itineraries, and two should be despatched on each route with separate sets of instruments. The routes suggested are the following: (1) Cape Town, through Stellaland, to the Zambesi; (2) Delagoa Bay to Stellaland; (3) Cape Town, through Namaqualand and Damaraland, to the Zambesi; (4) Loango to Zanzibar; (5) Zanzibar to the Egyptian Soudan; (6) the Lower Niger, through Darfur, to Khartoum; (7) the Gold Coast to Timbuctoo; (8) Morocco to Timbuctoo; (9) Tripoli to Socoto; (10) Bengazi, through Kufra and Borgu, to Kuka. All previous explorations, he says, would by these observations receive a sound scientific basis.

M. RADDE, the Director of the Natural History Museum at Tiflis, has been ordered by the Russian Government to investigate the mountain systems of the border-lands of Trans-Caucasia and Khorassan, between Ararat and Ala Dagh on the west and Elburz on the east.

FROM a report addressed by Col. Feilberg to the Argentine Minister of Marine on the subject of his mission to explore the Pilcomayo River, it appears that this stream is only navigable for eighty leagues from its mouth in the Rio Paraguay up to its confluent, the Rio Dorado. Five miles higher the rapids commence; there is then only two feet of water, the channel is narrow and very tortuous, and the current swift. The upper waters are lost in marshes, which the traveller crossed. On returning, the water had fallen considerably, and the journey was only accomplished with much trouble and after many accidents. During his stay on the Chaco he reports that he did not see a single Indian, although their tents were still standing in places. One of his officers had been sent with the chronometers to Corientes, to compare them by telegraph with the Observatory of Cordoba or Buenos Ayres. These comparisons are essential for the verification of the observations made, and as soon as they have been obtained, the maps which are to accompany the publication of the journal of the mission will be commenced.

ACCORDING to the *Colonies and India* a conference took place on March 31, by telegraph, between the Melbourne and Sydney branches of the Geographical Society of Australia, on the question of New Guinea exploration. It was decided to subsidise Mr. H. O. Forbes's expedition, to the extent of 500*l.*, on condition that the two Colonies receive copies of the explorer's diary and despatches, and duplicates of his collection of specimens. The Conference also decided to send an independent expedition from the Aird River, the whole expenses to be defrayed by the Society. The expedition will be placed under the leadership of Capt. Everell, who will be accompanied by Herr von Leudenfelt.

THE Report on the trade of Persia by our Consul at Teheran, which has just been laid before Parliament, contains some interesting statistics on the population of Persia, in order to judge how far the country has recovered from the effects of the great famine of 1871–72. The area of the dominions of the Shah is 1,647,070 square kilometres, and the population is estimated at 7,653,000, contained in 99 towns with a total population of 1,963,800, while the villages and rural districts contain 3,780,000, and the nomads are estimated at 7,909,800. It is curious to notice how the number of nomads are made up: the Arabs number 52,020; Turks, 144,000; Kurds and Leks, 135,000; Beluchs and gipsies, 4,140; Bakhtiaris and Lurs, 46,800. The statistics of the creeds are: Sheeahs, 6,860,600; Sunnis and other Mohammedan sects, 700,000; Parsees, 8,000; Jews, 19,000; Armenians, 43,000; Nestorians and Christians, 23,000. Of the Armenian population 52·8 per cent. are males and 47·2 females. Of the Mussulman population the mean proportion is 50·5 per cent. females and 49·5 males. The following is a list of some Persian towns with their respective populations:

Tabreez	164,630	Zenjan	24,000
Ispahan ...	60,000 to 70,000	Cazoin	40,000
Yezd	40,000	Resht (including adjoining villages) ...	40,000
Kerman	41,170	Astrabad	10,000
Shiraz	30,000	Nishapore	11,000
Shuster	under 20,000	Sebzevar	12,000
Dizful	25,000	Meshed	60,000
Burujird	20,000	Kashan	30,000
Kermanshah	30,000	Koom	20,000
Hamadan	30,000	Mianeh	7,000
Maragha	13,250	Mohammera	15,000
Soujboulak	5,000		

Mr. Dickson, taking the medium between the highest and lowest figures he has obtained, estimates the population of Teheran at about 120,000, while Col. Ross estimates that of Bushire at 70,000.

IN *Astron. Nachr.*, vol. cx., Prof. Dr. Auwers has published the results of his researches and calculations about the longitude of some places in Australia. Since these data will have to be altered by the result of the determination of the difference in longitude between Port Darwin and Banjuwangi (Java) we may omit particulars and only state that Mr. Auwers has found to be:—

	h.	m.	s.
Longitude of Sydney	10	4	49·75
,, Windsor	10	3	20·92
,, Melbourne	9	39	54·32
,, Adelaide	9	14	20·57

INFORMATION has been received in Berlin of the death, in the Cameroons, of Lieut. Tilly, the leader of another German expedition sent out to explore that part of Africa.

A PARLIAMENTARY paper just issued (Commercial, No. 5, 1885) contains an exhaustive report, by Vice Consul Comberbatch, on the Dobrudja. Under the head of geography it refers to the name, limits, frontiers, area, topography, division, mountains, forests, mines, rivers, marshes, lakes, islands, harbours, and tides of the district. This is succeeded by sections on the climate, history, ancient remains, population, sanitary state, government, public works, religion, education, agriculture, commerce, industries, navigation, natural history, and principal towns. The report, which occupies fifty pages, is thus a short treatise on this district at the mouth of the Danube, of which much was heard in connection with political events a few years ago.

ASTRONOMICAL PHENOMENA FOR THE WEEK, 1885, *MAY* 24–30

(For the reckoning of time the civil day, commencing at Greenwich mean midnight, counting the hours on to 24, is here employed.)

At Greenwich on May 24

Sun rises, 3h. 58m. ; souths, 11h. 56m. 36·3s. ; sets, 19h. 55m. ; decl. on meridian, 20° 51′ N. : Sidereal Time at Sunset, 12h. 5m.

Moon (Full May 28, 21h.) rises, 15h. 16m. ; souths, 20h. 59m. ; sets, 2h. 33m.* ; decl. on meridian, 5° 55′ S.

Planet	Rises	Souths	Sets	Decl. on meridian
	h. m.	h. m.	h. m.	° ′
Mercury ...	3 21 ...	10 21 ...	17 21 ...	11 3 N.
Venus ...	4 14 ...	12 19 ...	20 24 ...	21 47 N.
Mars ...	3 6 ...	10 29 ...	17 52 ...	14 56 N.
Jupiter ...	10 36 ...	17 50 ...	1 4* ...	13 25 N.
Saturn ...	5 19 ...	13 27 ...	21 35 ...	22 21 N.

* Indicates that the setting is that of the following day.

Occultation of Star by the Moon

May	Star	Mag.	Disap.	Reap.	Corresponding angles from vertex to right for inverted image
			h. m.	h. m.	° °
28 ...	θ Libræ ...	... 4½ ...	2 10 ...	3 5 ...	148 253

Phenomena of Jupiter's Satellites

May	h. m.		May	h. m.	
26 ...	20 10	II. tr. ing.	29 ...	20 46	I. occ. disap.
	23 6	II. tr. egr.	30 ...	0 18	I. ecl. reap.
27 ...	21 57	III. occ. disap.		20 25	I. tr. egr.
28 ...	20 39	II. ecl. reap.		20 56	IV. occ. reap.
	23 37	I. tr. ing.			

The Occultations of Stars and Phenomena of Jupiter's Satellites are such as are visible at Greenwich.

May	h.	
25 ...	13 ...	Mercury at greatest elongation from the Sun 25° west.
30 ...	21 ...	Mercury in conjunction with and 3° 15′ south of Mars.

THE VALUE OF A MARINE LABORATORY TO THE DEVELOPMENT AND REGULATION OF OUR SEA FISHERIES[1]

IT is a striking fact, to which attention has before now been drawn, that whilst the agriculturist, on whom we depend for a large part of our food supplies, has very largely availed himself of scientific knowledge in the treatment of crops and herds, the fisheries of our coasts, which provide an almost equally large amount of food to the people, have never been carried on with any regard to an accurate knowledge of the fishes on which they depend.

Agriculture is, in this country, a refined branch of chemistry ; but there has been no demand for a knowledge of marine life which might enable the fisherman to pursue his calling to the greatest advantage. In fact, our fishery industries are still barbaric ; we recklessly seize the produce of the sea, regardless of the consequences of the method, the time, or the extent of our depredations. In the same ignorant fashion as the nomadic herdsmen of Asia descend upon a fertile valley, and after exhausting it, leave it to time and natural causes for its recuperation, so do we treat the fishing-banks of our coast.

So long as fishing was relatively small in amount this method was not altogether objectionable. But with the increase of population, and the introduction of steam fishing boats and more effective instruments of capture, there is reason to believe that some at least of our coast fisheries are being destroyed, and that others may follow in the same direction.

Other civilised nations have perceived the necessity of attempting to regulate the various kinds of sea-fisheries on rational principles—that is to say, on principles based on an exact knowledge of the life and habits of the fi hes which it is desired to capture. The French, the Norwegians, and above others, the Americans, have given attention to this matter.

There is reason to believe that the Romans had gained a special skill—now lost—in cultivating sea fish. Whatever that may have amounted to, it is certain that modern Europe has entirely neglected the cultivation, and even the care of sea fisheries. It has been the merit of the Fish Commission of the United States to make the first attempt in modern times to deal with sea fisheries in the spirit of civilisation, that is of men who are determined to understand and control, for the advantage of their race, the operations of nature, rather than to leave things to chance, the unknown development of physical causes.

The direct efforts of the American Commission, and the knowledge which scientific men have accumulated with regard to fishes, without designing aid in the regulation and development of fisheries, do not enable us at present to answer many of the questions with regard to different sea fishes which we urgently require to know if we are to deal like reasonable, practical men with our fisheries, so as to improve them, or even so as to prevent their extermination.

At the late Fisheries Exhibition Congresses, the universal cry, the one unanimous demand, was "more knowledge!" We cannot tell whether beam-trawling with steamboats is injurious or not to some of our most valuable sea fishes, until we have more knowledge. We have not sufficient knowledge to enable us to say that it would restore some herring grounds to their former richness, if the fishermen were kept off those grounds for a few years.

We do not know why soles are getting scarcer every year ; we know nothing about soles, and so we can do nothing to remedy their constantly increasing diminution.

We do not know why oysters are scarce, or how to make them more abundant. A few hap-hazard attempts to cultivate oysters are now and then made, but have resulted in an immense loss of money rather than in gain, because we do not know all about oysters in the same precise and detailed way in which we know all about wheat, or all about pigs or chickens.

We do not know why some fishes swim in great shoals year after year at certain seasons near certain spots, and then to the dismay of the fishermen suddenly give up ever passing that way. We do not know whether we could hatch the young of soles, turbot, cod, and other valuable fishes, and stock the sea with them as we do our rivers with trout and salmon.

We do not know whether we could favour the increase of such fishes by cultivating in the sea their favourite food. In many cases we do not know what their food is.

We do not know whether we might increase these fishes by destroying their enemies.

In fact, we know exceedingly little about the minute details of the life of marine animals, and if we wish to deal with sea fisheries like rational men, we must find out these minute details, and gradually apply the knowledge so gained.

A laboratory on the sea-shore, provided with boats and fishermen, and having within its walls tanks for hatching eggs and watching sea fish, and conveniences for the work of naturalists trained in making such observations, is the way to meet the deficiency in our knowledge above noted.

This was perceived many years ago in France, and more recently various laboratories have sprung into existence on the Mediterranean and on the American coast.

There is not, as yet, any such place of investigation on the English coast, and it is this deficiency which the Marine Biological Association, of which my honoured friend, Prof. Huxley, is President, and H.R.H. the Prince of Wales is patron, proposes to meet by building and maintaining a really efficient and thoroughly organised laboratory and experimental aquarium on the shore of Plymouth Sound.

The Association does not propose merely to build this place, but to arrange for the carrying out there of most importan investigations on such questions as those I have a few minutes ago named. They have the hearty and earnest co-operation of all the naturalists in the United Kingdom, Scotch and Irish naturalists having united with their English brethren to form this institution.

Naturalists are glad to take part in the study of these practical questions, because the arrangements and the studies which are necessary to answer the questions of the practical fisherman, are also just those which are necessary to advance the knowledge of the order of nature which forms the single object of truly scientific investigation. They will systematically and eagerly join with one another in the operations of the Plymouth laboratory, to obtain thorough knowledge with regard to the habits, food, breeding, and life-conditions of all kinds of marine fishes, such

[1] Abstract of paper read at the Society of Arts, Wednesday, May 13, 1885. By E. Ray Lankester, M.A., LL.D., F.R.S., Professor of Zoology in University College, London, and Fellow of Exeter College, Oxford.

as will be not only valuable but actually indispensable to the practical fisherman; and in the reports of the work done in the new marine laboratory which will be published by the Association, I do not doubt that the basis for future legislation and for future methods of sea-fishery will be found.

I may here venture to mention some of the results obtained by the efforts of the naturalists who form the United States Fish Commission—at the head of which is Prof. Spencer Baird. I would, however, especially remark that the Commission has only been at work for ten years, and that very great practical results cannot be expected at once. A vast amount of knowledge has to be obtained before we can deal practically with all the various kinds of sea-fishes; and it is to me a proof of the wonderful sagacity and activity of the American naturalists that they have already been able to do what they have done in the practical direction.

Prof. Baird has especially attempted to artificially cultivate sea-fishes. It seems to him that it is better, if it be possible, to replenish the seas by stocking them with young fish, to take the place of those removed by fishermen, rather than to impose legislative restrictions and penalties upon the fishermen. The attempt to artificially cultivate sea fish is an admirable example of the relation of scientific knowledge—that is, thorough and cause-reaching knowledge—to practical commercial operations.

There are two distinct stages in this attempt at artificial cultivation. The first is the scientific. You must ascertain how, when, and where the fish naturally breeds; you must find out, experimentally, how to procure its eggs, fertilise them, and rear the young to a given size—on a small scale. That is the business of the scientific naturalist. When he has ascertained all the details of this operation—which differ entirely in the case of different fishes, and may take years to ascertain—then the second stage is entered on. The commercial man then comes forward, and in the light of the knowledge obtained for him by the scientific man, attempts the hatching of the fish on a large scale—not by the hundred, but by the million.

The American Fish Commission has undertaken both stages of the work, and the second is necessarily a very costly one. A very promising result has been obtained in the artificial breeding of codfish, and again in the case of the shad. [Details of these operations were here given by the author.]

Again, in dealing with the American oyster, the Commission has obtained what promises to be a very great success. [Details of this case were given.]

But there is an almost unlimited field of work before the American Commission.

Experiments and observations similar to those carried out by the American Commission, will be undertaken by the Biological Association at Plymouth. For example, the artificial cultivation of that most valuable of British fishes, the sole, will be at once taken in hand. At present absolutely nothing is known as to the spawning of the sole—the male fish is not even recognised. In the first instance the naturalists at Plymouth will study the eggs and the mode of spawning of the sole, and the way in which the eggs are fertilised naturally. Then the necessary conditions for the rearing of the young fish will be ascertained. After that it will be possible to hatch a vast number of young soles and turn them out into Plymouth Sound, and to determine in this particular area, which is admirably adapted by its natural delimitations for the experiment, whether the take of soles in the Sound has been increased by the operation.

Similar experiments will be tried with other fish; and also knowledge will be gained as to the food of various fishes, and the causes which determine their movements, their increase, and their diminution in the neighbourhood of Plymouth.

This knowledge will help us to form sound and reliable conclusions as to the supposed injurious effects of steam trawlers and other modes of fishing, and so lead on to sensible and valuable legislation in regard to the seasons and modes of fishing best suited to obtain the maximum benefit from the harvest of the sea.

The English oyster, though differing from its American congener, can no doubt be brought under control by a thoroughgoing knowledge of all the conditions affecting it at all periods of life; and this it will be a first duty of the Marine Biological Association to attain. [Suggested inquiries as to the oyster were here mentioned.]

Lastly, the subject of "bait" is one of great importance, which we shall be able to deal with effectively. Not only shall we find new and effective baits, at present neglected by our line fishermen, but we shall be able to direct the cultivation of such valuable baits as the mussel and the limpet.

There is no fact which gives one so vivid an idea of the immense commercial value of sea fisheries as the amount which is annually expended on mussels for use as bait in those fisheries. There are few statistics on this subject, or indeed on any matters relating to our sea fisheries, and it will be one object of the Marine Biological Association to collect such statistics. But there is a certain amount of information as to the use of mussels for bait. Thus between October, 1882, and May, 1883, twenty-eight boats engaged in the haddock fishery at Eyemouth, in the North of Scotland, used 620 tons of mussels (about 47,000,000 individuals), costing nearly 1800*l.* to the fishermen, that is to say, over a million and a half of mussels for the whole time, or about 7000 a day to each boat—at the rate of one penny for twelve mussels. The total value of mussels used for bait in the deep sea line fisheries of the British coasts must amount to many hundred thousand pounds in a year—and we can only roughly guess at the value of the fish caught by this large expenditure on bait. In spite of the great economic importance of the mussel, its complete history of reproduction and growth is not known, and though in France and Germany it is carefully and profitably cultivated, very few attempts have been made on the British coast to protect or to artificially favour mussel scalps so as to make them remunerative properties.

This is a subject with which a marine laboratory would enable us to deal in a very short time. The same general remarks, *mutatis mutandis*, apply to the second most important bait, viz, the limpet.

Before concluding this sketch of the work which lies before the managers of a marine biological laboratory, I may say a few words as to the nature of the buildings and equipment required for such an institution.

The most efficient scientific laboratory of the kind is that erected at Naples by Dr. Dohrn, a drawing of which is exhibited. The Naples laboratory, with its tanks, row boats, and steam launches, has cost about 20,000*l.*, and involves an annual expenditure of about 4000*l.* A staff of observers is paid out of this sum, and the efforts of the institution have hitherto been entirely directed to the obtaining of accurate scientific knowledge with regard to the fauna and flora of the Bay of Naples. It is justly regarded as one of the most important scientific institutions in Europe.

The United States Fish Commission have erected, from time to time, various small laboratories, and are now about to expend 10,000*l.* on a laboratory at Wood's Hole, and 20,000*l.* on building fish-ponds protected by piers of masonry. Since its commencement, the United States Commission has received from the Imperial revenue about 300,000*l.* In 1884 alone it received 70,000*l.* It must be remembered that these large sums cover the expense of very extensive operations in fish-breeding on a commercial scale, and are not solely for the purpose of preliminary investigation.

The Marine Biological Association proposes to proceed in a modest manner, arranging in the first instance for the carrying out of the necessary experimental inquiries. A site has been obtained on the Citadel Hill, at Plymouth, by permission of the authorities of the War Office, and here will be erected a laboratory, comprising on the ground floor large and small tanks, and above, a series of working rooms fitted with small tanks. Through all a stream of sea-water will be driven by pumping apparatus, from large tanks in the basement, containing several thousand gallons. These reservoirs will only be replenished two or three times in the year. Boats, including a steam-launch, will be required, and two or three fishermen, who will act as attendants. A resident superintendent, who will be a thoroughly qualified naturalist, will be appointed at a salary of 200*l.* a year, and will be lodged on the premises. Naturalists will frequent the laboratory at their own expense for the purpose of study, and from time to time competent investigators will be appointed to carry out particular inquiries. The latter will be paid for their work from special sources, not from the general income of the Association until that reaches a large amount. Great assistance will be afforded to the work of the Association by the local fleet of fishing boats, which is very numerous, and comprises some vessels of large size. It is estimated that a capital sum of 10,000*l.*, and the prospect of an income from annual subscribers, members of the Association and others, of about 500*l.* a year, will enable the important work which has been taken in hand to be commenced. The Council of the Association feel very great confidence that they will be

able to obtain annually sufficient funds to keep the laboratory in efficient working order when once the capital sum of 10,000*l.* has been subscribed. Towards the latter amount they have already raised a sum exceeding 5000*l.* From Plymouth as a centre, in the course of future years, the operations of the Association will extend, and additional laboratories will no doubt be constructed hereafter by the Association on other parts of the coast of the United Kingdom, should the first one prove a success, and the work carried out through its agency meet with public approval and support.

Whilst the Marine Biological Association aims at obtaining, by the operations of its laboratory and experimental aquarium, that knowledge which is clearly necessary for the improvement and regulation of our sea fisheries, it must be remembered that its work will necessarily enlarge and advance the great science of biology, and that to many of us this is its surest promise of utility, for we cannot always directly govern the march of scientific progress. The whole field of knowledge must be cultivated, in the simple faith that the increase of knowledge is the greatest good which human effort can achieve. By adopting a thorough and comprehensive scheme of study of the problems connected with the life of fishes, we shall, as invariably happens in the history of science, obtain results which at present we cannot foresee, but which, we may feel assured, will yield in unexpected ways rewards and blessings to humanity.

METEOROLOGICAL INSTRUMENTS

THE Royal Meteorological Society recently held its sixth Annual Exhibition of Instruments at the Institution of Civil Engineers, 25, Great George Street, S.W. This Exhibition was devoted to sunshine recorders, and solar and terrestrial radiation instruments.

The first attempt at obtaining an instrumental record of the amount of sunshine was made by Mr. J. F. Campbell, of Islay, in the year 1853, when he mounted a hollow glass sphere filled with acidulated water, in the centre of a cup of mahogany, so arranged that the sun's rays were focussed on the interior of the cup and burned it. The lines of burning, therefore, indicated the existence of sunshine. Solid glass spheres have been substituted for the hollow ones, and cards in metal frames have replaced the wood; but in its principle the sunshine recorder of 1885 differs little from that erected on Richmond Terrace, Whitehall, thirty years ago. Other modes of recording sunshine are based on the action of the rays of the other end of the spectrum on the actinic instead of the heat rays. Among workers in this direction may be mentioned Marchand of Fécamp, Sir Henry Roscoe, and others. The most recent improvements in this direction are those by Prof. McLeod and by Mr. Jordan.

With regard to solar radiation thermometers, the successive stages in the assumed perfecting of these instruments have been as follows:—An ordinary mercurial thermometer acts as a spherical mirror, and reflects the rays which fall upon it. To lessen this the bulbs were first made with black glass; moreover, originally the degree marks were put upon the supporting slab, then they were put upon the tubes of the thermometers. It was then found that in a position where two thermometers with similarly coated bulbs were exposed to the sun, but one was exposed to more wind than the other, the indicated temperatures varied greatly. To avoid this it was proposed that the thermometer should be inserted in a glass shield exhausted of air. Various forms of mounting have been adopted, but the chief efforts have been expended in determining the influence of the amount of air left in the so-called vacuum. The next stage was that, inasmuch as black glass had a bright surface, there was still much light reflected, and therefore the surface was dulled with a coat of lamp-black—so that all heat falling upon the bulb might be absorbed. Subsequently, owing to the influence of the lower temperature of the unblackened thermometer tube, about one inch of it was coated like the bulb. As evidence of the degree of exhaustion, a small mercurial pressure gauge was attached to the thermometer, and by other makers platinum wires were soldered through the shield so that the stratification of the electric arc might indicate the amount of air still left.

With regard to terrestrial radiation thermometers, the pattern of instrument used has varied very little. The Rutherford minimum has almost always been used, but its sensitiveness has gradually been increased: the spherical bulb was replaced by a cylinder, the cylinder was elongated and bifurcated, and eventually, in order to strengthen the forks, they were united into what is known as a "link." Another plan was to flatten the cylindrical bulb into as thin a plate as possible, this giving a maximum of surface in proportion to the contents. The bulb was also made double, and thus we have the so-called "bottle" pattern, and then the tube was let into the side of the bottle, and both ends of the bottle were left open, and so we have the "open cylinder"—a remarkable specimen of glass-blowing. Then there have been two patterns of mercurial thermometers—Casella's and Negretti's. Difficulties have arisen from the degree marks being obliterated by the weather. To guard against this the tube has been inclosed in what are known as Leach's shields, and many attempts have been made to render the joint at the entrance of the tube watertight. This is not easy, because the thermometer is exposed to a great range of temperature, and the air inside the shield varies so much in volume that it forces its way through almost every joint. The object is, however, effected when the external jacket is sealed on the stem near the bulb.

In addition to specimens illustrating the various patterns of the above instruments, the Exhibition also included a number of new instruments, and many interesting photographs, sketches and diagrams. The photographs of clouds and lightning were very good.

At the meeting of the Society the President, Mr. R. H. Scott, F.R.S., read a paper giving a brief account of the various instruments and arrangements to be found in the Exhibition for the purposes of recording solar and terrestrial radiation and the duration of sunshine both in regard of its light and its heat, the last-named being obtained by means of the sunshine recorders, which are now pretty generally used. He exhibited twelve monthly maps showing the percentage proportion of hours of recorded sunshine to the hours the sun was above the horizon in the various districts of the United Kingdom. He stated that the features which strike any one on examining the maps of sunshine, which are for the most part for the five last summers and for the four last winters, excluding January to March, 1885, which has not yet expired, are:—First, the broad fact that the extreme south-western and southern stations are the sunniest, as has already frequently been pointed out. Jersey is undoubtedly the most favoured of our stations in this particular. Second, that in the late autumn and winter Ireland is much sunnier than Great Britain, Dublin having absolutely the highest percentage of possible duration of sunshine in November and December, and being only equalled by Jersey in January. The Dublin instrument is not situated in the city, but at the Mountjoy Barracks in the Phœnix Park, beyond the Vice-regal Lodge. The north-east of Scotland is also exceptionally bright, as the station, Aberdeen, lies to leeward of the Grampians. In April the line of 40 per cent. of possible duration takes in Jersey, Cornwall, Pembrokeshire, the Isle of Man, and the whole of Ireland except Armagh. The absolute maximum of the year occurs in May, and the amount rises to 50 per cent. (nearly to 60 in Jersey) over the district just mentioned as enjoying 40 per cent. in April. In June there is a falling off, which is continued into July and even into August in the Western Highlands. In the South of England, however, a second maximum occurs in August, the figure for Jersey rising to 50 per cent. This is mainly due to the exceptionally bright weather of August, 1884, in the southern counties of England. In September, Ireland shows a falling off, and the greatest degree of cloudiness is in Lincolnshire. In October, the Midland Counties of England are the worst off. In November the line of 40 per cent. encloses two districts, one Dublin, already mentioned; the other the Eastern Counties (Cambridge and Beccles). The absolutely highest monthly percentages in the period under consideration are in the month of May, 1882, in which St. Anne's Head, Milford Haven, had 62 per cent., while Geldeston (Beccles), Douglas (Isle of Man), and Southbourne (Bournemouth) show 61 per cent.

SCIENTIFIC SERIALS

THE *American Journal of Science*, April.—On the use of carbon bisulphide in prisms, being an account of experiments made by the late Dr. Henry Draper of New York. The results so far obtained by Dr. Draper in his investigations on the cause of the difficulties encountered in the use of carbon bisulphide in prisms seemed so valuable and so likely to prove useful to others engaged in photographing the prismatic spectrum that it was decided to publish them in the *American Journal of Science*.

With the assistance of Mrs. Draper, Mr. George F. Barker was accordingly requested to collect from Dr. Draper's copious notes the facts here detailed in connection with his experiments. Some supplementary measurements have also been made to test the efficiency of the apparatus.—The genus Pyrgulifera, Meek, and its associates and congeners, by Charles A. White. These molluscan forms, constituting the Bear River Laramic fauna of the author, are not found among any other North American fauna, either fossil or recent, but appear to have their congeners in a fauna still surviving in Lake Tanganyika, Central Africa, as well as in the Upper Cretaceous fresh-water deposits of Hungary. —On the occurrence of native mercury in the alluvium in Louisiana, by Ernest Wilkinson. Native mercury has recently been unexpectedly discovered at Cedar Grove Plantation, Jefferson Parish, Louisiana, where it is found disseminated in small globules in the mean proportion of 0·002934 per cent. throughout the alluvial soil. It also occurs elsewhere in the same region in such large quantities and under such general conditions that its presence can hardly be attributed to human agency. Yet no other explanation is offered of this curious phenomenon.—Remarks on the series of earthquakes that have recently devastated the southern provinces of Spain, by C. G. Rockwood, jun.—On the structure of the spores or spore-like bodies (*Sporangites huronensis* of Sir J. W. Dawson) occurring in the Devonian formations of North America, by J. M. Clarke.—Denudation of the two Americas, by T. Mellard Reade. In this paper the author follows up the calculations already made by him regarding the quantity of matter annually removed in river water from the surface in England and Wales and some of the river basins of the European continent. Here the Mississippi, Amazons, and St. Lawrence basins are dealt with, the results confirming the provisional assumption that about 100 tons of rocky matter are dissolved by rain per English square mile per annum throughout the world.—On Arctic Interglacial Periods, by Dr. James Croll. It is argued that the Polar Interglacial periods were more marked than the Glacial, and that they neither did nor could exist *simultaneously* in both hemispheres. In a concluding note the author remarks that this will probably be his last paper on questions relating to geological climate, advancing years and declining health obliging him to abandon the subject in order to finish some work in a different field of inquiry which has been laid aside for over a quarter of a century.—Notes on some apparently undescribed forms of fresh-water Infusoria, No. 2 (with Plate III.), by Dr. Alfred C. Stokes.—Palæozoic notes; new genus of Cambrian Trilobites Mesonacis, by Charles D. Walcott.

Bulletin de la Société d'Anthropologie de Paris, 4e Fascicule, 1884.—The sequel to the "Anthropology of California," by M. Ten Kate.—Observations on the anthropological character and social conditions of the M'zabites, by Dr. Charles Amat, who has added to the results of his personal study of the people a brief summary of their history, derived from the chronicle of Abou Zakaria, translated by M. Masqueray, while he is indebted to a brother officer, M. Motylinsky, for much interesting information regarding the language, which differs entirely from Arabic, and presents close affinities with the dialects of the Berbers. The people, who are a remnant of the ancient sect of the Karidjites, retain many traces of pre-Moslem usages and forms of belief, follow agricultural pursuits, and are the main purveyors of corn in the Sahara.—Notes, by Dr. Hyades, on the Fuegians, considered from a hygienic and medical point of view. —On the significance of the name of the Aryans, by M. Ploix, who attempts to prove its derivation from a Sanscrit root indicating "white." This hypothesis is very forcibly attacked by M. O. Beauregard, who, in a subsequent communication to the Society, brings forward strong evidence to show that the etymological meaning of the term is "noble" or "venerable."—A report on the project of instituting an official anthropometrical examination of the pupils in the primary schools of Paris, by M. Manouvrier.—On the influence of the American medium on the races of the Old World, by M. de Quatrefages.—Notes by M. Pietrement in support of his opinions regarding the age of iron, which had been called in question by M. Mortillet.—Communication, by M. de Rialle, of M. Macey's account of a grave, discovered near Saïgon, Cochin China, in 1882. According to the opinion of the few natives who are versed in local archæology, this grave, which was discovered twelve feet below the surface, dates back at least 400 years. From the lower of the two superposed coffins, besides a few vertebræ and the tibiæ, a cranium was extracted which presents a deep perforation above the right temporal that may be regarded as the cause of the death of the Annamite chief to whom the remains belonged.—Report, by M. de Ujfalvy, of the finds obtained from a Celtic cemetery near Rosegg, in the valley of the Drave. The tumuli, of which there are more than 300, resemble in structure and general contents those opened at Hallstadt and in Styria, but in addition they have yielded a large number of curious little leaden figures of wheels, birds, men on horses, &c., attached to the surface or margins of the various vases.—On some crania from the Merovingian graves at Fermes (Oise), by M. de Maricourt, with an extensive series of measurements, which, according to him, afford strong presumptive evidence of diseases having a scrofulous or syphilitic origin.—On the Gallic rock-tumuli of Port Bara (Quiberon), by M. Gaillard.—On an elephant's tusk found in the valley of the Drance (H. Savoie), by M. D'Acy. This find was obtained at 3000 feet above the level of the sea, and is believed to belong to a relatively recent representative of *Elephas primigenius*.—On the manufacture of fire-flints still existing in France, by M. P. Salmon. This industry is chiefly carried on near Percheriou (Loir-et-Cher), whence large numbers of flints are annually exported to supply the demand still existing for them among Central African and other savage tribes.—Communication, by Dr. Verrier, regarding the work of Dr. Engelmann, of Louisville, on the various modes of delivery prevalent amongst women of different races.—On the different powers of resisting cold shown by various races, by M. Maurel.—On a placental anomaly in a case of twin-delivery, by Dr. Verrier.—Notes on the crania of three idiots, by Drs. Doutrebente and Manouvrier.—Observations on the static and dynamic conditions by which man is enabled to stand erect, by Dr. Fauvelle.—Researches on the so-called "Maye" of Provence, by Dr. Berenger-Ferand. The paper is an enlarged exposition of an earlier notice, which appeared in 1883, on the Provenzal customs of our own times, in which the author sees a survival of the ancient worship of Maia—as are our own May queen, Florrie games, jack in the green, and other May festivals—the long ages of Christianity having modified but not obliterated the traces of paganism.

Rendiconti del Reale Istituto Lombardo, March 12.—Note on the kinetic theory of the gases and on the limits of the terrestrial atmosphere, by Prof. R. Ferrini.—On some geometrical, statical, and kinematic properties of articulated polygons, by Prof. G. Jung.—A comparison of the respective merits of Bellani's lucimeter and the English heliograph constructed by Negretti and Zambra, of London, by Giovanni Cantoni.—On some uniform representations in the higher mathematical analysis, by Prof. Giulio Ascoli.—On some remarkable features of the stratified rocks in the Valtravaglia district, North Lombardy, by Prof. Taramelli.—On the question whether rice should be considered as a contraband of war, by Ercole Vidari.

April 9.—Historical notes on the comet of the year 1472, by Prof. G. Celoria.—On the geometrical movement of invariable systems, by Prof. C. Formenti.—Remarks on the cholera bacilli observed and described by Pacini in his various medical publications, by Prof. L. Maggi.—Further observations on uniform representations, by Prof. Giulio Ascoli.—Note on the traces of Roman jurisprudence in the Longobard edicts, by Prof. P. del Giudice.—Critical examination of the proposed Italian penal code punishments, by E. A. Buccellati.

Bulletin de l'Académie Royale de Belgique, March 7.—A word on the two Balenopteræ cast ashore at Ostend in the years 1827 and 1885, by P. J. Van Beneden.—Observations of Wolf's comet made at the Brussels Observatory (0·15 m. equatorial), by L. Niesten.—Observations of Encke's comet made at the same observatory, by E. Stuyvaert.—On the early epochs of Flemish history, by Alphonse Wauters.—Note on Louis du Tielt, painter and engraver, who flourished at Ypres during the seventeenth century, by Ch. Piot.

SOCIETIES AND ACADEMIES

LONDON

Royal Society, January 22.—"Observations on the Chromatology of Actiniæ," by C. A. MacMunn, M.A., M.D. Communicated by Prof. M. Foster, Sec.R.S.

The conclusions arrived at may in part be summed up as follows.—

(1) *Actinia mesembryanthemum* contains a colouring matter which can be changed into *hæmochromogen* and *hæmatoporphyrin*;

this is present in the other species mentioned above, and from its characters it is provisionally named *Actiniohæmatin*.

(2) It is not actiniochrome (a pigment found by Prof. Moseley in the tentacles of *Bunodes crassicornis*), as its band occurs nearer the violet than that of antiniochrome. Moreover, both actiniochrome and actiniohæmatin can be extracted with glycerin, in which the latter is convertible into hæmochromogen, but the former remains unchanged. Actiniochrome is generally confined to the tentacles, and is not respiratory, actiniohæmatin occurs in the ectoderm and endoderm, and is respiratory.

(3) A special colouring matter is found in *Sagartia parasitica*, different from either of the above, and this too exists in different states of oxidation. It is not apparently identical with that obtained by Heider from *Cerianthus membranaceus*.

(4) In the mesoderm and elsewhere in *Actinia mesembryanthemum* and other species, a green pigment occurs which alone and in solution gives all the reactions of *biliverdin*.

(5) *Anthea cereus*, *Bunodes ballii*, and *Sagartia bellis*, yield to solvents a colouring matter resembling chlorofucin, and all the colouring matter, which in them shows this spectrum, is derived from the "yellow cells" (= symbiotic algæ), which are abundantly present in their tentacles and elsewhere. It is not identical with any animal or plant chlorophyll, as is proved by adding reagents to its alcoholic solution.

(6) When "yellow cells" are present, there appears to be a suppression of those colouring matters which in other species are of respiratory use.

April 23.—"Magnetisation of Iron." By John Hopkinson, M.A., D.Sc., F.R.S.

The paper contains an account of the results of experiments which have been made on a considerable number of samples of iron and steel of known composition, including samples of cast iron, malleable cast iron, wrought iron, ordinary steels, manganese, chromium, tungsten, and silicon steels. The electrical resistance and the magnetic properties are determined in absolute measure. Amongst the electrical resistances the most noteworthy fact is the very high resistance of cast iron, as much as ten times that of wrought iron. The fact that manganese steel is almost non-magnetic is verified, and its actual permeability measured. The action of manganese appears to be to reduce the maximum magnetisation of steel, and in a still greater ratio the residual magnetism, but not to affect the coercive force materially. It is shown that the observed permeability of manganese steel containing 12 per cent. of manganese would be accounted for by assuming that this material consists of a perfectly non-magnetic material, in which are scattered about one-tenth part of isolated particles of pure iron. Some practical applications of the results are discussed.

April 30.—"Further Observations on Enterochlorophyll and Allied Pigments." By C. A. MacMunn, M.A., M.D.

In a paper read before the Royal Society in 1883, the writer described the spectroscopic and other characters of enterochlorophyll which was obtained from the liver or other appendage of the *enteron* of various invertebrates (hence the name). It is now shown that this pigment is *not* due to the presence of symbiotic algæ, or *immediate* food-products, but is built up by the animal containing it.

Taking the six bands[1] of vegetable chlorophyll in alcoholic solution described by Kraus, the first two and the fourth are coincident with those of enterochlorophyll in a similar solution; the third band is, however, frequently missing from the latter. The fifth and sixth bands belong to the yellow constituent, which Hansen shows to be a lipochrome; the corresponding bands in the case of enterochlorophyll also belong to a lipochrome, and are not always coincident with the lipochrome bands of plant-chlorophyll. This was proved by saponifying enterochlorophyll by Hansen's method (as described in NATURE, vol. xxx. p. 224). But saponification of vegetable chlorophpll changes it considerably, as bands of a solution, before saponifying, do not correspond with those of a similar solution after saponifying. Hansen's results were confirmed as far as the separation of "chlorophyll green" and "chlorophyll yellow" are concerned, and the crystals described by him obtained.

While the dominant band of "chlorophyll green" in solutions of plant-chlorophyll is moved much nearer the violet by saponifying, or split up into two in some cases, the corresponding band of enterochlorophyll disappears *in toto*, or remains in the same place. Another difference was also noted in the case of enterochlorophyll and in the case of *Spongilla* chlorophyll, namely, that it is impossible to bring about a *complete* separation of the constituents in most cases by saponifying and treating as Hansen directs.

All the bands of a solution of *Spongilla* chlorophyll are coincident with those of a similar solution of plant chlorophyll, as already proved by Prof. Lankester and Mr. Sorby.

From the enterochlorophyll of *Uraster rubens* crystals of "chlorophyll yellow" and "chlorophyll green" were obtained by saponifying.

Morphologically, enterochlorophyll occurs—as proved by the examination of fresh-frozen sections—in oil-globules, granules, and dissolved in the protoplasm of the liver cells; no starch or cellulose could be found in such sections after adopting the usual botanical precautions.

Hence enterochlorophyll is an animal product, and a chlorophyll, of which there are probably several occurring in animals.

Geological Society, April 29.—Prof. T. G. Bonney, D.Sc., LL.D., F.R.S., President, in the chair.—James Backhouse, Percy Bosworth Smith, and James Shipman were elected Fellows of the Society.—The following communications were read:—On the structure of the ambulacra of some fossil genera and species of regular Echinoidea, by Prof. P. Martin Duncan, M.B. (Lond.), F.R.S., V.P. Linn. Soc. After noticing the general knowledge which exists about the structure of the ambulacra in the Cidaridæ and the elaborate investigations of Lovén on the Triplechinidæ, the author brought before the Society the results of his own work with and without the co-operation of his fellow-worker in the description of the Echinoidea of Sind, Mr. Percy Sladen, F.G.S., and which referred to the Diadematidæ and the Arbaciadæ of the recent faunas. Starting with the knowledge of the construction of the modern Diadematidæ, the author investigated the genera *Hemipedina*, *Pseudodiadema*, *Pedina*, *Hemicidaris*, *Diplopodia*, and *Cyphosoma*. The necessity for the re-establishment of the genus *Diplopodia* was shown, and a new genus, *Plesiodiadema*, was founded. *Pseudodiadema*, shorn of the forms included in these genera, remains and differs more from *Diadema* than has been believed. The method of the growth of the great plates of *Hemicidaris* was explained, and the comparison between the peristomial plates of some of the Diadematidæ and the universal structure of the ambulacral plates in *Pedina* was made. The author considered that there are six types of ambulacra in the regular Echinoidea, so far as the group has been investigated, there still remaining much to be done. These types are the Cidaroid, Diadematoid, Arbacioid, Echinoid, Cyphosomoid, and Diplopodous. In conclusion the succession in time of the structures which characterise these types was considered.—The Glacial period in Australia, by R. von Lendenfeld, Ph.D. Communicated by W. T. Blanford, LL.D., F.R.S., Sec.G.S. Although several previous writers have suggested that boulders and gravels found in different parts of Australia are of glacial origin, the evidence is vague, and no clear proof of glaciation has been brought forward. During a recent ascent of the highest ranges in Australia, parts of the Australian Alps, the author succeeded in discovering a peak which he named "Mount Clarke," 7256 feet high, and in finding traces of glaciation in the form of *roches moutonnées* throughout an area of about 100 square miles. The best-preserved of the ice-worn surfaces were found in a valley named by the author the "Wilkinson Valley," running from north-east to south-west, immediately south of Müller's Peak and the Abbot Range. No traces of ice-action were found at less than 5800 feet above the sea. The rocks showing ice-action are all granitic, and the fact that the surfaces have been polished by glaciers is said to be proved by the great size of such surfaces, by their occurrence on spurs and projecting points, by many of them being worn down to the same general level, and by their not coinciding in direction with the joints that traverse the rock. In conclusion the author briefly compared the evidence of glacial action in Australia with that in New Zealand.—The physical conditions involved in the injection, extrusion, and cooling of igneous matter, by H. J. Johnston-Lavis, M.D., F.G.S., &c. The great disproportion between the displays of volcanic activity in the same volcano at different times, and between the eruptions of different volcanoes, is a subject deserving the most attentive consideration. The violence of a volcanic outburst does not bear any relation to the quantity

[1] The five bands in a leaf, as described by Kraus, can be seen by using a micro-spectroscope of small dispersion and good substage achromatic condenser.

of material ejected. The union of water with lavas may be compared with the solution of a gas in water; but there is reason to believe that in their deep-seated sources lavas contain little or no water. If igneous matter be extruded through dry strata the eruption might take place without explosive manifestations. But if igneous matter be extruded through water-bearing beds, a kind of dialysis would take place between the igneous and aqueous masses. In this way the tension of the steam in the fluid rock may at last become so great that a fissure will be formed at the surface and volcanic action will follow. In this way the violence of a volcanic eruption will be determined by the quantity of water contained in the strata through which the lava passes in its passage to the surface, and by the temperature at which it reaches the surface. This theory explains the acknowledged sequence of volcanic outbursts of different degrees of violence, and the intervals which occur between them. It also explains the differences between the central and lateral eruptions of a great volcano and the phenomena attending its extinction. The structures of the igneous rocks, whether of basic or acid composition, are greatly modified by the presence in them of volatile ingredients. The succession of events indicated by the structure of Monte Somma and Vesuvius, Roccamonfina, Monte Vulture, and Monte Nuovo show that after a long cessation of volcanic activity we have an extensive production of fragmentary and scoriaceous material, and that this is gradually succeeded by the eruption of lava-streams. The water and other volatile substances, such as sulphates and chlorides, which are given off abundantly in volcanic eruptions, may act as solvents for the various minerals which constitute lavas.

Physical Society, May 9.—The meeting was held in the Physics Theatre of Clifton College, Bristol, in consequence of an invitation from the British Naturalists' Society, Prof. Guthrie, President, in the chair.—Messrs. E. Cleminshaw, E. F. Herrom, and A. L. Selby were elected members of the Society.—The following communications were read:—On evaporation and dissociation, by Prof. W. Ramsay and Dr. S. Young. The authors gave the results of a series of investigations undertaken with the view of determining how far the passage of a liquid into a gas resembled the dissociation of a chemical compound. For this purpose the relation between the pressure and temperature of several dissociating substances such as ammonic carbonate, chloral hydrate, and phthalic acid had been examined. The authors hope shortly to publish the full details of these experiments and the conclusions arrived at.—On a model illustrating the propagation of the electro-magnetic wave, by Dr. S. P. Thompson. The model consists of two sets of beads. Each set is composed of a number of beads fixed to the extremities of wires, and by a suitable mechanical contrivance each executes an approximately harmonic motion at right angles to the wires and the mean plane of the set. The phase of each bead differing by a certain small amount from the succeeding, the whole represents a wave-propagation. The two sets are coloured differently and are so placed that their harmonic motions are executed at right angles about the same axis which represents the direction of propagation of an electro-magnetic disturbance, one wave being the electrostatic and the other the electro-magnetic displacement.—On a self-recording stress and strain indicator, by Prof. H. S. H. Shaw. This instrument was designed for one of Wicksteed's 50-ton single lever machines lately erected in the Engineering Laboratory of University College, Bristol, and has been found very simple and effective. In this testing machine the stress is applied by moving a mass of 1 ton along a lever; this mass is connected by a cord with a vertical cylinder upon the indicator. This cylinder carries a paper wound around it, and turns upon its axis as the mass is moved towards the end of the lever. A pencil capable of a vertical motion bears against this, and thus horizontal distances upon the paper are measures of stress. The strain is measured by the vertical motion of the pencil, the position of which is controlled by a wire attached to the rim of a wheel above, upon the same axis of which are other smaller wheels, any one of which can be connected to a fine wire which is carried horizontally to the upper end of the test-piece passing over a pulley fixed to it, and is fixed to the lower end. Any extension of the test-piece can be multiplied at pleasure on the diagram by attaching the wire to a larger or smaller wheel.—Note on the so-called silent discharge of ozone generators, by Mr. W. A. Shenstone. Mr. Shenstone had arranged some apparatus by which this could be viewed. It seemed to have the characteristics of the Brush discharge.

EDINBURGH

Royal Society, April 20.—Robert Gray, Vice-President, in the chair.—In a paper on the effect of pressure on the temperature of minimum compressibility of water, Prof. Tait showed that the various results obtained admitted of easy deduction from theory.—A note on the variation by pressure of the melting-point of paraffin, &c., by Mr. W. Peddie; and a note on the thermal effects of tension in water, by Mr. G. N. Stewart, were submitted by Prof. Tait.—Mr. Hugh Robert Mill read a paper on the temperature of the water in the Firth of Forth, describing the work done at the Scottish Marine Station in this direction. The annual range of temperature, from summer maximum to winter minimum, was found to vary from nearly 40° F. at Alloa, where the river is fresh at low tide, to 20° at Queensferry, twenty miles seaward, and 10° at the mouth of the Firth thirty-five miles further on. The mean temperature of the water appeared to be the same—47°·5—at all parts of the estuary. From June to September the river was warmer than the sea, from October to May it was colder, the average rise or fall in temperature at any time along the Firth being 0°·07 per mile. During the summer period the surface-water had a higher, and during winter a lower, temperature than that beneath. The annual minimum was reached in February, the maximum in August, and there were indications of the period being delayed toward the open sea. Materials are unfortunately wanting for discussing the variations of temperature in the North Sea beyond the influence of land. Mr. Mill showed curves of the monthly mean temperatures of the water plotted by the use of polar coordinates. Each month was represented by an angle of 30°; the temperature being measured on the radius, equal values were shown as concentric circles. Temperatures so plotted appear as closed curves, and in several cases those for the water resembled a circle placed eccentrically to the circles of reference. This method of curve-drawing has several advantages over that by the use of rectangular coordinates where periodic phenomena are to be represented.—Mr. J. T. Cunningham, of the Marine Station, read a paper on the relations of the yolk to the gastrula in teleosteans and in other types.

Mathematical Society, May 8.—Mr. A. T. G. Barclay, President, in the chair.—Prof. Chrystal read papers on repeated differentiation, and on a process for finding the differential equation of an algebraic curve. Dr. Thomas Muir made a communication on integration formulæ, and gave a historical note on the so-called Simson line.—Mr. J. S. Mackay contributed several mnemonics for certain mathematical constants.

SYDNEY

Linnean Society of New South Wales, Feb. 25.—Prof. W. J. Stephens, M.A., F.G.S., President, in the chair.—The following papers were read:—On some reptiles from the Herbert River district, Queensland, by William Macleay, F.L.S., &c. Five new species are here described, *Hinulia picta*, and *Tetradactylus guttulatus* of the family Scincidæ, and of Ophidians *Nardoa crassa*, *Tropidonotus ater*, and *Hoplocephalus assimilis*.—Notes on certain Ceylonese Coleoptera, described by the late Francis Walker, by A. Sydney Olliff. In these notes Mr. Olliff, who had examined Mr. Walker's types in the British Museum, endeavours to clear up the synonomy of the Clavicorn families. The name *Asana* was proposed for the *Trogosita rhyzophagoides* of Walker, which cannot be referred to any known genus. In form it resembles *Lipaspis*, but is characterised by the presence of a scutellum.—On the flight of birds, by R. von Lendenfeld, Ph.D.

PARIS

Academy of Sciences, May 11.—M. Bouley, President, in the chair.—Remarks on the application of photography to the mapping of the stars by means of MM. P. and Pr. Henry's new objectives, by M. Mouchez. The first essays with an objective of 0·16 m. and a provisionary apparatus proved so successful, that a new instrument has been constructed with two objectives of 0·24 m. and 0·34 m. respectively. Although not yet completely regulated, this instrument has already yielded some remarkable results, fully justifying, if not exceeding, the hopes entertained by astronomers. It appears to have once for all solved the problem how to apply photography to the construction of a map of the heavenly bodies which shall include stars of the 14th and 15th magnitudes.—On the spontaneously reversible spectral rays, and on the analogy between the laws of

their distribution and intensity with those of the hydrogen rays, by M. A. Cornu.—On the electric conductibility of solid mercury and of pure metals at low temperatures, by MM. Cailletet and Bouty. From numerous experiments made with mercury, silver, tin, aluminium, magnesium, copper, iron, and platina, the authors conclude that the electric resistance of most pure metals decreases regularly when the temperature is lowered from 0° to −123°, and that the coefficient of variation is apparently much the same for all. It seems probable that the resistance would become extremely slight at temperatures lower than −200°, although this point has not yet been practically tested.—Note on the action of aluminium on the chloride of aluminium, by MM. C. Friedel and L. Roux.—An inquiry into the reason which renders mechanical exciters incapable of bringing into play the excito-motor regions of the brain proper, by M. Vulpian.—Remarks on MM. A. F. Marion and G. de Saporta's "Evolution of the Vegetable Kingdom," by M. Duchartre.—On a method of reconnoitring the enemy's position at great distances with a description of the telemetrograph, an instrument invented for carrying out these operations (one illustration), by M. A. Laussédat.—On the cure of progressive myopy by the processes of iridectomy and sclerotomy, with remarks on the theory of this ophthalmic affection, by M. H. Dransart.—Note on the theory of the figure of the earth, by M. O. Callandreau.—Remarks on a new and accurate method of astronomic observation by means of a fixed lunette attached to the meridian, by M. Ch. von Zenger. By this simple process the angle of position and the distance of the double stars may be determined and measurements taken of the parallax of the sun or the stars. For simple observations a precision of 0″·02 may be relied upon which is considerably greater than that hitherto obtained by the use of the most accurate and powerful meridian lunettes.—Results of experiments undertaken at the national powder mills of Pont-du-Buis with the regulating apparatus of two turbines for the purpose of testing the conclusions deduced from M. Léauté's memoir on oscillations at long intervals in machinery set in motion by hydraulic agency, by M. A. Bérard.—On the polarisation of the metallic capillary tubes by the flow of fluids under high pressure, by M. Krouchkoll. When a conducting fluid is driven through a capillary metallic tube at a pressure of less than fifteen atmospheres, the tube and the fluid being placed in communication with the mercury of a capillary electrometer, no polarisation of the tube takes place. But if the pressure be raised, the author shows that the tube begins to become polarised, the polarisation increasing with the pressure.—Description of a new electric pile, at once simple and cheap, which has been named the "self-accumulator" by the inventor, M. Jablochkoff. For this pile it is claimed that it emits no odour, that it utilises the local currents which are so troublesome in ordinary piles, and especially that it supplies electric power at a very low price, for in it filings, cuttings, and other waste forms of metals may be employed.—On the tensions and critical points of some vapours, by MM. C. Vincent and J. Chappuis. The author's observations are here confined to hydrochloric acid and the chloride of methyl, the object being to show how the maxima tensions of a series of liquefied gases vary with the temperature, to determine the critical points of these products, and to compare the results obtained for the purpose of verifying the hypotheses advanced by MM. Nadejine and Pawlowsky. — Note on the oxychlorides of aluminium, by MM. P. Hautefeuille and A. Perrey.—On the apparent volatilisation of silicum at a temperature of 440°, by MM. P. Hautefeuille and A. Perrey.—Note on a method of preparing arsenical acid, and on the existence of combinations of arsenious and arsenical acids, by M. A. Joly.—On the limit of combination for the bicarbonates of magnesium and potassium, by M. R. Engel.—On a hydrochlorate of protochloride of chromium, by M. Berthelot.—A calorimetric study on the effects of the tempering and cold-hammering of cast steel, by M. Osmond.—Remarks on the mineralogical constitution of the Sierra Nevada of the Iberian Peninsula, by M. Guillemin-Tarayre.—On the liberation of carbonic acid and the absorption of oxygen by leaves kept in dark places, by MM. P. P. Dehérain and L. Maguenne.—Note on a new gutta-percha plant, by M. E. Heckel. As a substitute for the Isonandra gatta, Hooker, which is threatening to disappear, the author proposes the *Butyrospermum Parkii*, Kotschy, which possesses similar properties, and which is widely diffused throughout equatorial Africa, between Upper Senegal and the Nile basin.—A fresh contribution to the question of the origin of boric acid: analysis of the Montecatini waters between Florence and Pistoja, by M. Dieulafait.—On an arrangement enabling the observer to follow with the eye the phenomena presented by aquatic animals subjected to a pressure of 600 atmospheres, by M. P. Régnard.—On a new apparatus intended to detect infinitesimal quantities of blood wherever present in fluids or on solid substances, and named the "hema-spectroscope" by the inventor, M. M. de Thierry.—On pathological urines, by M. A. Villiers.—Note on a method for measuring the intensity of sensations, and especially those of colour, by M. Aug. Charpentier.—On the formation and development of the spores in *Cladothrix dichotoma*, by M. A. Billet.—A study of the Bacterium ureæ, by M. A. Billet.—Remarks on the cause of a new epidemic recently prevalent amongst the domestic ducks in the neighbourhood of Castres, Tarn, by M. A. Caraven-Cachin. This disease, which at one time raged with great violence, was ultimately traced to the leaves of the *Ailantus grandulosa*, Desf., or varnish of Japan, growing in the district and eaten by these birds.

BERLIN

Physiological Society, April 17.—Prof. Busch spoke on anomalies in human teeth, and illustrated his observations in part by preparations laid before the Society, in part by plaster casts. In the first place he treated of anomalies of situations he had observed in teeth—the horizontal position of a wisdom tooth, which, pressing against the third molar, produced inflammation in the latter; the projection of teeth through the alveolar wall of the maxilla on the anterior or posterior side, an occurrence happening mostly in the case of permanent canine teeth which pushed their way through at a late period, when there was no place left for them in the jaw; the exchange of situation between the canine tooth and the first bicuspid in the order of the teeth. Another kind of anomalies respected the number of the teeth, especially of the incisors. Instead of the normal number of four in each jaw, five were now and again observed, and in a few, very rare, cases, as many as six. On the other hand, there were cases of only two incisors with a correspondingly large lacuna. The failure of the wisdom tooth was not a rare occurrence. Anomalies of dental structure the speaker illustrated by pieces of ivory, which presented very remarkable deviations from the normal course of their fibres. In human teeth there had to be considered under this head enamel pearls, that is, smaller or larger round drops of enamel adhering to the roots, and having no connection with the crown. Anomalies of size were very rare. The breadth of the physiological variations amounted to about 3 to 5 mm. Now and again, however, enlargements were observed as high as 10 mm., and diminutions as low as to 0·9 cm. In the latter case crown and root had each transformed itself into the shape of a cone. Enlargements affected the root more frequently than the crown. Anomalies of the root were sometimes seen in curves shaped like an S or hook, but more frequently in the increase or diminution of the number of the roots. More than five outspread roots, more or less perfect, had never been observed. Molars of the lower maxilla were not unfrequently found with three, and bicuspids with two separate roots. In incisors and canine teeth divisions of the tips of the roots were occasionally found with two pulps, or more or less deep segmentations. A diminution, as well as an increase in the number of the roots had also been observed; yet was the coalescence of separate roots of rarer occurrence than their increase by splitting. The frequency of the anomalies referred to was not great. Out of nearly 11,000 teeth examined, only about 100 anomalous specimens had been found. Still more seldom did swellings occur on the teeth. These were sometimes soft, and consisting of connective tissue; sometimes completely calcified without containing one of the tooth tissues differentiated; sometimes situated on the crown, sometimes on the root. These Odontoma, like the teeth themselves, were always to be found in particular grooves of the maxilla. No osseous coalescence of the teeth and maxilla had ever been observed. At the close the speaker produced casts of gums which showed very considerable variations in their curves, ranging from an entirely flat up to a highly arched form.—Prof. Christiani communicated briefly the results of experiments carried out by Herr Gnezda on the poison of the cobra di capello (*Naja tripudians*). The poison was obtainedin India by causing the snakes to bite into snails or mussels wrapped in gutta-percha and filled with water. The watery solution thus obtained was reduced by evaporation. Of its physical and chemical qualities it was to be remarked that the

poison belonged to the class of propeptons. Experiments were instituted with representatives of all the vertebrata. They were all susceptible of the poison, and died when the dose of the poison amounted to 3mg. per kilogramme animal. The time when death followed a full dose of the poison was very various. Rabbits died after half an hour, pickerels after an hour, frogs later, then cats, and lastly pigeons. Stronger doses hastened death. Dilutions and the introduction of artificial respiration delayed death. The physiological effect extended principally to the central nervous system. The muscles and the peripherical nerves continued irritable, although paralysis set in very soon. Seldom were spasms and compulsory movements observed. The poison appeared to have hardly any effect at all on the heart.

Physical Society, April 24.—Dr. Kayser reported on a recent paper of Prof. Bunsen (*Wiedemann's Annalen*, 1885, Heft 3) in which the differences between the results of the speaker's experiments regarding the absorption of carbonic acid on smooth glass surfaces and those published by Prof. Bunsen two years ago received their explanation. While, namely, Dr. Kayser had found that the absorption of carbonic acid proceeded according to definite laws formulated by him, Prof. Bunsen had observed that this process of absorption did not terminate even after as long a period as three years, but still continued, even though at a reduced rate. In his most recent work Prof. Bunsen had now established that the glass threads, even after a current of dry air had been for a considerable time directed over them, still retained a layer of water which was thin in proportion as the temperature was high, but did not become entirely dissipated till the temperature reached as high as about 500° C. This layer of water it was which absorbed the carbonic acid, and all the more powerfully the denser was the layer of water. The density of the water, however, stood in inverse relation to its thickness. From these experiments Dr. Kayser concluded that the absorption of carbonic acid on the glass threads which Prof. Bunsen had observed continuing for so long a period was only an absorption of the gas by the adhering water and no absorption on the smooth glass surface, whereas in the speaker's experiments, in which the glass threads had in boiling oil been freed from all adhering matters, the carbonic acid had been absorbed by the smooth glass.—Dr. Less spoke of two curves placed before the Society, as markings of the barograph on April 22 and 23 during the time of the brief thunderstorm in Berlin. The two curves presented in general an analogous course, concurring, moreover, with curves which Dr. Less had observed last year during the severe July storm. Before the outburst of the thunderstorm the curves sank slowly, next rose steeply to a considerable height; with the attainment of the maximum of pressure coincided the stroke of lightning; the curve then maintained itself at a level for some time, throughout which the thunder-shower or hail was wont to fall; on the cessation of rain the curve of atmospheric pressure sank steeply to beneath the former minimum. In the two April curves a further sudden rise preceded the second weaker stroke of lightning, and there then followed several smaller jerkings of the curves coinciding with the time of the formation of clouds consequent on the short thunder-storm. In the curves of the July of last year during the severe storms so copiously charged with lightning, the apex of the curves after the sudden ascent was not straight, but consisted wholly of short indentations each of which appeared to correspond with an individual lightning stroke, so far as it was possible to fix the precise times. The sudden steep ascent of the curve on April 22 and 23 coincided with a sudden increase in the force of the wind, which soon, however, fell weaker, and at last sank almost to complete stillness. The speaker also reported the corresponding numerical values for the variations of atmospheric pressure marked by the barograph.

VIENNA

Imperial Academy of Sciences, March 5.—Contribution to a knowledge of Coniopterigidæ, by F. Löwe.—On a new morphological element of peripheric nerves, by A. Adamkiewicz.—On the sensibility to light and colours of some marine animals, by V. Graber.—On some propagatory organs of the fruits of Compositæ, by M. Kronfeld.—On the fauna of the Jurassic deposits of Hohenstein, Saxony, by G. Bruder.—On mannite lead-nitrate, by A. Smolka.—Note on Löwe's lead-nitrate and on Morawski's penta-plumbonitrate, by the same.—On the temperature of Vienna and its environs, with a study on the action of local influences on the mean temperature, by T. Hann.—On camphoronic acid, by T. Kachler and F. V. Spitzer.—On the daily and yearly course, and on the period of disturbances of magnetic declination at Vienna, by T. Liznar.

March 12.—On nerve-corpuscles, by A. Adamkiewicz.—On the use of boiling oxygen, nitrogen, carbon oxide, and atmospheric air as a freezing-agent, by S. von Wroblewski.—Contribution to a knowledge of the texture of hyaline cartilage, by E. Zuckerkandl.—On the Upper Italic flora of the Lunz strata and of the bituminous slate of Raibl, by Dr. Stur.

March 19.—Crystallographic researches on camphor derivates, by V. von Zepharovich.—Experimental studies on the determination of the constant of dielectricity of some gases and vapours, by T. Klemencie.—On the planes of solution of calcareous spar and arragonite, by V. von Ebner.—On figures obtained by corroding arragonite, by the same.—On a meteoric explosion observed at a distance of 1000 metres by R. Spitaler on March 15, by E. Weiss.

UPSALA

Society of Science, April 17.—The following paper, by Dr. K. B. J. Forssell, was accepted for insertion in the Society's *Journal*:—"Beiträge zur Kenntniss der Anatomie und Systematik der Gloeolichenen." Prof. Lilljeborg described a *Metridia armata* (Boeck) taken in the Antarctic Ocean (lat. 54°–5° S.), and suggests that it was probably found near both poles. It was taken by Capt. Schéele, of the Swedish barque *Monark*, an amateur scientist to whom the Society had lent instruments, vessels, and apparatus for deep-sea researches. He further exhibited *Pluroma abdominale* (Lubbock), also taken by Capt. Schéele in the South Atlantic. It was remarkable as having an appendicular eye on the side of the head.—Prof. Hildebrandsson spoke about the twilight phenomenon, specially with reference to some observations of the purple glimmer then prevailing, made by Dr. Gyllenskjöld.—Prof. Clason gave a lecture on the functions of certain parts of the brain.

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