THURSDAY, JANUARY 29, 1891.

UNIVERSITY COLLEGE AND ITS APPEAL FOR FUNDS.

UNFORTUNATELY it is an economic fact, that, under existing conditions, the highest education cannot be self-supporting. The more advanced the teaching, the smaller the class, and as a result the amount of fees received. The pursuit of knowledge in the highest sense, as has often been said, is one of the nineteenth century forms of "a vow of poverty." Research must be endowed; if not, it must be alimented by other pursuits, that is, by temporary desertion. But with certain branches of knowledge the teacher is not the sole cause of expense. In pure mathematics a blackboard, which is not a costly piece of apparatus, is almost the limit of his reasonable requirements. In classics and literature generally some maps and photographs content all but the most exacting; a few casts and models in addition place him in a state of pedagogic luxury. But in science, as the word is commonly understood, especially in the physical and natural departments, the teacher requires laboratories and museums, apparatus and specimens, which often are costly. Science, in short, as unfriendly critics in other departments are wont to say, is like a daughter of the horse-leech, always crying "give, give."

At the present time the two University Colleges in London are suffering from the pinch of poverty, and fearing that atrophy of the purse will result in diminution of efficacy. University College and King's College are appealing to the public simultaneously and with mutual goodwill, for a capital sum to enable them to provide for several pressing wants, more especially for additional laboratories and appliances required by students in an age of scientific progress. Of these two colleges, the former may be said to appeal *urbi et orbi*. It was founded some sixty years ago, at a time when the older universities were closed to all who could not subscribe to certain theological tests, practically to all but members of the Established Church of England. This position it has ever maintained. Its chairs and its lecture-rooms are open to all without respect of creed.

A committee is now being formed in order to make an appeal to the public, and especially to the citizens of London, on the basis of a statement issued by the Council of University College. It asks for a sum of not less than fifty thousand pounds, to be devoted mainly to the increase of buildings and appliances for teaching. The most pressing need is a new physical laboratory. That which at present exists was opened in the session of 1867–68. It was not built for the purpose, being merely one of the College lecture-rooms, but it was the first laboratory of its kind opened in London. Since then other rooms have been added, but all the arrangements are of a makeshift character. Additional space is absolutely necessary. At present the students are too much crowded; it is impossible to keep the more important instruments in fixed places, so that much time is lost and risk of injury incurred by moving them about, and advanced work or original investigation has become almost impossible. Grave difficulties also arise from want of steadiness in the floors, and from unfavourable magnetic conditions caused by local circumstances, such as the arrangements for warming the building. Hardly less pressing is the need for improving the means of teaching electrical engineering, in which instruction has now been given for about five years with yet more inadequate appliances. At the present moment hardly any branch of technical physics is of greater practical importance, and it cannot be better taught than in a college where a sound knowledge of pure and applied mathematics, of physics and of mechanical engineering, can be obtained.

The last-named of these subjects also calls for funds. The engineering laboratory dates from 1878, and for some years was the only one in this country. The system of laboratory instruction, initiated by the late professor, Mr. A. B. W. Kennedy, has been adopted in all the leading engineering schools in Great Britain. This has led to a very remarkable development in the methods of engineering education, so that additional space and additional machines are required to enable University College to retain the position which it has obtained as an engineering school.

A Professorship of Architecture was founded fifty years ago at University College, and was for long the only Professorship of the kind in England. It is very desirable to form a collection of architectural models, and a school of architectural drawing. The College appears to be a place exceptionally suited for a complete school of architecture, because of the existence of the Slade School of Fine Art, as well as an engineering school.

Further, the Society for the Extension of University Teaching in London finds that the lectures on chemistry and physics, given under its auspices, require to be supplemented by evening classes for laboratory instruction. A scheme is being drawn up, the main outlines of which have been already approved by the Council of University College, to provide for this want; but as the existing laboratories are already fully occupied, and the apparatus in use by more advanced students during the day cannot be cleared away to make room for an evening class, additional rooms will be required.

Lastly, many of the professors are insufficiently remunerated. For instance, with the single exception of English, no language-chair has, as yet, been adequately endowed. The Council is anxious to extend the teaching of European languages and to co-operate with the Imperial Institute in the development of its school of modern Oriental studies, in which work King's College also is giving effective aid. But this work cannot be self-supporting at present, if, indeed, it ever become so; and how are good teachers to be secured without some assured stipend?

It is, then, to be hoped that the citizens of London will not prove less liberal in the cause of education than those of Manchester, Liverpool, Birmingham, and other great towns. It may be said that in these the University College is the sole place of higher education, but that in London other institutions now exist in which such training may be obtained. Possibly there may be some truth in this remark, but if so, it would be an ungenerous answer to the present appeal. These two Colleges, and University College especially, have borne the burden and heat of the day. For many years it met a great and crying want. It cannot be charged with having failed in its duty. It may point in honest pride to the teachers who have occupied its chairs, to the many men of eminence in science, in literature, and in various professions, especially those of Medicine and Law, who have been trained within its walls. It is a standing monument of the munificence of a past generation; it has, indeed, received, within the last few years, more than one liberal bequest, but these are not applicable to the present, most urgent, need; so that, unless further aid be given, its usefulness must be diminished.

WESTERN CHINA.

Three Years in Western China: a Narrative of Three Journeys in Szechuan, Kweichow, and Yunnan. By Alexander Hosie, M.A., F.R.G.S., H.B.M.'s Consular Service, China. With an Introduction by Mr. Archibald Little. (London: George Philip and Son, 1890.)

IN the year 1876 certain serious disputes between Great Britain and China were brought to an end by an agreement known, from the place at which it was negotiated and signed, as the Chefoo Convention. One of the provisions of this famous instrument was that the British Government might send officers to reside at Chungking, on the Yangtsze, in Szechuan province, in order to study the conditions of British trade in that region. Beginning with 1877, a succession of junior officers of the British Consular Service in China have been stationed at Chungking, and from this great commercial mart as a centre have travelled far and wide in parts of China hitherto wholly, or almost wholly, unknown to the West. The late Mr. Colborne Baber was the first of these, and his travels are recorded in the special volume of the Royal Geographical Society, "Travels and Researches in Western China," which the late Colonel Yule described as "that admirable and delightful narrative which the periodical press has allowed to pass almost absolutely unnoticed—taking it, I suppose, for a Blue-book, because it is blue!" The reports of these officers have from time to time been laid before Parliament, and are amongst the most interesting publications ever issued in this way. Not long ago a report from Mr. Bourne, Mr. Hosie's successor, recorded a journey from Chungking across Yunnan to the frontier of Tonquin, along that frontier towards the sea, and then back again across Kweichow province to Chungking; but this, though full of interesting and important information relating to the country, the people, and especially to the trade between Tonquin and Southern China, remains more or less inaccessible in its present shape. Mr. Hosie has followed Mr. Baber's example, and has prepared for popular perusal an account of his journeyings. He is fortunate in the time and circumstances of the publication, for, by a recent agreement between the British and Chinese Governments, the town of Chungking is to be opened, under certain conditions, to the trade and residence of British merchants. The book contains an introduction by Mr. Archibald Little, whose name has for some years been associated with efforts to navigate the upper waters of the Yangtsze, and to throw Chungking open to foreign trade.

Mr. Hosie's journeys carried him in various directions, and had various objects in view; but, naturally, he avoided as far as possible the footsteps of his predecessors. His first journey, which lasted for nearly ten weeks, took him southward from Chungking into the mountainous province of Kweichow, where he came across the aboriginal Miao-tsze, now almost extinct, to Kwei-yang-fu, the capital, whence he turned westward to Yunnan-fu, the capital of the province of the same name, and so by the mountains of North-Eastern Yunnan home to Chungking. On this journey, besides the Miao-tsze he first saw the white-wax insect, about which he has much to say later on. The second journey lasted nearly six months, and carried the traveller through a more interesting and less-known region. From Chunking he travelled to the north-west across the great plain of Cheng-tu, noted for its extraordinary fertility, the density of its population, and the wealth of its inhabitants. From another point of view, also, it is notable as the only large area of level ground in all Western China; it is a plateau about 7000 feet above the level of the sea, at the foot of the mountains of Tibet, and has an area of about 2400 miles. Richthofen says of it that there are few regions in China, equal areas compared, which can rival it in wealth and prosperity, density of population and productive power, fertility of climate and perfection of natural irrigation; and there is no other where, at the present time, refinement and civilization are so generally diffused among the population. From the city of Cheng-tu, the administrative capital of Szechuan, Mr. Hosie turned to the south-west through the districts inhabited by the Lolos, an aboriginal tribe, discovered practically by the French Expedition under De Lagrée and Garnier, and further investigated by Mr. Baber and Prof. de Lacouperie. Thence he passed into the famous valley of the Chien-chang, and to the city of the same name, the Caindu of Marco Polo, which is the centre of the insect white-wax trade, and following the track of the great Venetian arrived at Tali-fu in Yunnan, the Carajan of Marco. The brine industry which the old traveller found flourishing—it was here that cakes of salt were used as currency—still exists. From this city, Mr. Hosie, passing through Yunnan-fu and by the valley of the Chi-hsing River, reached Chungking.

Mr. Hosie's third journey was in one sense the most interesting of all, for, although the country traversed was not all new, the object was to study carefully, for the authorities at Kew, the Chinese insect wax industry. He decided for this purpose to visit the centre of the wax culture of the province, to ascend by the way the sacred Mount Omei, from whose summit the glory of Buddha is said to be visible, and then to strike the Yangtsze at its highest navigable point. The mountain, which is about 11,000 feet high, has been devoted to the worship of Buddha almost since the beginning of our era, and is sufficiently remarkable from a physical point of view. Mr. Hosie devotes a special chapter to the white-wax insect, and the industry associated with it, in which he traces the career of the *Coccus pe-la* of Westwood from its cradle, through its busy and interesting life, to its dishonoured grave. It is only in quite recent years, and mainly through Mr. Hosie's journey, that the mystery surrounding the industry has been cleared up. The subject was frequently referred to in older works in China, and the chief object of Mr. Hosie's journey was to procure for Sir Joseph Hooker specimens of the foliage, of the flowers, and trees, on which the insects are propagated, specimens of the living incrusted white-wax, samples of the latter as it appears in commerce, and Chinese candles made from it. The Chien-chang valley already alluded to, which is about 5000 feet above the level of the sea, is the great breeding-ground of the white-wax insect. One very prominent tree there is known to the Chinese as the insect tree. It is an evergreen with the leaves springing in pairs from the branches, very thick, dark green, glossy, ovate, and pointed. In May and June the tree bears clusters of white flowers, which are succeeded by fruit of a dark purple colour. The Kew authorities have come to the conclusion that it is *Ligustrum lucidum*, or large-leaved privet. In March, when Mr. Hosie saw the trees, he found attached to the bark of the boughs and twigs numerous brown pea-shaped excrescences. The larger of these were readily detachable, and, when opened, presented either a whity-brown pulpy mass, or a crowd of minute animals like flour, whose movements were just perceptible to the naked eye. From two to three months later these had developed in each case into a swarm of brown creatures each provided with six legs and a pair of *antennæ;* each of these was a white-wax insect. Many of the excrescences also contained either a small white bag or cocoon covering a pupa, or a perfect imago in the shape of a small black beetle. This beetle is a species of *Brachytarsus*. If left undisturbed, the beetle, which is called by the Chinese the "buffalo," will, heedless of the *Cocci*, continue to burrow in the inner lining of the scale which seems to be its food ; the beetle is, in fact, parasitic on the *Coccus*. When a scale is plucked from the tree the *Cocci* escape by the orifice which is made. Two hundred miles to the north-east of the Chien-chang valley, and separated from it by a series of mountain ranges, is the town of Chia-ting, in which insect white-wax as an article of commerce is produced. The scales are gathered in the Chien-chang valley, and are made up into paper packets each weighing about 16 ounces. Sixty of these packets make a load, and are conveyed by porters from Chien-chang to Chia-ting (in former years there are said to have been as many as ten thousand of these porters). They travel only during the night, in order to avoid the high temperature of the day, which would tend to the rapid development of the insects and their escape from the scales. At the stopping-places the packets are opened out in cool places, but in spite of this each packet is found to have lost on an average an ounce in transit. A pound of scales laid down in Chia-ting costs, in years of plenty, about half-a-crown ; in bad years the price is doubled. In favourable years a pound of scales will produce four to five pounds of wax. In the plain around Chia-ting the plots of ground are thickly edged with stumps varying from 3 or 4 to 12 feet high, with numerous sprouts rising from their gnarled heads, and resembling at a distance our own pollard willows. The leaves spring in pairs from the branches, and are light green, ovate, pointed, serrated, and deciduous. The tree is said in all probability to be the *Fraxinus chinensis*, a species of ash. On the arrival of the scales from Chien-chang about the beginning of May, they are made up in small packets of from twenty to thirty scales, which are inclosed in a leaf of the wood-oil tree. The edges of the leaf are tied together with a rice straw, by which the packet is suspended close under the branches of this ash, or white-wax tree as the Chinese call it. A few rough holes are drilled in the leaf with a blunt needle, so that the insects may find their way through them to the branches. On emerging from the scales, the insects creep rapidly up to the leaves, among which they nestle for a period of thirteen days. They then descend to the branches and twigs, on which they take up their position, the females doubtless to provide for a continuation of the race by developing scales in which to deposit their eggs, and the males to excrete the substance known as white wax. This first appears as an undercoating on the sides of the boughs and twigs, and resembles sulphate of quinine, or a covering of snow. It gradually spreads over the whole branch, and attains, after three months, a thickness of about a quarter of an inch. After the lapse of a hundred days the deposit is complete, the branches are lopped off, and as much of the wax as possible is removed by hand. This is placed in an iron pot of boiling water, and the wax, on rising to the surface, is skimmed off and placed in a round mould, whence it emerges as the white-wax of commerce. Where it is found impossible to remove the wax by hand, the twigs and branches are thrown into the pot, so that this wax is darker and inferior. The insects, which have sunk to the bottom of the pot, are placed in a bag and squeezed of the last drop of the wax, and are then thrown to the pigs. The wax is used for coating the exterior of animal and vegetable tallow candles, and to give greater consistency to the tallow. It is also said to be used as a sizing for paper and cotton goods, for imparting a gloss to silk, and as a furniture polish.

Such is a brief summary of the account given by Mr. Hosie of this extraordinary industrial product. Those who wish to know more of the subject will find it in chapter xi. of the present volume, and in certain Parliamentary Reports therein referred to. In his last chapter Mr. Hosie refers to the non-Chinese races of Western and South-Western China, a subject about which very little is known, but which is of great interest to the ethnologist. In an appendix he gives exercises on the language of the Phö tribes. There is also an excellent sketch-map of South-West China to illustrate the journeys. It will thus be seen that, although the main object of Mr. Hosie's explorations was trade, the volume contains much matter of scientific interest. It is written in a simple and entertaining manner, and takes a very high rank indeed in the records of recent travel in that interesting region. Members of Her Majesty's service possess the great initial advantage of being thoroughly acquainted with the Chinese language and the Chinese people. How far this has aided Mr. Hosie in his journeys, and especially in his book, will be evident to all readers. As a sting in the critical tail, however, we venture to take exception to the transliteration of Chinese names which Mr. Hosie has adopted, and which appears to us to be growing too common amongst Chinese scholars. We fail to see the object of those eccentric combinations of letters and points, of which "Ssŭ-ch'uan," as applied to the name of the great province in which Mr. Hosie's journeys mainly lay, affords an example. If it be admitted—and we think it must be—that any combination of our letters cannot be more than an approximation to the Chinese sounds, which, by the way, vary almost indefinitely throughout the country, it would seem more reasonable to adopt a simple combination than a very elaborate and difficult one. We have always thought that, in this matter of transliteration, it is better, in order to avoid confusion and complication, to "stand on the ancient ways," however defective they may be, than to change them for others, of which the most that can be said is, that they are less defective.

THE GENUS STELLETTA.

Die Gattung Stelletta. Unter Mitwirkung von F. E. Schulze. Bearbeitet von R. von Lendenfeld. Mit 10 Tafeln. (Berlin: Georg Reimer, 1890.)

OSCAR SCHMIDT, in the year 1862, in his well-known work on the sponges of the Adriatic Sea, established the genus Stelletta for a group of tuber-like corticate sponges. Schmidt described several species from the Adriatic, and others still, in after years, from the coast of Algiers and from the Gulf of Mexico. After Schmidt, Carter took up the task of describing new forms, and he added many to the list between the years 1880 and 1886. Sollas, also, in his great work on the Tetractinellida of the *Challenger* Expedition, with a large mass of material before him, took the genus as the type of a family, and grouped beneath it a number of new genera and species.

The work that had been done, therefore, during these past eight-and-twenty years has been very considerable, and we opened this monograph on the genus Stelletta, by Dr. R. von Lendenfeld, with great expectations, thinking to find therein a masterly account of the whole group. The first and second pages give a neat though condensed account of the origin of the genus, which in the first lines is described according to the "diagnosis" of Dr. Lendenfeld, followed no doubt closely by the original "diagnosis" of Schmidt; then comes, on the next page, a statement which at once arrested our attention, to the effect that Sollas's family Stellettidæ, with its four sub-families and their genera, were all "in our sense" but species of Stelletta.

Now in a large volume lately published, under the auspices of the Royal Society of London, on the "Horny Sponges," by Dr. Lendenfeld (1889), he gives us a classification of the phylum, in which he adopts the arrangement of Sollas, as "embodying the latest results." No doubt, we reasoned, Lendenfeld's researches on the forms of this genus, the investigation of a mass of material far exceeding that which the *Challenger* brought together, and the assistance of that without any doubt most able investigator, F. E. Schulze, with whose assistance this memoir was written, had brought all this change in his views to pass. We called to mind that Dr. Lendenfeld's views of genera and species were somewhat peculiar: has he not himself written, "it is impossible to give a definition of what I mean by a genus, species, or variety" ("Horny Sponges," p. 835)? and then again, in referring to the labours of Polejaeff, he tells us he does not establish any new genera; he is of opinion that there are virtually only three genera of these horny sponges to be distinguished, and he is further of opinion that these sponges should be considered as one family. "Considering the very limited material at the disposal of Polejaeff, we (Lendenfeld) cannot be surprised that he should have arrived at an opinion so very different from that of all other writers on the subject." So that, however peculiar Lendenfeld's views might be, yet he was sure to base them on a fair quantity of material. Thus reasoning, we resumed our reading of his memoir on the genus Stelletta.

We read through a list of species "which, with greater or less certainty, we place in this genus, taking, however, no account of synonyms." This list extends over four pages, and contains "sixty-nine" forms. Immediately after the list we read: "The material which was at our service was in part collected by ourselves in the Gulf of Trieste and near Lesina, in part preserved and sent to us by Dr. Græffe. Five species, *Stelletta grubei*, *S. dorsigera*, *S. boglicii*, *S. pumex*, and *S. hispida*, were with great exactness examined."

We turned over the next page, and it was at once evident that the memoir was no monograph of the genus, but a no doubt very exact account of these five species, of which four were described long ago by Schmidt, and one, *S. hispida*, quite recently by Buccich and Marenzeller; and even of these five, though all are figured in the ten plates which accompany this memoir, yet of one, *S. pumex*, O. Schmidt, there is only a brief diagnosis given. Of the four species mentioned, most careful descriptions are given, and these are accompanied by good figures of the mega- and microsclere, and the histology of each species. The sections are very pretty, but distinctly schematic.

The memoir certainly is a useful contribution to our knowledge of the Adriatic species of the genus Stelletta, though it cannot be said to add much to that knowledge; and it is, moreover, interesting as shadowing out in some measure the lines on which our author purposes, no doubt, to write his monograph of the corticate sponges, in which he will justify his assertions as to the genera and species of Sollas. He gently reproves Marenzeller for referring, in his recent memoir on the Adriatic species of this genus, *S. grubei*, *S. boglicii*, *S. dorsigera*, and *S. anceps* to a single form, to be known as *S. grubei*, and he states that he cannot agree with him (p. 6); but seeing what he hints as to the future of the numerous species described by Sollas in the *Challenger* Report (p. 14), it would not surprise us if in the next volume on sponges, brought out, let us hope, under the auspices of the Royal Society, Dr. Lendenfeld returns to the early views of Polejaeff, and perhaps even to those of Marenzeller. There is little difficulty in seeing how this could be done—a new character added to a genus (see p. 57), and so it can be made to hug within its embraces a whole new lot of forms; repeat the process, and you likewise increase the progeny that will lay claim to be included. It does seem impossible to give a definition of what Dr. Lendenfeld means by a genus, but in time he may be able to do so himself.

CORAL ISLANDS AND REEFS.

Die Theorieen über die Entstehung der Koralleninseln und Korallenriffe und ihre Bedeutung für geophysische Fragen. Von Dr. R. Langenbeck. (Leipzig: Wilhelm Engelmann, 1890.)

IN this work, an octavo volume of 190 pages, rather closely printed, Dr. Langenbeck gives a critical history and discussion of the controversy on the origin of coral reefs, commencing with the publication of the first edition of Darwin's well-known book. It consists of a preface, which gives a brief historical summary of the literature of the subject, and six sections. The first one deals with the coral reefs in regions which either are stationary or moving in an upward direction. This deals with the Florida coast, Bahamas, Cuba, Philippines, Solomon Islands, &c. Dr. Langenbeck, in summing up, points out that barrier-reefs, like atolls, can be separated into two classes: the one—such as that off New Caledonia—following the contour of the neighbouring coast line, but separated from it by a deep channel, and rising steeply on the outer side, sometimes from a great depth; the other, like those of Florida—more irregular in disposition, and in close relation with banks of sediment and marine currents.

In the second section Dr. Langenbeck points out that the hypotheses of Murray and Guppy fail to explain the structure of many atolls and barrier-reefs. His argument follows the lines usually adopted by the opponents of these hypotheses, and brings together in a comparatively short compass a large number of important facts. The third section treats of the occurrence of the three types of reefs—fringing-reefs, barrier-reefs, and atolls—in the same neighbourhood, and the evidence of transition from movements in one direction to those in the opposite. The fourth is devoted to a description of the fossil coral reefs in the different geological formations, dwelling especially on their thickness—a matter to which reference has often been made in recent controversies. This, perhaps, is the most valuable portion of the book, for after briefly referring to the difficulties in obtaining the evidence, Dr. Langenbeck gives a summarized account of the coral reefs which hitherto have been observed. Reefs, sometimes of considerable thickness, occur in the Silurian, but they are developed on a much larger scale in the Devonian. In the Asturias they attain a thickness of 100 metres, but this is much exceeded in Western Carinthia, where the maximum thickness amounts even to 700 metres. In the Carboniferous and Permian, reefs, as a rule, are poorly developed, but they are found on a grand scale in the Alpine Trias. These are described, together with a summary of the discussion relating to them since von Richthofen first asserted the dolomite masses of the South-East Tyrol to be ancient reefs. The evidence supplied by the remainder of the Mesozoic and the Tertiary period is reviewed, and that afforded by the hill El Yunque, in Cuba, regarded as an elevated coral reef, which is fully 300 metres thick, is not forgotten. The present distribution of coral reefs is described in the fifth section; and in the last they are discussed in relation to various theories of a more general nature, among them that of Suess in regard to an accumulation of the ocean in equatorial and Polar regions.

Dr. Langenbeck's conclusion as to the main question is nearly the same as that expressed by the editor of the third edition of Darwin's "Coral Reefs" (which he does not appear to have seen), viz. that, while it is not applicable in every instance, yet it is the only one which can explain the peculiarities of very many coral islands and reefs in all three oceans—that is to say, he considers that Darwin's "subsidence" hypothesis holds its own as a general explanation. But whether his conclusion be accepted or not, the value of his book can hardly be questioned as a very full, laborious, and conscientious summary of the observations which have been made since the publication of Darwin's classic work. As a book of reference it will be most useful to all who are interested in the history of coral reefs.

OUR BOOK SHELF.

Fauna der Gaskohle und der Kalksteine der Permformation Böhmens. By Dr. Anton Fritsch. Vol. II. Part 4 (pp. 93–114, pls. 80*b*–90); Vol. III. Part 1 (pp. 1–48, pls. 91–102). 4to. (Prag: Fr. Řivnáč, 1889–90.)

DR. ANTON FRITSCH still continues to issue annual instalments of his great work on the Permian Vertebrata o Bohemia, and the two latest parts are specially devoted to an account of the remarkable Palæozoic group of Elasmobranch fishes, of which *Pleuracanthus* is the earliest described type. No less than twenty-two plates and upwards of sixty figures in the text illustrate the skeletal anatomy of these fishes in a manner that has not hitherto been attempted; and there is a supplemental plate in the first of the two parts representing the finest known example of the Dipnoan genus *Ctenodus*. The Bohemian material at the disposal of Dr. Fritsch is, indeed, so much finer than any previously studied and scientifically described by an ichthyologist that the memoir now before us marks an important advance in our knowledge both of the primitive Elasmobranchii, and to a certain extent also of the Dipnoi.

Ichthyologists of the modern school will scarcely assent to the inclusion of the autostylic Holocephali and the hyostylic Plagiostomi in the same order; but Dr. Fritsch's arrangement of the Pleuracanth fishes and the Acanthodii as two special subdivisions of the last-mentioned group will probably be accepted by all who have followed the most recent researches. In the systematic account of the Pleuracanthidæ the three genera *Orthacanthus*, *Pleuracanthus*, and *Xenacanthus*, are recognized, and described in detail, the two latter also forming the subject of beautiful restored figures. There is a concluding chapter summarizing the general results of the investigation; and this is accompanied by some theoretical remarks on the origin of the so-called archipterygium of Gegenbaur, with a series of diagrams to illustrate the principal stages of its supposed evolution and subsequent specialization. Each of the pectoral fins in the Pleuracanthidæ is a biserial "archipterygium," with a tendency towards becoming uniserial; and, according to Dr. Fritsch, there is no pelvic cartilage, the hitherto reputed pelvic element being truly the basipterygium. The dorsal fin is also primitive in the fact that it is much extended, while its endoskeletal supports are in direct connection and numerical relation with the neural arches of the axial skeleton. Otherwise, many striking resemblances between the Pleuracanthidæ and the modern Notidanidæ are observed, and Dr. Fritsch points out for the first time that these two families agree in the possession of more than five pairs of branchial arches.

A future opportunity may be afforded for a discussion of the principal details of the memoir, and it will suffice on the present occasion merely to direct the attention of the pure morphologist, as well as the palæontologist, to one of the most important treatises on fundamental facts that has appeared in the recent literature of the Vertebrata. A. S. W.

The Life of Ferdinand Magellan. By F. H. H. Guillemard. (London: George Philip and Son, 1890.)

THIS volume belongs to the well-known series, "The World's Great Explorers," and is in every way worthy of the volumes by which it has been preceded. It is curious, as Dr. Guillemard points out, that, while the world is year by year presented with biographies of persons for whom a tithe of Magellan's renown cannot be claimed, no life of the great circumnavigator has yet been published in English. Dr. Guillemard, having resolved to write the present book, set to work in earnest to provide an adequate biography. He consulted many old Spanish documents relating to the subject, and did his best to present in a bright and attractive form the materials thus acquired. A good deal of his work is conjectural, but intelligent readers will have no difficulty in discriminating between the established facts of the story and those parts of it which are based merely on probabilities. After an introductory chapter, in which the way is prepared for the right apprehension of the geographical problems of Magellan's age, the author describes the explorer's early life, his Indian service, and his service with Albuquerque and in Morocco. The most important part of the book, of course, is that which relates to Magellan's last voyage, a most careful and spirited account of which in all its stages, so far as they are known, is given by Dr. Guillemard. This portion of the narrative includes, besides what is told about the discovery of the Strait, chapters on South-east America and the mutiny in Fort St. Julien, the Ladrones and the Philippine Islands, the battle of Mactan and the death of Magellan. We are also told how the survivors of the battle of Mactan arrived at the Moluccas, and how they returned to Spain. The volume is well supplied with maps and good illustrations.

Key to Arithmetic in Theory and Practice. By the late J. Brooksmith, M.A., LL.B. (London: Macmillan and Co., 1890.)

THIS is a most voluminous work, comprising as many as 789 pages. Each example is completely worked out, and the methods adopted are straightforward and clear. The book will be found useful by teachers, and it will be a valuable aid to beginners, whom it will enable to follow each step in detail. The late author evidently devoted a great deal of patient labour to the preparation of the volume: for one fully worked out cube root sum takes no fewer than 1269 figures, while others of the same nature employ as many as seven or eight hundred in their solution.

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 intended for this or any other part of* NATURE. *No notice is taken of anonymous communications.*]

The Cold of 1890–91.

ON a number of days during the present severe frost, the temperature at 4 feet was colder than on the grass, causing the upper portion of trees to become loaded with *hoar*, whilst none was deposited on the lower branches. This was a marked feature here in January 1888, during a long prevalence of dense fog.

On December 11, 1890, at 3 p.m., the temperature was 34°·5 on grass, 33°·0 at 4 feet, and 30°·0 at 20 feet; and on the 26th, at 9 a.m., it was 34°·4 on grass, 33°·5 at 4 feet, and 31°·2 at 20 feet.

From the observations of Mr. G. Fellows at Beeston Fields, near Nottingham, the same increase of cold in the air is shown, and also at the same time. These two reports have been tabulated, using the + sign where the upper temperature was lower than that on the grass. It seems desirable to record this phenomenon. Beeston Fields is 206 feet above the sea, whilst Shirenewton Hall is 530 feet, and situated 5 miles from the Bristol Channel. On one occasion this increase of cold in the lower air caused cirri clouds to form over the water of the Bristol Channel.

The excessive cold of more inland localities is not felt here; our greatest cold has been 14° of frost, whilst at Beeston Fields 27° of frost has been registered.

1890. Nov.	Shirenewton Hall. Greatest Cold. 4 Feet.	Shirenewton Hall. Greatest Cold. On Grass.	Shirenewton Hall. Difference.	Beeston Fields. Greatest Cold. 4 Feet.	Beeston Fields. Greatest Cold. On Grass.	Beeston Fields. Difference.
25	30°·0	30°·0	0°·0	28°·8	21°·8	– 7°·0
26	30·0	29·0	– 1·0	28·2	23·0	– 5·2
27	22·0	20·0	– 2·0	23·8	21·0	– 2·8
28	20·0	20·0	0·0	25·3	21·7	– 3·6
29	21·0	21·0	0·0	32·0	25·2	– 6·8
30	25·5	24·5	– 1·0	23·7	10·7	– 13·0
Dec.						
1	31·0	31·0	0·0	26·8	26·0	– 0·8
2	31·0	31·7	+ 0·7	31·9	32·5	+ 0·6
3	31·4	30·0	– 1·4	33·4	31·7	– 1·7
4	34·0	34·0	0·0	34·7	34·0	– 0·7
5	34·0	33·0	– 1·0	36·7	36·2	– 0·5
6	26·0	25·0	– 1·0	35·6	34·7	– 0·9
7	30·0	29·0	– 1·0	29·8	23·0	– 6·8
8	30·0	30·0	0·0	32·2	30·0	– 2·2
9	23·0	22·0	– 1·0	28·4	29·0	+ 0·6
10	29·0	30·0	+ 1·0	28·4	30·7	+ 2·3
11	29·1	30·2	+ 1·1	29·3	30·0	+ 0·7
12	24·0	23·0	– 1·0	27·3	28·0	+ 0·7
13	24·9	25·0	+ 0·1	27·4	23·0	– 4·4
14	19·2	19·0	– 0·2	13·4	10·2	– 3·2
15	19·5	16·9	– 2·6	15·8	11·8	– 4·0
16	24·0	19·5	– 4·5	27·5	23·3	– 4·2
17	26·0	26·0	0·0	30·8	27·7	– 3·1
18	26·0	24·0	– 2·0	28·3	27·4	– 0·9
19	26·5	28·0	+ 1·5	24·0	28·0	+ 4·0
20	18·0	16·9	– 1·1	19·4	22·8	+ 3·4
21	23·8	23·6	– 0·2	12·9	8·2	– 4·7
22	20·9	19·8	– 1·1	4·9	4·7	– 0·2
23	24·0	24·1	+ 0·1	11·0	10·7	– 0·3
24	29·5	28·0	– 1·5	25·5	24·8	– 0·7
25	23·0	24·5	+ 1·5	22·9	23·0	+ 0·1
26	25·4	28·2	+ 2·8	23·7	24·8	+ 1·1
27	31·0	29·0	– 2·0	28·0	27·3	– 0·7
28	29·0	27·0	– 2·0	27·8	28·0	+ 0·2
29	28·0	27·0	– 1·0	28·0	27·8	– 0·2
30	20·9	20·7	– 0·2	22·8	19·8	– 3·0
31	17·9	17·7	– 0·2	21·0	21·6	+ 0·6
1891. Jan.						
1	20·7	19·7	– 1·0	24·9	24·4	– 0·5
2	26·8	27·8	+ 1·0	30·7	28·4	– 2·3
3	27·6	27·6	0·0	23·4	24·5	+ 1·1
4	33·1	26·7	– 6·4	28·5	29·0	+ 0·5
5	25·1	22·7	– 2·4	28·7	26·1	– 2·6
6	24·0	21·7	– 2·3	24·8	21·7	– 3·1
7	19·5	17·9	– 1·6	20·5	15·8	– 4·7
8	22·3	14·9	– 7·4	21·0	17·6	– 3·4
9	27·3	27·3	0·0	21·2	20·0	– 1·2
10	26·9	26·9	0·0	24·0	19·3	– 4·7
11	22·7	15·7	– 7·0	18·8	14·6	– 4·2
Min.	17·9	14·9		4·9	4·7	

Shirenewton Hall, Chepstow. E. J. LOWE.

Destruction of Fish in the Late Frost.

IN passing across the small suspension bridge over the canal on the north side of the Regent's Park yesterday morning, I observed a number of white flakes on or in the floating ice. On looking more closely, I saw they were dead fish, which apparently were frozen into the ice. The canal was nearly covered with ice, and the fish were scattered in the latter for as far as I could see. I think I may safely say there were on the average three fish for every two square yards; not seldom I saw three or four lying within one square yard. They were roach, or one of the fish resembling it; more commonly 3 or 4 inches long, occasionally larger or smaller. Very likely small fry and minnows were present, but these I could not distinguish from where I stood. Of course it is well known that fish are killed during a long severe frost, but I never saw such wholesale destruction, and it led me to wonder whether in any case such a cause may have acted in the geological history of the globe. Perhaps I am asking a question which only displays my own ignorance, but can anyone tell me how it is with the fish in countries like Siberia? Do they desert those parts of the rivers which are frozen over, or are the currents more rapid, so as to transfer air beneath the ice from unfrozen parts, or, as in some glacier-streams, are they altogether absent?

T. G. BONNEY.

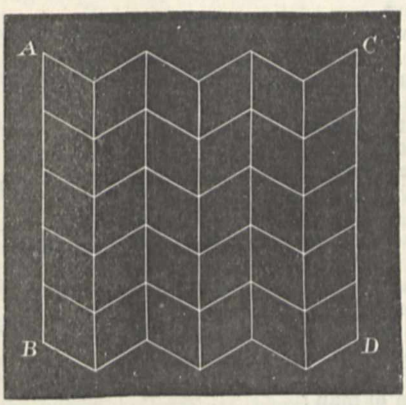
23 Denning Road, N.W., January 26.

Bees' Cells.

IN writing a paper upon the cells of hive-bees for the *Nineteenth Century* some months ago, a property of these cells occurred to me, which seems to be sufficiently interesting to be worth noting down.

The property is this. Typical bee cells may be manufactured entirely out of bee rhombs; that is, out of rhombs such as those by which the terminations of the cells are formed. Moreover, for the manufacture these rhombs will be required in dozens or half-dozens.

Suppose, for instance, that I have three dozen of such rhombs. Take thirty of them, and lay them upon a flat surface, in contact with each other, as in the figure. Conceive them to adhere into one sheet, A B C D, or (which comes to the same thing) let a piece of paper, A B C D, be shaped as in the figure. Now



let the figure A B C D be bent round a hexagon, so as to form a hexagonal prism, the edges A B and C D being thus made to coincide. The prism will have open ends, and we have six rhombs left with which to close them, three for each end. Now bisect the prism by a plane perpendicular to its axis, and we shall have two typical bee cells.

The same thing will be true of any number of dozens or half-dozens.

This geometrical construction has, of course, nothing to do with the question, How does the bee build her cells?, but it is curious, and (so far as I know) has not been noticed previously.

Rose Castle, January. H : CARLIOL :

The Crowing of the Jungle Cock.

IN the Proceedings of the Zoological Society, 1890, p. 48, Mr. Bartlett makes the following statement on the subject of the crowing of the jungle fowl: "There can be no doubt that the origin of our domestic fowls must be attributed to the wild jungle fowls of Asia, but none of the known wild species are ever heard to utter the fine loud crow of our domestic cock." I can recall very distinctly an exception to this statement. When living in Timor, at my hut on the Fatunaba hills, I heard—more than once—the crow of the jungle fowls which used to frequent a bit of very dense scrub not far from our camp. I was first led early one morning to the knowledge of the presence of these birds in my vicinity, by hearing (with more than ordinary satisfaction) a call which was the counterpart of the well-known cadences of the barn-door cock; but it was, if I may so represent it, considerably thinner in volume, more wiry, and higher pitched than his. I hastened after this first chanticleer, and succeeded in getting a perfect sight of and a shot at him, but without securing my victim, deeply to my disappointment, as I can well remember, for it would have been just then a most welcome accession to an empty larder.

HENRY O. FORBES.

Canterbury Museum, Christchurch, New Zealand,
October 29, 1890.

Throwing-Sticks and Canoes in New Guinea.

IN reply to my friend Mr. H. O. Forbes's letter to NATURE of January 15 (p. 248), I would like to say that I admit that my statement regarding the occurrence of the throwing-stick in South-east New Guinea is misleading. When I wrote the paper from which Mr. Forbes quotes, I was unaware that the Papuan throwing-stick was confined to a portion only of Kaiser Wilhelm's Land, and that its use was unknown in the British Protectorate. It is almost impossible to find out the exact geographical distribution of Papuan objects, either from the accounts of travellers or from museum specimens.

With regard to the canoes, in the paragraph preceding that quoted by Mr. Forbes I refer to the fact that down the south-east coast of New Guinea "the canoes have only a single outrigger," and thereby admit that it is indigenous to New Guinea. My point was, and still is, that the single outrigger has been introduced into Torres Straits by South Sea men, and that as far as the western tribe is concerned it was first introduced by my friend Ned Ware (Uea, Loyalty Islands). I believe it can be shown that the particular form of outrigger in question differs in minor details from the "New Guinea model."

May I take this occasion to express the hope that Mr. Forbes will publish the anthropological notes which he must have accumulated during his three years' residence in the country? As he has travelled up and down the coast, he must be in a position to give us some of that precise information as to the special characters and manufactures of the various tribes which is now lacking. A. C. HADDON.

Royal College of Science, Dublin.

THE SUPPOSED OCCURRENCE OF WIDE-SPREAD METEORITIC SHOWERS.

IN a recent paper[1] it was shown that the prevalent belief in widespread meteoritic showers, whether true or untrue in general, was, as regards the Desert of Atacama, on the western coast of South America, based on insufficient evidence: that in one case the wide-spreading of a shower was undoubtedly caused by a mere interchange of labels; in another by misinterpretations of the statements relative to a locality; that while the places were widely separated from which other fragments, belonging to a single type, had been brought, they were on definite and dangerous lines of traffic along which similar fragments are known to have been previously carried on the backs of capricious mules; further, that the statement that "meteorites were found at every step in the Desert" had been made at a time when almost the whole of the Desert was untrodden and unexplored; finally, that the latest explorations did not suggest the existence of meteoritic masses at small distances from each other over any large area of that part of South America.

[1] *Mineralogical Magazine*, vol. viii. p. 223; NATURE, vol. xli. p. 108.

Attention was thus directed to the following facts: (1) only nine falls of meteoric iron are known to have been observed during the last 140 years; (2) not more than two masses of iron have been seen to fall simultaneously; (3) the largest (Nejed) weighed only 131 pounds; (4) falls of stones, sometimes thousands in number, have been often observed; (5) the largest authenticated separation for the individuals of a single fall, whether of stone or iron, has been sixteen miles; (6) in some regions meteoric iron will endure for ages before rusting completely away; (7) the discovery of numerous masses of iron in certain districts may be due to the circumstance that the ground has been unexplored, or at least uncultivated, during many centuries.

It has already been pointed out by Prof. Daubrée that the small dispersion of a meteoritic fall is suggestive of the entry into the terrestrial atmosphere of only a single mass, afterwards fractured by the enormous resistance of the air; for the individuals of a swarm of meteoritic masses, various in form and size, would experience resistances so different in magnitude, that the residual masses would probably be scattered over areas of the earth's surface much larger than those which have characterized any of the observed falls.

The converse is not necessarily true, for a wide separation of the individuals of a meteoritic fall might conceivably be due to successive fractures of a single primitive mass. And it may be worthy of remark that, but for the differential action of the atmospheric resistance, the dispersion consequent on the breakage of the primitive mass would be very small, however numerous the so-called explosions, since each fragment would retain the enormous velocity belonging to it as part of the original moving body: that by simple division a single mass, or a swarm, could succeed in dropping fragments at distant points of the line of flight is mechanically impossible.

Remembering the close similarity in structure and material of the single representatives of meteoritic falls to those which have been picked up in hundreds, or even thousands, and the identity in character of the luminous and also of the detonatory phenomena in the different cases, it is difficult to grant that the enormous disparity in the numbers of the individual masses, which have been found after different meteoritic falls, is satisfactorily explained by any possible diversity in structure or velocity of singly entrant blocks.

The evidence for and against the natural occurrence, over a large area, of meteoritic masses belonging to a single and well-defined type, is thus not without scientific interest: firstly, as throwing light on the possible occurrence, within comparatively recent times, of large meteoritic showers, such as are not known to have been actually observed; and secondly, as bearing on the true relationship of meteorites and shooting-stars.

The occurrence of widespread meteoritic showers has been regarded as established by the distribution of meteoritic masses, not only in the Desert of Atacama, but also in Africa and Mexico. It is true that masses of meteoric iron, rarely more than one or two hundred pounds in weight, have also been found dispersed in considerable numbers over the extensive territory of the United States of North America; but it has been as yet impossible, by investigation and comparison of the mineralogical characters of those masses, to obtain any trustworthy evidence that distant individuals have ever belonged to one meteor.

The evidence relative to a wide distribution in Africa of masses belonging to a single type is extremely slight: when examined, it appears to be based solely on the brief statement made by Captain Alexander, "that there were abundant masses of iron scattered over the surface of a considerable tract of country." It is practically certain that Alexander never saw the masses, and that the above information was given to him by a native; in any case, it is not suggestive of a distribution over an extraordinary area.

But the evidence relative to Mexico is of a much more voluminous character, and is deserving of the closest attention. Mexico is remarkable beyond any other part of the earth's surface for the number and magnitude of the masses of meteoric iron found within its borders: it has been generally assumed that widespread showers are necessary to the explanation of their occurrence. Prof. Lawrence Smith came to the conclusion that masses belonging to a single meteor were distributed over hundreds of miles of country in Northern Mexico, and his conclusion has been generally accepted. Prof. Whitney, and also Señor Urquidi, regarded it as possible that a whole series of iron masses, for a distance of more than a thousand miles through Mexico and the United States, were the result of a single fall: Huntington states that the fact of certain masses having been "found in places so remote from each other does not seem to preclude their having belonged to one individual, since the Rochester meteorite was seen to pass over the States of Kansas, Missouri, Illinois, Indiana, Ohio, and is supposed to have passed over Pennsylvania and New York, and thence out to sea, dropping fragments in its course. It therefore is possible that at some remote period an enormous iron meteorite may have passed over the entire breadth of the United States, the main mass reaching Mexico, but large fragments breaking off and falling during its passage across the country." Prof. Barcena is further of opinion that "the peculiar property, difficult of explanation, which the Mexican soil has in attracting the meteoric irons is even noticed at present" (in the attraction of shooting-stars). We may remark that only a single fragment of the above-mentioned Rochester meteorite could ever be found.

The following questions thus present themselves for consideration:—

(1) What meteoritic falls have been actually observed in Mexico?

(2) In what localities are meteoritic masses said to have been met with?

(3) Is our knowledge of the distribution in these localities at all precise?

(4) Is the climate favourable to the preservation of meteoritic masses?

(5) Are any falls of remote date?

(6) Have any masses been transported from their place of fall?

(7) Had the ancient Mexicans any skill in the transport of heavy blocks?

(8) Had they any respect for meteorites as bodies fallen from the sky?

(9) Is there any evidence of the wide dispersion of masses belonging to a single type?

(10) If so, is the dispersion celestial in origin or due to the action of man?

1. Only seven meteoritic falls are known to have been actually observed in Mexico, and in no case were more than three fragments found. During the same interval of time, larger showers and more numerous falls have been observed within the British Isles, which are comparatively small in area.

2. Meteorites of unobserved fall have been found only in the following States:—I. Coahuila and Nuevo Leon; II. Chihuahua; III. Sinaloa; IV. Durango; V. San Luis Potosi; VI. Zacatecas; VII. Mexico and Morelos; VIII. Oaxaca; IX. Guerrero.

3. It is the supposed distribution of meteoric irons in the Bolson de Mapimi, Northern Mexico, that has been largely relied upon as illustrating the occurrence of widespread showers. It will be found, however, that, until many years after the publication of the papers of Shepard and Lawrence Smith, the Bolson was in the possession

of the dreaded Comanches and Apaches, and no trustworthy information relative to the greater part of that district can have been available.

4. Mexico is a lofty and extensive table-land—the capital being 7600 feet, Durango 6630 feet, Chihuahua 4600 feet, and El Paso del Norte 3800 feet, above the sea-level. Hence the air is exceedingly dry, and the climate unusually favourable to the preservation of meteoric iron.

In the discussion of the meteorites of Atacama, it was proved that, even in the still drier atmosphere of that region, meteoric stones could only escape disintegration for a very limited interval of time.

5. The history of some of the Mexican masses goes back to very distant times. One was found in an old tomb in the ruins of Casas Grandes: it was wrapped in the same kind of cloth as envelops the bodies found in the adjacent tombs, and must have been buried there before Mexico was conquered by the Spaniards. In the cleft of another mass is to be seen an ancient chisel of "copper," the material used by the Aztecs for their arms, axes, and tools in general. Two small worked specimens, belonging to the Aztec period and made of meteoric iron, are exhibited in the Museum of Mexico. At least one of the masses in the south of Chihuahua was known long before the latter part of the sixteenth century.

It is quite possible that, with the exception of the small piece which fell in 1885, not a single one of the Mexican iron masses has fallen since the Spaniards obtained possession of the country. The masses thus seem to be nearly permanent in their material, and may have been lying for any number of centuries in the region where they have been found.

6. Some of the masses have certainly been transported from their place of fall. The one found in the tomb at Casas Grandes was clearly not *in situ;* and yet it was so large that twenty-six yoke of oxen are said to have been used to haul it from the tomb to the village. The masses met with at Saltillo, Potosi, and Cerralvo, were discovered in forges in use as anvils; the large masses of San Gregorio, Concepcion, Descubridora, Charcas, Zacatecas, and Yanhuitlan, are all known to have been moved by the Spaniards, some of them for considerable distances. The possibility of similar removals prior to the conquest of Mexico cannot be entirely disregarded.

7. The Aztecs were capable of moving immense blocks of material when they wished. The remarkable carved Calendar-Stone or Sun-Stone, preserved in Mexico, weighs twenty-four tons; when extracted from the quarry it must have weighed forty tons: yet it was transported by the Aztecs many leagues across a broken country intersected by watercourses and canals.

8. The inhabitants of both the Old and New World have regarded meteorites as objects for reverence and worship. In the Aztec creed the creation of mankind was associated with the fall of a stone from the sky. The companions of Cortes are said to have seen a stone at Cholula which had fallen, enveloped in a cloud of fire, upon the pyramid: Lumbier refers to it as placed on the summit of the pyramid for the purpose of worship. The respect of the ancient Mexicans for native iron, whether known to be of meteoric origin or not, is illustrated in the careful envelopment and burial of the large mass of iron at Casas Grandes. One of the large Chihuahua masses was believed by the Mexicans of the sixteenth century to have been deposited by the Deity for their use as a landmark. Hence it would have been far from surprising if a religious and skilful people, like the Aztecs, had transported meteoritic masses from their original sites for the purpose of worship: the large blocks of stone on Salisbury Plain furnish a good example of the transportation of heavy blocks of stone for great distances by a still more ancient race.

9–10. In very few cases is there any evidence at all of wide distribution of masses belonging to a single type. The large masses of San Gregorio, Concepcion, and Chupaderos, all in Chihuahua, are very similar in their external characters, and probably belong to a single fall: the extreme separation is about sixty-six miles, but the two former have undoubtedly been transported from some distance to their present sites. Masses belonging to a single type, and probably the results of a single fall, have been brought from widely-separated places in Coahuila and its neighbourhood; masses belonging to another type have been brought from places in the Valley of Toluca, and also at considerable distances therefrom: there is very strong evidence, however, that in these two cases the dispersion has been artificial. In the remaining cases there is nothing suggestive of widespread showers.

The following is the result of an investigation relative to the discoveries of meteoric irons in the various States:—

I. *Coahuila and Nuevo Leon.*—The known meteoric masses of Coahuila are:—(1) The masses which Shepard designated by the name Bonanza. (2) Those collected by Dr. Butcher. (3) Those brought from Santa Rosa, but of which the previous history is matter of inference. (4) The so-called Sancha Estate mass. With the above must be considered (5) the Fort Duncan mass (from the Texas side of the Rio Grande); and conveniently also (6) the Potosi mass, and (7) the Cerralvo mass, both from Nuevo Leon.

After a minute comparison of various statements, it appears certain that the localities designated by Shepard and Butcher are really identical, and that all the masses brought from Santa Rosa, and the one from the so-called Sancha Estate, had been previously transported from this locality to Santa Rosa, the nearest town. Until recent years iron anvils were extremely costly articles in Northern Mexico, whence it arose that the mass of meteoric iron found about 1837 were distributed for use in forges. The Fort Duncan mass, though found 140 miles away in 1882, is of identical characters, and is probably part of the same meteor. Much larger masses were long ago dispersed from Santa Rosa to greater distances than Fort Duncan, though in the opposite direction. Santa Rosa was a town through which much traffic passed from the eastern side of the Mexican table-land to Texas; and Fort Duncan is the place where the river was crossed. The Potosi and Cerralvo masses were both found in forges, and have neither of them been compared with those of Coahuila: they had obviously been transported, possibly either from Santa Rosa or Catorce. Their carriage from either place would present no practical difficulty.

II. *Chihuahua.*—The meteoric irons of Chihuahua, mentioned in literature, belong to one or other of the following:—(1) the Casas Grandes mass; (2) a mass exhibited in 1876 at the United States International Exhibition; (3) the group between Presidio del Principe and Cuchillo Parado; (4) the group near Huejuquilla or Jimenez.

The first two masses will probably prove to be identical, for while the former has been lost since 1873, and the history of the latter previous to the appearance at the Exhibition of 1876 is not yet traced, the descriptions of the two masses are not inconsistent with each other. The Casas Grandes mass was estimated to weigh 5000 pounds, and was found in an old tomb. The scientific examination of the Exhibition-mass is not yet made, so that no comparison with the other Chihuahua masses is practicable.

No particulars of the group said to be between Presidio del Principe and Cuchillo Parado have yet been published.

The remaining Chihuahua masses, termed the Huejuquilla group, comprise the following:—

A mass now at San Gregorio, estimated to weigh 11 tons.

A mass now at Concepcion, estimated to weigh 3 tons.

A large mass said to have been seen many years since at Rio Florido.

Two masses now at Chupaderos, estimated to weigh 15 and 9 tons respectively.

A small fragment brought from Sierra Blanca.

A small fragment brought from Tule.

The first of these, the San Gregorio mass, is mentioned in works published in the years 1619 and 1629: it was already regarded as a great curiosity, and everyone passing along the road to New Mexico went to look at it. There was at that time a tradition among the Indians that it had accompanied their forefathers on their migrations from the north to people Old Mexico, and was to serve as a memorial of that great event. It is doubtless identical with the large Durango mass mentioned by Humboldt, who, in misapprehension, stated that it was located near Durango City. Such a mass has been unsuccessfully searched for again and again in that neighbourhood since Humboldt's time. The mistake arose in a very simple way: at that date the Province of Durango included the district in which the San Gregorio mass is lying: since the independence of Mexico has been established, San Gregorio has been assigned to the State of Chihuahua, which was made distinct from that of Durango. Hence it came about that the mass which had once been so well known that it was called the Durango iron (not, as Humboldt supposed, because it was near the city of that name, but from the locality being in the province of Durango) could later on not be recognized by its old name. The mass was moved to San Gregorio itself, according to one account, from El Morito, about 2 leagues distant.

The second large mass, now at Concepcion, was moved to that place in 1780 from Sierra de las Adargas, many leagues away.

There is very strong evidence that the Rio Florido mass is really identical with that of Concepcion.

The two enormous masses, still at Chupaderos, are probably where they fell; they seem to have been known many years before they were mentioned by Bartlett in 1852.

Only one small fragment of one of a number of large masses found before 1784 in the Sierra Blanca has been preserved to our day.

The small fragment brought from Tule is without history or description, so that no connection with the above masses can be asserted.

III. *Sinaloa.*—Only one mass of iron is known to exist in this State, but it is said to be of enormous size, 12 feet long, 6 feet broad, and 4 feet high: no comparison with the other Mexican meteorites has yet been made.

IV. *Durango.*—Four areas of Durango are represented by meteoritic masses—namely, La Plata, Guadalupe, Mezquital, and Bella Roca. The mass found at the first place was destroyed at the beginning of the century, and was never investigated; those of the three remaining areas belong to types which are widely different from each other. Strong evidence is brought forward that the Durango mass of Karawinsky was obtained from Guadalupe: the Cacaria mass belongs to the same area.

V. *San Luis Potosi.*—Only two areas are represented in San Luis Potosi, and one of these, Charcas, only by a single mass. It is almost certain that the Charcas mass was transported to that place from the other area—namely, that of Catorce. The Venagas mass of Lawrence Smith is proved to be identical with the Descubridora mass found near Catorce.

VI. *Zacatecas.*—Only one mass has been found in this State, and it has distinctive characters.

VII. *Mexico and Morelos.*—Most of the masses found in the former State have been got from the neighbourhood of Xiquipilco in the Valley of Toluca: they were carried to various towns as articles of merchandise, and were largely used for agricultural implements; hence their wide-spreading is almost entirely artificial. As regards the masses of Cuernavaca, Ameca-Ameca, and Los Amates, mentioned in 1889, there is no evidence that they have been examined and found identical in character with those of Xiquipilco, which were known before 1776; and even if they prove to be identical in character, there is as yet no evidence that they may not have been transported from that locality. The localities Tejupilco and Sizipilec are due to incorrect labels.

VIII. *Oaxaca.*—Only one mass, that of Yanhuitlan, has been found in this State. Another locality, Cholula, is merely a mistake for Tepos-colula, which is close to Yanhuitlan. A further locality, Chalco, is itself a mistake for Cholula. The fragments known as Misteca are merely pieces of the Yanhuitlan mass.

IX. *Guerrero.*—Only one mass, a very small one, is said to have been found in this State, and of this there are grave doubts as to its meteoric origin.

We may summarize the above as follows:—

In each of the States of Zacatecas, Oaxaca, and Guerrero, at most a single mass of meteoric iron has been found, and there is absolutely nothing to suggest that they do not represent independent falls.

In Sinaloa, likewise, only a single mass has been met with, and its characters have not been determined: a suggestion of a relationship with another group would rest on the slight fact that the site of this extremely large mass is in a straight line with two other sites where large masses are now lying.

In San Luis Potosi two localities are recognized, but there is a strong probability that the Charcas mass, which has undoubtedly been transported to that town from a distance, was brought from the other locality, Catorce.

In Durango four or five distinct localities are known, but the characters of the only masses which have been examined point unmistakably to the falls of distant masses having been independent of each other.

In Mexico there has undoubtedly been a large shower of limited dispersion in the Valley of Toluca: the three remaining masses from Mexico and Morelos have not been examined, and are very small and portable: even if they have not been transported, they may be found on examination to present characters which will differentiate them from the masses of the Toluca shower.

From Coahuila many masses have been got, but it is extremely probable that all of them were brought from a single district of very small area: the two Nuevo Leon masses had obviously been transported, possibly from Coahuila or San Luis Potosi.

In Chihuahua three or four areas are represented; but only those of the Huejuquilla group have been examined, and that in a very incomplete way: the recognition of the singleness of fall of that group depends almost entirely on the general similarity of appearance of the large masses. If the masses really belong to a single fall, as the available information makes most probable, the maximum dispersion would have been 66 miles if the masses had fallen where they now lie; but one of the terminal masses is known to have been transported on one occasion by the Spaniards for a distance of about two leagues, and, according to an old tradition, it had previously been brought from the north by the Indians.

There appears to be no satisfactory evidence of the occurrence of such widespread meteoritic showers as have been assumed by Smith, Whitney, Urquidi, and Huntington.

Full information relative to this subject, with three maps of the region, will be found in the last number (42) of the *Mineralogical Magazine.*

L. FLETCHER.

HENRY BOWMAN BRADY.

HENRY BOWMAN BRADY was born on February 23, 1835, at Gateshead. His father, an esteemed medical practitioner of that place, belonged to the Society of Friends, and retained to the end the dress and manner of conversation of that body. The father's house, for many years the home of the son, was one of those charming Quaker abodes where strength and quietude sit side by side, and where homely plenty and orderly preciseness hide for a moment from the stranger the intellectual activity which is filling the place. Though the son, when I knew him, had abandoned the characteristic dress and speech of the Society, without, however, withdrawing from the body, the influences of his surroundings moulded his character, making him singularly straightforward and free from manner of guile.

After an ordinary school career spent in Yorkshire and Lancashire, and an apprenticeship under the late Mr. T. Harvey, of Leeds, and some further study at Newcastle in the laboratory of Dr. T. Richardson, which may be considered as the forerunner of the present Newcastle College of Science, he started at business in that city as a pharmaceutical chemist in 1855, while yet a minor. That business he conducted with such ability that in 1876 he felt able to resign it to Mr. N. H. Martin, and to devote the whole of his time to scientific work.

He contributed to science in two ways—one direct, the other indirect. Of the many scientific movements of the last thirty years or so, one not of the least remarkable has been the scientific development of the pharmaceutical chemist. Into that movement Brady threw himself with great vigour, especially in his earlier years. He was for many years on the Council of the Pharmaceutical Society, and the progress of that body was greatly helped by his wide knowledge of science and of scientific men and things, as well as by his calm and unprejudiced judgment.

His more direct contributions to science were in the form of researches in natural history, more especially on the Foraminifera. His first publication seems to have been a contribution in 1863 to the British Association as a report on the dredging of the Northumberland coast and Dogger Bank; his last was a paper which appeared only a short time ago. Between these two he published a large number of researches, including a monograph on Carboniferous and Permian Foraminifera, an exhaustive report on the Foraminifera of the *Challenger* Expedition, as well as monographs on Parkeria and Loftusia, and on Polymorphina, in which he was joint author.

By these works he not only established a position, both in this country and abroad, as one of the highest authorities on the subject, but, what is of more importance, largely advanced our knowledge. Every one of his papers is characterized by the most conscientious accuracy and justice; and though his attention was largely directed to classification and to the morphological points therein involved, his mind, as several of his papers indicate, was also occupied with the wider problems of morphological and biological interest which the study of these lowly forms suggests. I have myself often profited by his wide knowledge and power of accurate observation in discussing with him questions of this kind arising out of his studies, and learning from him views and opinions which, to his critical mind, were not as yet ripe enough for publication.

The leisure of the last fifteen years gave him opportunity for travel, and he visited various parts of the world, utilizing many of his journeys—notably one to the Pacific Ocean—in the collection and study of Foraminifera. Some of these travels were undertaken on the score of health, to avoid the evils of an English winter, for he was during many years subject to chronic pulmonary mischief.

During his last journey for this purpose—one to the Nile in the winter of 1889-90—he met with difficulties, and failed to receive the benefit from the change which he had secured on former occasions. During the last two or three years, and especially during the last year, his condition gave increasing anxiety to his friends; the malady against which he had so long struggled seemed to be beating him at last; and we heard with sorrow rather than with surprise that the fierceness of the recent cold had conquered him. Settled for the winter at Bournemouth, and full of cheerful hopes for the coming summer, he succumbed to a sudden attack of inflammation of the lungs, and died on January 10, 1891.

Science has lost a steady and fruitful worker, and many men of science have lost a friend and a helpmate whose place they feel no one else can fill. His wide knowledge of many branches of scientific inquiry, and his large acquaintance with scientific men, made the hours spent with him always profitable; his sympathy with art and literature, and that special knowledge of men and things which belongs only to the travelled man, made him welcome also where science was unknown; while the brave patience with which he bore the many troubles of enfeebled health, his unselfish thoughtfulness for interests other than his own, and a sense of humour which, when needed, led him to desert his usual staid demeanour for the merriment of the moment, endeared him to all his friends.

M. FOSTER.

NOTES.

PROF. VICTOR HORSLEY AND MR. FRANCIS GOTCH have been appointed Croonian Lecturers to the Royal Society for the present year. They have chosen as their subject, "The Mammalian Nervous System; its Functions and their Localization as determined by an Electrical Method." Thursday, February 26, is the date fixed for the delivery of the lecture.

A VERY valuable addition has just been made to the Kew Herbarium by the purchase of an extensive collection of dried plants from West Sze-chuen and the Tibetan frontier, at elevations of 9000 to 13,500 feet, lately brought home by Mr. A. E. Pratt, who travelled and collected ornithological and other specimens of natural history at the expense of Mr. J. H. Leech. The botanical specimens are excellent, and promise many novelties of Himalayan affinities.

A CIVIL LIST pension of £150 has been granted to Lady Burton, the widow of the eminent traveller and Oriental scholar. The movement for this recognition of Sir Richard Burton's brilliant achievements originated with the Council of the Royal Geographical Society, who were supported by the Royal Asiatic Society, the British Association, and the Anthropological Institute.

A LETTER from the Palais des Académies, at Brussels, announces the death of Lieut.-General Liagre, the Permanent Secretary of the Académie Royale des Sciences, des Lettres, et des Beaux-Arts de Belgique. He was born at Tournai, in 1815, and died at Ixelles, on the 13th of this month.

WE are glad to see that the *Speaker* has taken up the subject on which we have had so much to say lately—that of the proposed South Kensington and Paddington Subway Railway. In the current number it has an able and most interesting article, directing attention to the fact that the introduction of electricity as a motive power for trains has created a new peril for institutions devoted to the teaching of physical science. It points out that in the neighbourhood of an electric railway, such as that now running in South London, a moderately advanced course in experimental physics could not be given, and that even comparatively rough apparatus would be affected. The course marked out for the proposed line runs under one of the physical laboratories of the Royal College of Science, and is separated by the breadth of the road only from the other; and it passes within a few yards of the City and Guilds Central Institute for Technical Education. "That the line might be in some respects convenient," says the *Speaker*, "is quite possible; that if the powers to employ electricity are granted and used as at Stockwell, existing physical laboratories will be rendered useless, is certain. The South London line is surrounded by an iron tube which acts as a 'magnetic screen,' and serves to diminish its magnetic effects on external objects. No such precaution is, as far as we are aware, to be adopted at Kensington, and in this respect, at all events, the proposed line is likely to be the more injurious of the two. To the laboratories of the Royal College of Science teachers are brought by Government funds from all parts of the country. Every summer two hundred come from far and near to hear lectures and to go through a course of laboratory work. We believe that one of the main objects of the College is to raise the standard of knowledge among those on whom many a small town has to depend for scientific instruction. It is improbable that the laboratories could be removed from South Kensington, for their connection with the great collection of scientific apparatus in the Museums is essential. The City and Guilds Central Institute has been built at a cost of £100,000. After some years of contest with our English lethargy it has reached success. The electrical department is full. Is it reasonable that a commercial company should be allowed to acquire powers to ruin the physical laboratories of two such institutions by the employment of electric traction?"

WITH respect to our report of the meeting of the Royal Society of Edinburgh of January 5 (p. 287), Sir William Thomson writes to us that a statement attributed to him is obviously incorrect, and that six lines and three words after the words "Sir William Thomson, however," near the end of the report, should be deleted. "It is obvious," he says, "that any upward current of air which could carry drops of water 40 or 50 feet up from the sea is more than amply sufficient to supply what a bird needs for soaring."

AT the meeting of the International Congress of Hygiene and Demography there will be a special section for the discussion of questions connected with the relations of the diseases of the lower animals to those of man. The section proposes to consider, amongst other subjects, the infectious, contagious, parasitic, and other diseases communicable from animals to man, and *vice versâ*; the methods of the propagation of diseases affecting mankind by means of animals and animal products; the infection of meat, milk, and other comestibles; and the restrictions to be placed upon the sale of infected food and the movement of infected animals. On each of these questions papers will be obtained from prominent British and Continental authorities as the basis of debates. The President of the section will be Sir Nigel Kingscote, Chairman of the Board of Governors of the Royal Veterinary College. Prof. G. T. Brown and Dr. E. Klein, F.R.S., will act as Vice-Presidents.

THE *Kew Bulletin* for January opens with an interesting section on West African bass fibre, the prospects of which in the English market seem to be remarkably good. Writing on a sample sent to them from the Royal Gardens, Kew, Messrs. Ide and Christie, on October 10, 1890, expressed the opinion that, if properly selected and cleaned, the fibre might sell at £25 per ton in London, a figure which, they thought, would leave a handsome profit to the producer. Writing again, on October 24, Messrs. Ide and Christie stated that a few bales had been sold, and had fetched the extreme price of £42. They added, "We scarcely expect this price would be maintained for substantial quantities, but for fibre of equal merit, the immediate outlook would seem to indicate that £35 or £40 might be the range of value."

THE same number of the *Kew Bulletin* contains a paper on Chinese ginger, of which it is said in China, where it grows, that it never flowers. Dr. H. A. Alford Nicholls, writing from Dominica, West Indies, on July 5, 1890, and Mr. Charles Ford, writing from Hong Kong, on July 10, 1890, both state that the plant has flowered under their care. Mr. W. T. Thiselton Dyer contributes a paper in which he gives a full and most lucid account of the production of seed and seminal variation in the sugar-cane. Referring to the work done by Messrs. Harrison and Bovell in the West Indies in connection with this subject, Mr. Dyer points out that it was undoubtedly anticipated in Java. He does ample justice, however, to the independent labours of these gentlemen. Noting that their discovery has been termed "accidental," he says:—"Even if true, that is no demerit. Most discoveries in some sort are accidental. They often lie, so to speak, under our eyes, and only reveal their significance to those who are ready to appreciate it. This Messrs. Harrison and Bovell did, and the greatest credit is due to them for the fact. All that Kew has done in the matter was to put it on record, and give it a scientific verification. For my own part, I have no doubt, looking at the whole history of the improvement of cultivated plants, that the discovery, for so I think it, of Messrs. Harrison and Bovell, has been the starting-point of a new era in the cultivation of the sugar-cane."

MR. CLEMENT WRAGGE, the Government Astronomer of Queensland, has sailed from Brisbane for the New Hebrides, where he is to superintend the erection of some Observatories on the islands. They will be maintained at the expense of the Queensland Government.

AT the next International Geographical Congress, which will be held at Berne from August 10 to 15, the following will be the principal subjects considered:—(1) Technical geography (mathematical geography, geodesy, topography, cartography, photography, &c.). Under this head will be discussed the first meridian and the spelling of geographical names. (2) Physical geography (hypsometry, hydrography, meteorology, variation of climate, the boundary-line of the ice, terrestrial magnetism, botanical, zoological, and geological geography, volcanoes, earthquakes, ethnography, anthropology, and archæological geography). (3) Commercial geography. (4) Travels and discoveries. (5) The extension of geographical knowledge. Those who propose to contribute papers should write to Dr. Gobat, Berne, not later than March 1.

MR. R. BOWDLER SHARPE has received from America an interesting testimonial, congratulating him on the completion of the thirteenth volume of the British Museum "Catalogue of Birds." It is signed by members of the American Ornithologists' Union, and other American naturalists. They express the warmest appreciation of Mr. Sharpe's labours as an ornithologist, especially of his work in connection with the classification and the nomenclature of the Passeres. Among the signatures we note those of G. N. Lawrence, J. A. Allen, Elliott Coues, R. W. Shufeldt, C. B. Cory, Robert Ridgway, and G. Brown Goode.

DR. HUGH ROBERT MILL is delivering in Edinburgh a course of twelve lectures on "The Earth and Man: a Study in Advanced Geography." The lectures are being given under the auspices of the Scottish Geographical Society, and are intended to illustrate a memorial recently presented by the Society to the Universities Commission, asking that lectureships on geography should be founded in the Scottish Universities. The attendance is most encouraging, 104 tickets having been taken.

SOME time ago M. Berthelot, judging from a text of the eleventh century, formed the opinion that the word "bronze" was derived from "Brundusium," or Brindisi. According to *La Nature*, this view has been confirmed by the discovery of a passage in a document of the time of Charlemagne, where reference is made to the "composition of Brundusium":—copper, two parts; lead, one part; tin, one part. It would appear that at Brundusium bronze was in ancient times manufactured on a great scale.

THE Report of the Honorary Committee for the Management of the Calcutta Zoological Gardens says that, in accordance with a suggestion in the resolution of the Government of Bengal on the Committee's Report for the year 1888–89, a hand-book embodying the experiences gained in the management of animals in the Zoological Gardens, Calcutta, is in course of preparation.

A NATIONAL Exhibition will be held at Palermo from November 1891 to May 1892. It will include an international section for engines and machinery relating to industries such as are carried on in small workshops or dwellings.

THE collection of birds made by Mr. F. J. Jackson during his recent successful expedition to Uganda has been placed in the hands of Mr. Bowdler Sharpe, who, in the current number of the *Ibis*, describes fourteen new species, chiefly from Mount Elgon and the Kikuyu country. In the same periodical Mr. Ogilvie Grant describes four new species of Francolin and a new Hornbill. In the April number of the *Ibis* Mr. Sharpe will continue his account of Mr. Jackson's collection, and we understand that the list of novelties is by no means exhausted. The birds of the Teita district and those obtained in Ukambani seem to be the same as those of Shoa; but on Mount Elgon Mr. Jackson appears to have met with a peculiar fauna, which, to judge by the birds alone, has relations with the Cameroons, one or two species being closely allied to forms only known from the high mountains of this part of Western Africa.

AT the recent meeting of the American Ornithologists' Union, Mr. D. G. Elliot was elected President. Mr. Elliot is well known for his sumptuous zoological works, of which the monographs of the *Felidæ* and the *Phasianidæ* are the most important, the illustrations having been drawn by Mr. Wolf. Dr. Elliott Coues has retired from the Vice-Presidency, but remains on the Council of the Union. The active members number fifty-two, the honorary members twenty-eight, the corresponding members seventy-one, and the associate members 368. In the roll we notice several ladies' names. In the January number of the *Auk* appears a plate of *Icterus northropi*, drawn by Mr. J. L. Ridgway, and far exceeding in execution anything that the journal in question has hitherto produced. Our own ornithological journal, the *Ibis*, will have to look to its laurels, for recently, though the drawing of Mr. Keulemans has been as splendid as ever, the colouring of the plates has been anything but accurate.

AN American Morphological Society has lately been formed. A well-attended meeting was held for its "inauguration" in the Massachusetts Institute of Technology, Boston, on December 29 and 30, 1890. Prof. E. B. Wilson occupied the chair, and Prof. C. O. Whitman was appointed President for the current year. After the details of the organization had been completed, the following papers were read and discussed:—On the development of the Scyphomedusæ, by I. Playfair McMurrich; on the intercalation of vertebræ, by G. Baur; the heliotropism of Hydra, a study in natural selection, by E. B. Wilson; the early stages of the development of the lobster, by H. C. Bumpus; some characteristics of the primitive vertebrate brain, by H. F. Osborn; the development of Nereis and the mesoblast question, by E. B. Wilson; the præ-oral organ of Xiphidium, by W. M. Wheeler; a review of the Cretaceous Mammalia, by H. F. Osborn; spermatophores as a means of indirect impregnation, by C. O. Whitman; the phylogeny of the Actinozoa, by I. Playfair McMurrich.

THE National Association for the Promotion of Technical and Secondary Education has issued a report of the proceedings of the Conference between the executive committee and representatives of County Councils and others, held at the Society of Arts on December 5, for the discussion of the working of the education clauses of the Local Taxation Act, 1890. The Association also publishes selected reports of committees of County Councils, and other schemes and proposals for the utilization of the new fund for educational purposes. These reports have been edited by the secretaries of the Association.

THE *Annuaire de l'Académie Royale de Belgique* for 1891 has recently been issued. It mainly contains an historical account of the organization and work of the various sections of the Academy, and notices of deceased members.

THE *Annals of the Astronomical Observatory of Harvard College*, vol. xxx., Part I, contains the observations made at the Blue Hill Meteorological Observatory, Massachusetts, U.S.A., in the year 1889, and a statement of the local weather predictions, by Mr. A. Lawrence Rotch. Special attention has been paid to observations of the distribution, density, and amount of cloud throughout the year. The thermometric and barometric readings, wind movements, and rainfall have been tabulated and summarized in a very concise manner.

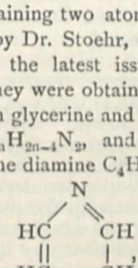
A PAMPHLET has been received from Mr. John Romanes, in which several questions of cosmical physics are discussed. The author believes that the planets, and probably their satellites, are ejects from the sun. He attempts to explain the motions and the forms of the orbits of these bodies on this theory, extends the results to double and multiple stellar systems, and propounds a new hypothesis as to the origin of celestial species.

SIGNOR GUGLIELMO has sent us a paper, presented to the Accademia dei Lincei in September 1890, in which he describes a method for multiplying the dispersive power of a spectroscope, by means of mirrors so arranged that they cause the rays of light to traverse the prisms several times.

ON February 7 and the three following Saturday afternoons, at 4.15 p.m., Prof. H. G. Seeley, F.R.S., will deliver a course of four lectures, at the Gresham College, Basinghall Street, on "The Gravel-beds of the Thames and its Tributaries in relation to Ancient and Modern Civilization." The lectures will be given in connection with the London Geological Field Class.

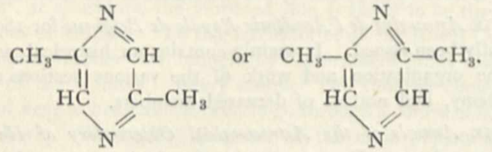
THE third series of lectures provided by the Sunday Lecture Society begins on Sunday afternoon, February 1, in St. George's Hall, Langham Place, at 4 p.m., when Mrs. S. D. Proctor will lecture on "The Life and Death of Worlds," with illustrations by the oxyhydrogen lantern. Lectures will subsequently be given by Prof. Marshall Ward, Mr. Charles Cassal, Mr. J. M. Robertson, Mr. Arthur Nicols, Miss A. B. Edwards, and Prof. Percy Frankland.

A NEW class of organic bases, resembling the pyridine series in constitution but containing two atoms of nitrogen, have been synthetically prepared by Dr. Stoehr, of the University of Kiel, and are described in the latest issue of the *Journal für praktische Chemie*. They were obtained as secondary products in the reactions between glycerine and ammonium salts. Their general formula is $C_nH_{2n-4}N_2$, and they appear to be the higher homologues of the diamine $C_4H_4N_2$,



which bears the same relation to pyridine as the latter bears to benzene. They are rendered doubly interesting by the fact that

Dr. Stoehr has also discovered their presence in the products of distillation of the alkaloid brucine. The best investigated member of the series, $C_6H_8N_2$, is a clear colourless liquid just slightly heavier than water, its sp. gr. at 0° being 1·0079. It boils constantly without decomposition at 153°·5–154° C. (corr.), and determinations of its vapour density at the temperature of naphthalene vapour by Victor Meyer's method yield numbers pointing to the above molecular composition. From its reactions it appears to be the dimethyl derivative of the primary diamine, and may consequently possess the constitution



It exhibits almost all the properties of the pyridine bases. Its odour is very similar to that of the higher members of that series, but reminds one, at the same time, of the narcotic bases, particularly nicotine. It is soluble in water, dissolving with such considerable rise of temperature as to indicate the formation of a hydrate; it is precipitated from its aqueous solution on the addition of potash. It is, curiously, nearly as soluble in cold water as in hot—a phenomenon which is familiar to us in the case of common salt. Its salts are most remarkably like those of the pyridines, and the peculiarities exhibited by the latter are strongly accentuated in them. Thus the hydrochloride, $C_6H_8N_2.HCl$, is deliquescent and sublimes below 100°. The platinochloride, $C_6H_8N_2.2HCl.PtCl_4 + 3H_2O$, which forms fine crystals of the colour of bichromate of potash, possesses in a marked manner the property so characteristic of the platinochlorides of the pyridines, known as "Anderson's reaction," of parting with hydrochloric acid on warming in solution, and depositing condensed salts. On merely warming the solution, bright yellow crystals of the salt $(C_6H_8N_2)_2PtCl_4$ commence to deposit. The double salt with gold chloride, $C_6H_8N_2.HCl.AuCl_3$, forms magnificent acicular crystals several inches long, while the mercuric chloride salt forms large rhombohedrons. The second member of the series investigated proved to have the molecular composition $C_8H_{12}N_2$, and to be an ethyl derivative of the primary diamine. It was likewise a liquid, boiled at 178°·5 (corr.), and possessed properties analogous to the methyl compound just described.

THE additions to the Zoological Society's Gardens during the past week include a Macaque Monkey (*Macacus cynomolgus* ♂) from India, presented by Count Povoleri, F.Z.S.; a Ring-tailed Coati (*Nasua rufa* ♂) from Guatemala, presented by Mr. Cyril Smith; two Hawfinches (*Coccothraustes vulgaris*), British, presented by Mr. J. Newton Hayley; two Blood-breasted Pigeons (*Phlœgnas cruentata*) from the Philippine Islands, a Chinese Turtle Dove (*Turtur chinensis*) from India, presented by Mr. Wilfred G. Marshall; a Rhesus Monkey (*Macacus rhesus* ♀) from India, a Yellow-crowned Penguin (*Eudyptes antipodum*) from New Zealand, deposited.

OUR ASTRONOMICAL COLUMN.

DARK TRANSITS OF JUPITER'S SATELLITES.—The Publications of the Astronomical Society of the Pacific, vol. ii. No. 11, contains several communications on dark transits of the satellites of Jupiter. Mr. Keeler sums up the phenomena as follows:—

(1) In ordinary transits, the satellite is bright when projected upon the surface of Jupiter near the limb, and is usually lost sight of when it reaches the central parts of the disk.

(2) Occasionally the satellite appears darker than the surface of Jupiter when in transit, even when projected on the brightest parts of the disk, and the depth of shade may be very considerable, as a satellite has often been mistaken for its shadow. On leaving the disk, the satellite nevertheless appears quite bright when projected against the sky.

(3) Dark transits of satellites increase in frequency with the order of distance from the primary, being more common for the outer satellites than for the inner ones.

(4) The phenomena are irregular in occurrence, and therefore not predictable.

In order to account for these facts a variety of theories have been propounded. Mr. Keeler advances the idea that the satellites are surrounded by atmospheres containing large quantities of aqueous vapour. A circulation of clouds may thus be set up by means of the intrinsic heat of the central planet. The cloud surfaces of the primary and its satellites being similar, the albedo of the two may be equal. If, however, any accidental disturbance should be set up which would cause a precipitation on the side of the satellite furthest from the source of heat, the albedo would be diminished, and if, at such a time, the satellite was passing across the disk of Jupiter, we should have the phenomena of a dark transit. On this supposition the unstable condition of the atmospheres of the outer satellites sufficiently explains their frequent dark transits.

A simpler and therefore more probable explanation is supported by Prof. Holden. It is that the phenomena of both bright and dark transits depend upon the contrast between the brightness of a satellite and that of the part of the planet upon which it happens to be projected. He finds that much of Jupiter's surface is only about three or four times as bright as the limbs—that is, has an albedo three or four times 0·07. If this be so, then on a background of 0·21 or 0·28, the first satellite, having an albedo of 0·22, or the second, with an albedo of 0·27, would usually be lost. Careful observations of the phenomena attending these transits will considerably elucidate the matter.

SOLAR ACTIVITY (JULY–DECEMBER 1890).—In *Comptes rendus* for January 19, Prof. Tacchini gives the following *résumé* of the solar observations made at the Royal Observatory of the Roman College during the second half of 1890:—

1890.	Relative frequency of spots.	Relative frequency of days without spots.	Relative magnitude of spots.	Relative magnitude of faculæ.	Number of groups per day.
July	3·80	0·40	8·23	12·83	0·97
August	3·42	0·52	15·29	11·77	0·68
September	5·83	0·18	23·68	22·32	1·46
October	3·17	0·58	17·33	10·83	0·75
November	2·45	0·50	7·95	22·75	0·55
December	3·38	0·38	9·25	17·75	0·81

The observations extend over 149 days. The following are the results obtained for solar prominences:—

1890.	Number of days of observation.	Prominences: Mean number.	Mean height.	Mean extension.
			″	°
July	30	2·07	33·8	1·4
August	31	2·65	27·5	1·1
September	24	2·88	35·8	1·2
October	22	8·05	40·6	1·5
November	16	2·13	28·0	1·5
December	12	3·42	40·4	1·6

M. Marchand, in the same number, gives the result of sun-spot observations made at Lyons Observatory last year. The following are the mean total areas of the groups measured expressed in millionths of the sun's visible hemisphere:—

January	22·5	July	49·7
February	23·0	August	51·0
March	51·0	September	154·1
April	34·6	October	160·5
May	20·5	November	137·2
June	8·3	December	41·0

M. Marchand remarks that in 1890 the proportion of days without spots was 0·456, whilst it was 0·555 in 1889. On the other hand, in 1889, only 29 groups of spots were observed, having a total surface area of 1890 millionths of the sun's visible hemisphere. In 1890, 43 groups had a total surface area of 3760 millionths. It is evident, therefore, that there was a sensible augmentation of solar activity last year.

PLANET OR NEW STAR?—The current number of *Comptes rendus* contains an announcement which astronomers would regard with much interest if it were substantiated. Dr. Lescarbault, the astronomer on whose statement the existence of the intra-Mercurial planet Vulcan mainly relies, observed a bright body in Leo on January 11, and, being unable to find it mapped in any atlas in his possession, he estimated its position as R.A. 11h. 4m., Decl. 6°, and concluded that the body was a new star, or one suddenly increased in brilliancy. There is little doubt, however, but that Dr. Lescarbault is mistaken in his conclusions, and that the body observed was the planet Saturn, whose position on the date named was R.A. 11h. 15m., Decl. 6° 59′.

THE FUTURE OF GEOLOGY.[1]

I PURPOSE, in this my retiring address, to make some observations and offer some suggestions as to the future of geology. Not, indeed, that I can claim the *rôle* of a prophet. But there are indications in the tone and manner of recent discussions and research which point clearly to the probable course of geological investigations in the immediate future. Geology has lately become too speculative. For at least a second time in its history we need to pause in order to gather up the records of the past, and to think seriously about the best method of progress in the future. A century ago, the conflict between the Wernerian and Huttonian theories was at its height. Speculation upon imperfect data ruled all. The practical work of William Smith and other English geologists, and the common sense of Englishmen, stayed this mad theorizing; and in the year 1807 the Geological Society of London was established for the express purpose of observing facts and recording observations. The results of this transference of energy from fierce controversy and dispute to patient investigation and labour of detail have been magnificent. And now again the old lines of controversy are reopened. The extraordinary revelations of recent microscopical research, and other improved modern methods, have necessarily reacted on physical geology; and there is once more great danger lest patient labour and accurate induction from proved data should give place to wild theorizing and acrimonious controversy.

The future of geology depends primarily on its practical uses. The method of its study, also, including the possible discovery of new methods of research, must be a potent factor in its development. Not less important is the consideration of the problems, whether physical, stratigraphical, or biological, which at present demand solution. And, as in all sciences and in all life, surrounding influences and environment have much to do with growth and progress. On each of these four points I wish to make a few remarks.

(1) The practical use of geology has received a striking illustration during the past year. Thirty-five years ago Mr. Godwin-Austen maintained the probability of Coal-measures beneath the newer strata of the south-east of England; and such Coal-measures have now been found. To the civil engineer, to the miner, to the stone-mason, builder, and architect, to the well-sinker and searcher for water, a knowledge of geology has become essential; and even so humble a person as the modern farmer and gardener might learn something from the coprolite and manure beds of the geologic series, and from the disposition of rocks and soils. During the past year nineteen committees appointed by the British Association have been concerned with geological subjects. Some of these are speculative and theoretic, but the majority are of practical use. The rate of increase of underground temperature has a direct bearing on mining operations; the circulation of underground waters is of great importance to the water-supply of towns and cities; the manure gravels of Wexford may revive the husbandry of Ireland; the flora of the Carboniferous rocks may throw light on the origin of coal and the probabilities of its occurrence in new localities; and even such apparently theoretic themes as the fossil Phyllopoda of the Palæozoic rocks, the Higher Eocene beds of the Isle of Wight, the erratic blocks sacred to our friends Dr. Crosskey and Mr. Martin, or the collection and identification of meteoric dust, may prove of importance in a practical direction. But not the least valuable are those researches which deal with foreign localities; and the Atlas Range of Morocco, the earthquakes of Japan, and volcanic phenomena of Vesuvius, may vie in value with the Bridlington sea-beach, and the action of waves and currents on the beds and foreshores of estuaries. So long as British enterprise is forcing its way to the centre of Africa, and exploring the Australian continent and the larger islands of the East, a fuller knowledge of foreign geology becomes imperative.

But apart from these matters of general interest or worldwide importance, the practical use of geology is exemplified in the researches of individual observers, and of societies like our own. The investigations of Dr. Callaway in the Uriconian rocks of Shropshire; the discovery by Dr. Lapworth of the Pre-Cambrian rocks at the Lickey and Nuneaton; and the more recent discovery by Mr. Landon of the Lower Bunter Sandstone at Barr Beacon, considerably to the east of the South Staffordshire coal-field, which had hitherto been thought to be its limit, are all illustrations of what may still be done by patient and zealous work. The crown of future success rests on the brow of toil and thought. Even the things of theory and speculation ofttimes become exalted into practical service by the growing developments of advancing knowledge, and the varying demands of human progress.

(2) I advance now to the method in which geology should be studied, and the possible discovery of new means of research. The day has long gone by when geology could be viewed "as a fashionable toy that everyone who has been to school is supposed capable of handling." No one now dares to touch its problems without some knowledge of physics, mathematics, biology, and chemistry. When Dr. Buckland led his tribe of random riders amongst the Oolitic strata of Oxford, or when Sir Roderick Murchison discoursed in sapient language on the rocks of Siluria, geology might have been a "fashionable toy." But not so now. The stern requirements of modern days have made it more accurate, and rendered it more sure. And with its enlargement has come an attention to minute detail, an observance of processes and of the results of processes which in the olden days had no place. To be a geologist now, at all events in the special phases of the science, a man must be either a mathematician, a physicist, a master of biology or of chemistry. Happy the man who can combine the whole!

Prof. A. H. Green, of Oxford, in his recent address as President of the Geological Section of the British Association, at Leeds, discoursed on the value of geology as an educational instrument. He began by admitting candidly that geologists were in danger continually of becoming loose reasoners, because the data from which they reasoned were necessarily scrappy and the geological record imperfect, or the facts were capable of interpretation in more than one way, or the determinations were shrouded in mist and obscurity. Notwithstanding this, he urged that the study of geology would be useful educationally by teaching wariness when the pupil comes to handle the complex problems of morals, politics, and religion. Further:—"There are immense advantages," he continues, "which the science may claim as an educational instrument. In its power of cultivating keenness of eye it is unrivalled, for it demands both microscopic accuracy and comprehensive vision. Its calls upon the chastened imagination are no less urgent, for imagination alone is competent to devise a scheme which shall link together the mass of isolated observations which field work supplies; and if, as often happens, the fertile brain devises several possible schemes, it is only when the imaginative faculty has been kept in check by logic that the one scheme that best fits each case will be selected for final adoption. But, above all, geology has its home, not in the laboratory or study, but *sub Jove*, beneath the open sky, and its pursuit is inseparably bound up with a love of Nature, and the healthy tone which that love brings alike to body and mind" (*Times* report, September 5; NATURE, vol. xlii. p. 455). Prof. Green proceeds to argue that geology should be taught in schools for more prosaic reasons; the two chief of which are that geography, and especially physical geography, cannot be taught without constant reference to certain branches of geology, and that there are many points of contact between the history of nations, the distribution and migrations of peoples, and the geological structures of the lands which they have dwelt in or marched over. And he concludes by sundry good illustrations of such school teaching, into which I need not now follow him.

Many may be disposed to think that this able and admirable address of Prof. Green is overstrained and overstated. But it must be remembered that, in order to convince the British public, it is necessary to state things strongly, and to draw things

[1] Presidential Address by the Rev. G. Deane, D.Sc., delivered before the Birmingham Philosophical Society on October 8, 1890.

clearly and deeply. I do not myself believe that the average school boy and school girl need to be taught "wariness" in matters of morals, politics, and religion. They are generally wary enough about these matters as it is; and, what is more, soon get weary of them. And, possibly, too much stress is laid upon the relation of geological structure to the history of nations and the migrations of peoples. An enthusiastic geologist might feel inclined to generalize that, inasmuch as the two great battles of the Franco-German war of 1870—Gravelotte and Sedan—were fought upon Jurassic strata, therefore such strata facilitate military operations, and all the great battles of history were fought upon Jurassic strata.

But, allowing that there may be some overstatement and special pleading, there is a great amount of truth in the address from which I have quoted. Many people go through life with their eyes shut. They do not really see what they think they see; and what they think they see is not what they ought to see—not what exists and presents itself to them. Whatever, then, trains to accurate observation of facts and phenomena is of value as an educational instrument. The great end of education is to call out and train the powers we possess, whether of mind or body. Whatever, therefore, develops and strengthens a faculty will further this end; and that scheme of training which best fosters *all* the powers of mind will be the most satisfactory. The mathematician is apt to think lightly of the probable and moral reasoning of the philosopher, and the classic sometimes prone to scorn the pretensions of science. For the highest kind of education, a severe, long-continued, and isolated application to one special branch of study is requisite; though there is then great danger that the mind will become warped and one-sided. But, for the initial stages of education, the pursuit of a definite science will tend to supplement and complete the discipline of other studies, and to render the juvenile mind *totus, teres, atque rotundus.*

Prof. Green has done good service in urging the claims of geology in this direction. It can never take the place of physics or chemistry; but it is at least the equal of either biology or physiology for training the mind to accurate and complete observation of facts and phenomena. The word has come from the chair of authority not a day too soon; and it is to be hoped that ensuing years may witness a great extension of geological teaching in our schools for both boys and girls.

The British Islands form the natural home of geological science. Though limited in area when compared with other countries, they contain in this small space a very great variety of different strata. Indeed, with one or two exceptions of no very great importance, the whole succession of geological rocks is represented in our land. Though we have not the immense development of one particular formation which occurs in some other regions, we have an immense variety of formations. The surface of our country is a miniature picture of the whole geological series; and England, Wales, Scotland, and Ireland thus become the key to the world.

Accordingly, it is not surprising that, in Britain, geology has been an honoured science, and that its leading votaries have attained a world-wide reputation. Other lands have nobly borne their share in discovery and speculation; but I think we may justly claim for Britain the crown of geological progress. As a science, geology began to emerge in Italy in the sixteenth and seventeenth centuries. Pythagoras, Strabo, and others of the ancients had, indeed, speculated on cosmogonies; but in Italy, at the time mentioned, the fossils of the sub-Apennine hills led to genuine geological controversy. A century later, Werner in Saxony, and Hutton in Edinburgh, were the great teachers of the science; and at the beginning of the present century the formation of the Geological Society of London based the study of geology upon a rigid induction of facts, and tended to discountenance crude speculation and hasty theory. Since then the nations of Europe and America have striven in friendly rivalry to further the knowledge of the science they love so well.

I am well aware that in two branches of study, as I shall explain further on, Britain until recently has lagged behind other countries. But this notwithstanding, Britain may well claim to be amongst the foremost in geological research. And we may to-night remember that Birmingham is the centre and apex of England, and that within a comparatively short distance from this room nearly all the geological formations can be observed and studied. Few places are more favourably situated for extensive and varied research than Birmingham. Within a distance of little more than fifty miles from this spot you may study the representatives of all the systems of rocks except the upper part of the Oolitic, the Cretaceous, and the Tertiary groups. And what are fifty miles in these days of railways? At slight expense and slight fatigue, a day's fresh air and bracing work full well repay the geologist. And within almost walking distance abundant materials for geologic study and pleasant recreation may be found. The Clent Hills, the Bromsgrove Lickey and the Severn Valley, the Clee Hills, the rocks of Ludlow, Wenlock, and South Derbyshire, the hills of Dudley and Rowley Regis, of Barr Beacon and Sedgley, of Coalbrookdale and the Wrekin, of Church Stretton, Charnwood Forest, Malvern, and the Cotswolds, are all within easy reach. And these together represent almost the whole of the series of known rocks, whether igneous, sedimentary, or metamorphic.

I have claimed for Great Britain pre-eminence in geological research. I might also claim for Birmingham pre-eminence in one, if not in both, of the branches of geological study which Great Britain has until recently neglected. In the chemical constitution of rocks, and their microscopical structure, the Continental geologists have in years gone by done better work than the English. But we are in recent years striving to wipe away this reproach. Forty years ago Mr. Sorby, of Sheffield, commenced his microscopical researches; and, in Birmingham, Mr. Samuel Allport has been conspicuous for success in this line of investigation. Mr. Teall, of the Geological Survey, Prof. Bonney, and many others, have amply redeemed, in this respect, the credit of the country. At the present time Dr. Callaway, Mr. T. H. Waller, and others, are making large use of this method of inquiry.

The chemical relations of geological questions do not even now command in England the attention they deserve; as there is a wide field of research for a qualified chemist in geological problems.

The study of a complex science like geology, then, includes almost all other sciences. In order to understand the real bearings of the manifold questions that emerge, the geologist needs to be almost omniscient. He must know something of almost every physical science—chemistry, mineralogy, and crystallography; what is now known by the name of physiography, including meteorology and natural philosophy; biology, physiology, and anatomy are all requisite. Microscopical research is essential. And if the higher parts of mathematics can be added, the observer will be still better equipped.

The past year has seen a new direction of enterprise in regard to the registration of geologic facts. The photographic art has been called into organized recognition. At the meeting of the British Association held at Newcastle-on-Tyne in September 1889, a committee was formed to arrange for the collection, preservation, and systematic registration of photographs of geological interest in the United Kingdom. In some counties, as in our own, this impetus has taken a rather wider sweep, and aims at a general photographic survey of the county. As is known to many here present, an influential county council has been appointed for this purpose in Warwickshire, with Mr. J. B. Stone as president, and Mr. W. J. Harrison as secretary; and two members of this Society have been delegated to act thereon. Unquestionably many instructive geological sections have been lost to science through want of correct drawing, or photographing, at the time of their exposure; and it is hoped that this committee may aid in recording and retaining such facts. The result of the first year's work has been satisfactory; and the report to the Association at the Leeds meeting shows that 196 geological photographs have been sent in. It is to be hoped that in years to come this method of rendering permanent transient sections may be productive of good.

The possible discovery of new methods of research opens up a wide field of speculation, into which time forbids me to enter at large. Improvements made in modern optical instruments have enabled the geologist to see through a brick wall, or force his way through a prickly problem; and the day may not be far distant when the very centre of the earth will be as clearly seen and understood as its surface now is. One of the most promising new methods of research is the separation of minerals by means of heavy solutions, and other methods are sure to come. It remains to be seen how far the recent marvellous advances in electrical science may throw light on the problems of rock metamorphism. The transitions from one kind of rock into another are startling and puzzling; and it may possibly be found that terrestrial magnetism and electrical force are potent factors in the results which field geologists have observed and recorded.

The genius of discovery is not yet exhausted; and the triumphs of the last fifty years augur an enlargement and expansion in the immediate future which will place the science of geology in the forefront of human progress.

(3) Passing now to the problems, whether physical, stratigraphical, or biological, which at present demand solution, I may remark that an ex-President of this Society—Mr. William Mathews—in the year 1883, made this topic, with great lucidity and power of reasoning, the theme of his address. Mr. Mathews dealt with four subjects: the doctrine of uniformity, the origin of mountains, the supposed cause of glacial epochs, and the eroding power of ice. As I have myself, in various papers read either before this Society or before the Natural History and Microscopical Society, discussed more or less fully the whole of these subjects, I do not propose touching them to-night. In fact, the last seven years have brought other questions to the front, on which I may venture to dilate.

Prof. Huxley, in his address as President of the Geological Society of London, in the year 1869, traced three phases of geological speculation, viz. the catastrophism of Murchison and the older geologists, the uniformitarianism of Hutton, Playfair, and Lyell, and what he styled evolutionism, which adopts all that is sound and good in the other two, and is destined to swallow them up. He argued that both catastrophism and uniformitarianism had kept alive the tradition of precious truths: catastrophism in insisting upon the existence of a practically unlimited bank of force, on which the theorist might draw; and uniformitarianism in insisting on a practically unlimited bank of time, ready to discount any quantity of hypothetical paper. And he maintained that there is no sort of theoretical antagonism between the two, as it is very conceivable that catastrophes may be part and parcel of uniformity; and still less is there any necessary antagonism between either of these doctrines and that of evolution, which embraces all that is sound in both, and applies the same method to the living and not-living world.

I consider the position thus taken up by Prof. Huxley to be absolutely impregnable. It is well to bear in mind that geology knows at present no finality. Time-honoured views have been shattered and pulverized by the recently-published papers on the Highlands of Scotland, and by both Continental and English geologists on the structure of the Alps. And no one could have attended the London meeting of the Congrès Géologique International without seeing that grave changes in geological conceptions, and in geological interpretations, are impending. The school of evolution will indubitably swallow up those of catastrophism and uniformitarianism.

And if evolution thus bids fair to dominate physical and stratigraphical geology, its influence can also be traced in the succession of living forms. Prof. Huxley himself has done as much as any living man in this direction. In his well-known lecture before the Royal Institution on February 7, 1868, he conclusively showed that bird fossils are reptilian in their character, and the reptile fossils of the Secondary rocks are bird-like in character. And further, in his lectures at the Royal School of Mines, in 1876, he gave a long and exhaustive series of transitional links, from the Ceratodus of the Trias, which affords a connecting link between fish and Amphibia through the reptilian types of the Secondary rocks, to the protohippus, hipparion, anchitherium, palæotherium, and orohippus of the Tertiary rocks, which are links of transition from the modern horse to the rhinoceros, the pigs, and the ruminants.

The recapitulation theory of development, as expounded in the writings of Fritz Müller, von Baer, Balfour, and Haeckel, supports the theory of evolution; and has been explained and illustrated at great length and with much power by Prof. A. Milnes Marshall in his recent brilliant address to the Biology Section of the British Association at Leeds. He writes:—

"The doctrine of descent, or of evolution, teaches us that as individual animals arise, not spontaneously, but by direct descent from pre-existing animals, so also is it with species, with families, and with larger groups of animals, and so also has it been for all time; that as animals of succeeding generations are related together, so also are those of successive geologic periods; that all animals living or that have lived are united together by blood relationship of varying nearness or remoteness; and that every animal now in existence has a pedigree stretching back, not merely for ten or a hundred generations, but through all geologic time since the dawn of life on this globe.

"The study of development, in its turn, has revealed to us that each animal bears the mark of its ancestry, and is compelled to discover its parentage in its own development; that the phases through which an animal passes in its progress from the egg to the adult are no accidental freaks, no mere matters of developmental convenience, but represent more or less closely, in more or less modified manner, the successive ancestral stages through which the present condition has been acquired.

"Evolution tells us that each animal has had a pedigree in the past. Embryology reveals to us this ancestry, because every animal in its own development repeats this history, climbs up its own genealogical tree" (NATURE, vol. xlii. p. 468).

The theory of evolution, then, in some one or other of its forms, must be accepted as the basis of the geology of the future. The physical problems which in past years have been examined and discussed by Sir William Thomson, M. Delauney, the Rev. Osmond Fisher, and others, have in recent years been still further elucidated; conspicuously so by our excellent secretary, Mr. Davison, and Mr. T. Mellard Reade. The stratigraphical problems have called in the aid of thrust planes, reversed faults, dynamo-metamorphism, and catastrophes to alter the dead level of uniformity. And the biological problems are explicable only on some theory of evolution. In Huxley's words, evolution is destined to swallow up the other two theories.

Perhaps the most striking development of modern geology is the rise and growth of the Congrès Géologique International; and the questions discussed thereat are, of course, the prominent questions of the present time. Beginning its existence at Paris in 1878, it has since met at Bologna in 1881, Berlin 1885, London 1888, and the next meeting is fixed for Philadelphia in 1891. Its growing importance is indicated by the numbers of foreign members in attendance. These were:—Paris 110, Bologna 75, Berlin 92, London 151, and our American cousins next year, as is their wont, will probably "whip creation." As I had the pleasure of attending the London meetings, I read a paper thereon before the Geological Section of this Society, and allude to the subject now only because the topics of the Congress suggest the matters which are under immediate discussion. These were three—the map of Europe, nomenclature and classification, and the nature and origin of the crystalline schists.

The geological map of Europe is under the care of an influential committee, meeting in Berlin, on which Germany, France, Great Britain, Austria-Hungary, Italy, Russia, and Switzerland, are all represented. The scale adopted is 1 : 1,500,000; that is, 1 inch to 23·673 miles; and the map will consist of forty-nine sheets. Some parts of Central Europe are on the eve of publication; and, although the colours are somewhat different from those we are accustomed to in England, it will be a great advantage to have uniformity of colouring for all European countries.

On nomenclature and classification, the Congress, having at the previous meetings dealt with the unification of geological terms, gave attention to the classification of the Quaternary and the Cambrian and Silurian strata. It was generally felt that, notwithstanding the insignificant thickness of the Quaternary strata, the advent of man and the existing mammals was sufficient to render this epoch absolutely distinct from the Tertiary. But on the great Cambro-Silurian question a battle royal ensued. As I have treated this fully in my previous paper, I must not take up time to-night upon it. This controversy still rages, both at the Geological Society of London, and in the pages of the *Geological Magazine*. Prof. Blake is mad on his Monian system; Dr. Hicks is naturally jealous for his Dimetian, Arvonian, and Pebidian of the St. David's promontory; Dr. Callaway is equally sensitive as to his Uriconian rocks of Shropshire; Dr. Lapworth, the inventor of the term Ordovician for the Upper Cambrian of Sedgwick and its equivalent the Lower Silurian of Murchison, may yet have something more to say before the controversy closes; and some of the Continental and American geologists seem to think the whole thing a storm in a teapot, and appear disposed to adhere to the ancient lines.

Closely connected with this controversy as to the base of the sedimentary rocks, comes the discussion concerning the nature and origin of the crystalline schists, which occupied two morning sittings at the Congress. Here, again, modern researches tend to subvert the older theories. Dynamic metamorphism, accompanied by recrystallization on freshly induced planes, curves, and surfaces, is now held to explain the most extraordinary transitions from one kind of rock into another. Both chemical analysis, aided by new methods, and microscopical investigation, with improved instruments, establish this conclusion; and it would seem likely that the immediate future would realize the reasoning of Hutton and Playfair that the sedimentary rocks give no indication of a beginning and no prospect of an end. Certain it is that the indications of bedding and sedimentary origin are encroaching fast upon what was only a short time ago considered part of the primæval crust of the earth. Some cases of supposed bedding, as for example in the Malvern crystalline axis and in some districts around the Wrekin, have been shown to be connected with igneous rock probably rearranged under great pressure. But as to the origin of the crystalline schists, Profs. Heim, of Zurich, Lehman, of Kiel, Drs. Lapworth and Callaway among ourselves, Dr. Hicks, and many other most able investigators, are firmly convinced that mechanical pressures and deformations are in reality the cause of the most sensational changes from both sedimentary and igneous rocks into crystalline schists. No doubt the old conflict will come on again, and it will be many years before these views will be universally accepted. But that they are destined to dominate the immediate future is as clear to me as the shining of the sun on a bright day at noon. The molecular changes induced by vast pressure and its accompanying natural forces are quite sufficient to change the structure and nature of crystals and rocks. Investigations in the field and in the laboratory will soon set these points at rest, though for some years to come the conflict of opinion may be strong and fierce. The chief difficulty at present is the apparent elimination of alumina and magnesia; but I have little doubt our chemists of the future will solve this problem, and their researches will throw light upon the nature of these widely extended though little-known substances. When practical geologists speak of the crystalline schists and associated strata as "a jumble of rocks," it is time someone arose to reduce the "jumble" to order; and there is every reason to believe that chemical and microscopical research will speedily bring him.

(4) The last element in the future of geology which I propose to speak of may be expressed as the external influences which bear upon the development of the science; so to speak, its environment.

Looking around at present upon geological activities in Britain, we find the Geological Society of London, the organization represented by the Geological Survey, a number of Societies scattered through the Kingdom which are devoted, either solely or partially, to the furtherance of geological research, and a large number of earnest individual workers in almost every nook and corner of the land. To these must be added the Royal Society, the Professors of the Science Colleges, with the great influence they spread, the British Association for the Advancement of Science, and the influence of the Universities in geological directions. With this vast army of workers geology *must* advance. Bnt, as in the past so in the future, it will be an advance amongst difficulties, and in the face of opposition and obstruction.

The spirit of the age has a mighty power on all things; and it might be thought, at first sight, that the spirit of the age would urge the science of geology forwards at almost headlong speed. But I am not at all so sure of this: it may urge general scientific inquiry forwards, but the popular directions do not run on geological lines so much as on some others. To put the matter in a nutshell, geology does not pay; and it must be made to pay, before competent and trained men will be able to give time and toil to its pursuit. Very few competent persons can afford to give up their leisure, and *also* their money, from a mere love of the science.

The last twenty years have witnessed a great expansion in scientific matters. Science Colleges have been established in many of the great centres of population, and to most of these a Professor of Geology is attached; in the Board Schools of most large towns and cities, science is taught, and with it Geology to a greater or less extent; more often less, and sometimes meagre. Private schools and organizations, likewise, sometimes favour, generally tolerate, the study. But still we are not happy. These things are not as they should be. Geology may reasonably claim a prominence it has not yet received.

In the days of Sedgwick, Buckland, Chalmers, Hugh Miller, Lyell, and Murchison, the leading geologists might be counted on your fingers; now they may be counted by scores, and it may confidently be expected that, notwithstanding pecuniary disability and in defiance of difficulties, the numbers will still increase. But at present the superior advantages of other lines of scientific thought and effort draw many away from the geologic path. Those who remain are attracted more by love of truth than hope of pay. If the amount of money sunk and lost through want of correct and accurate geological knowledge could be fully estimated, its total would be astounding. Some well-laid schemes, under good geological direction, doubtless have failed; but such are very few. The successes have greatly exceeded the failures. Here, close to Birmingham, the Sandwell Park Colliery may be pointed to; and the "Search for Coal" Committee in the south-east of England, will, in all probability, render a good account of their labours. With such examples before us, the public zeal for geology ought to be greatly stimulated.

In estimating the spirit of the age with regard to geology, one element ought to be noticed, which I rather shrink from introducing here—I mean the past theological hostility to the science. I will, however, deal with it generally, without introducing controversial matters. This hostility is scotched, but not killed, as it ought to be by this time. In centres of intelligence it has now but little or no power, but it lingers in the dark places of the land. A perverted theological bias has never yet succeeded in preventing the ultimate advance of a correct and accurate science; but it may hinder and obstruct. Lukewarm friends are little better than open enemies; and unconscious influence, from the cause referred to, may, and probably does, hold back many from hearty and earnest support of geological work. What is wanted for genuine and full growth and progress is the earnest and sympathetic aid of all classes and conditions. If this be withheld, the growth will languish and the progress will lag. Compared with the past, indeed, we have reason for immense thankfulness; but the evil still lurks, and has yet to be faced and finally destroyed.

And now, to apply this spirit of the age to concrete existence, and attempt to read the future in the light of the present, that future will depend upon at least two main supports, viz. (1) the union and the rivalry of effort, and (2) the devotion of either public or private money to geological objects, and to the determination of crucial points.

(1) The union of effort is represented by the many Societies already referred to scattered over the face of the country; by the central bonds of the Geological Society of London and Section C of the British Association; and by the newly developing Congrès Géologique International, which promises good service in the common cause. Some of these Societies—Field Clubs especially—are more of the picnic and social character than is likely to conduce to effective progress of scientific research; and even the meetings of the British Association are open to some criticism on this score. In our Midland district, in 1876, a new departure was started in the Midland Union of Natural History Societies; and this, after some vicissitudes, is still living a vigorous life; held a highly successful annual meeting at Oxford last year; and this year, at Leicester, a most pleasant meeting has been held, accompanied by two well-planned excursions—one botanical, and the other geological—through Charnwood Forest.

For one, I am not disposed to value lightly the influence of even mere social gatherings connected nominally with science. They tend to give a tone both to the neighbourhood where they are held, and to those who attend them; and also put people on the alert for possible discoveries. The experts in geology are few, but the watchers and labourers are many; and these last, scattered as they are throughout the country, may hear of or find out facts and points of interest which the experts may subsequently be called upon to examine and explain. Many an interesting geological fact, or even crucial section, has been lost simply because no one who understood the matter was at hand to decipher and preserve it, or report it to those who could do so. By all means let us increase our army of observers; what they hear of and discover experts can explain. A striking illustration of this kind of labour has recently occurred in this district. Mr. Sherwood, of Sutton Coldfield, found a freshly opened section near Barr Beacon, which exposed rocks that were new to him. He reported the fact to Mr. Landon, of Saltley College, who discovered an eroded surface of the Lower Bunter Sandstone, in a locality where it had previously been believed to be absent. Mr. Landon has since discovered quartzite implements in a river gravel at Saltley. I have had, in my own experience, similar illustrations, one of which is worth recording. When residing in the valley of the Ouse, in Bedfordshire, during an occasional absence from home, a well was sunk near my house. The workmen came upon the lower jaw of a hippopotamus, and of course proceeded to demolish it with their pickaxes. A friend of mine happened to pass, and he succeeded in saving for me some fragments of teeth and jaw. When I returned, the bulk of the remains had been used as stuffing to the back of the well. But my friend had saved sufficient to prove the existence of *Hippopotamus major* in that locality.

This union of effort necessarily involves some amount of friendly rivalry. It seems to be a law of humanity that two vigorous persons, jogging side by side along the same road, stimulate each other to increased pace. And so, in each society, the blending of effort is a stimulus to each individual worker. In a union of societies, the same power should be felt; each will vie with the others, not simply for pre-eminence of course, but for progress. And the result comes unconsciously in the advancement of the object they have in common. Geologists in the nations of Europe and America, organized in various societies, and surrounded by different influences, have one common object, and mutually stimulate each other towards the attainment of full and complete geological knowledge. It may be, sometimes, that this rivalry will lead to strenuous conflict; but conflict of opinion and thought, so long as personal rancour and strife are excluded, will always lead onwards in the path of truth.

(2) In approaching the matter of money—whether public or private—devoted to geological objects, I touch a subject of some magnitude, complexity, and difficulty. When the British purse is appealed to, buttons are often in requisition, not in lieu of coins, but to close the exit of coins. But it is perfectly clear that geological investigation is expensive, and the pecuniary resources of most competent geological observers are limited. Geologists have to rely, for the most part, upon natural sections and exposures, or upon those artificial sections and borings which commercial enterprise opens up. A judicious expenditure of money to make artificial sections and borings, in order to determine crucial points, would often be amply repaid.

In the allocation of public money to geological objects, we have conspicuously before us the Geological Survey of the Kingdom, the maintenance of the Royal School of Mines, and the Natural History Museum at Kensington. Then, during the last year, a grant in aid of provincial Science Colleges has, after much agitation, been wrung from the Treasury; though how much of this will find its way to geological objects is very problematic. Perhaps the most significant "sign of the times" in this direction is the Report of the Committee, appointed by the Commissioners of the 1851 Exhibition, as to the establishment of Science Scholarships in provincial and colonial Universities and Colleges. The second item of the Committee's recommendation runs thus: "That the scholarships be limited to those branches of science (such as physics, mechanics, and chemistry) the extension of which is specially important for our national industries" (NATURE, vol. xlii. p. 431). Of course this is a case of complete powerlessness on the part of geologists. The Commissioners are acting within their rights, and after due deliberation. But, with all deference to the illustrious men of science who have drawn up this Report, I humbly think that geology ought not to be excluded from the subjects that are specially important for our national industries.

Various scientific Societies allocate money in aid of geological research. The grants from the Royal Society and the British Association have been of great service, not only in rousing activity, but also in rewarding, or rather recompensing, worthy work. The Geological Society of London has at its disposal several most honourable awards for well-spent labour. The medals come first—the Wollaston, Murchison, Bigsby, and Lyell Medals being the highest geological honours of the country. But the surpluses of these funds, as also the "Barlow-Jameson Fund," are allocated from time to time to repay in some measure the expenses of those who have rendered distinguished service and wrought good work. With us in the Midlands the Darwin Medal of the Midland Union, and the grants made from our "Endowment of Research Fund," are a humble reflex of such awards. There is ample scope for extension and enlargement in awards of this kind.

But perhaps the development of future British geology may come from other sources. The enterprise of the South-Eastern Railway directors has opened up the possibility of coal-fields where thirty-five years ago geologists said they might exist; and public companies can do much to aid further research. Private enterprise also may do much. This old land of ours is not yet used up, and one need not despair of discovering still, in its soil and rocks, fresh elements of permanence and power.

I have thus endeavoured to trace what seem to me to be the possibilities of future geology. There may be regions yet unsearched which will yield up their treasures to the diligent. The current controversies on theoretical points afford scope for the acutest intellect to unravel and explain. New methods of research give promise of coming discoveries. The spirit of the age and the surroundings of the science are favourable on the whole to progress. If money be forthcoming to meet needful expenses, and observers are careful and accurate, the past triumphs of geology will appear small compared to the triumphs that are yet to come.

THE SOUTH AFRICAN DOCTRINE OF SOULS.

IN the second of two interesting papers on the manners, customs, superstitions, and religions of South African tribes (Journal of the Anthropological Institute, vol. xix. No. 3, and vol. xx. No. 2), the Rev. James Macdonald, who has had ample opportunities of studying the subject, has a good deal to say about the doctrine of souls which prevails among the aborigines of South Africa. It is extremely difficult, he explains, to discover what the people really believe about the spirit world, so many and varied are the traditions relating to it. There are, however, certain outstanding facts common to all; and of these Mr. Macdonald gives a clear and instructive account.

All human beings are supposed to have souls, but their souls are not believed to be entirely confined to the body. A man's soul may, it is thought, occupy the roof of his hut, and, if he changes his residence, his soul does so at the same time. Mr. Macdonald takes this to be a loose and indefinite way of expressing "the belief that a man's spirit may have influence at a distance from the place where he is himself at any time." The people often use the word "zitunzela"—from "izitunzi," shadows—to express their ideas of human spirits and the unseen world generally; and this is "the nearest description that can be obtained." A man is constantly attended by the shadows or spirits of his ancestors as well as his own, but the spirit of one who dies without speaking to his children shortly before death never visits his descendants except for purposes of evil. In such cases magicians or priests offer costly sacrifices to prevent misfortune and death.

Great importance is attached to dreams or visions, which are supposed to be due to spirit influence. When the same dream comes more than once, the dreamer consults the magicians, who profess to receive revelations through dreams. If the dreamer has seen "a departed relative," the magician says, "He is hungry." Then a beast is killed; the blood is collected, and placed in a vessel at the side of the hut farthest from the door; the liver is hung up in the hut, and must not be eaten until all the flesh of the animal has been used. The "essence" of the food is "withdrawn" by the spirit during the night, and after a specified time all may be eaten except the portions which the magician orders to be burned.

Ancestor-worship is not only professed by the South African tribes, but "they actually regulate their conduct by it." Says Mr. Macdonald:—

"If a man has a narrow escape from accident and death, he says, 'My father's soul saved me,' and he offers a sacrifice of thanksgiving accordingly. In cases of sickness, propitiatory sacrifices are offered to remove the displeasure of the ancestors, and secure a return of their favour. Should anyone neglect a national custom in the conduct of his affairs, he must offer sacrifice to avert calamity as the consequence of his neglect. When offering propitiatory sacrifices, the form of prayer used by the priest is: 'Ye who are above, accept our offering and remove our trouble.' In freewill offerings, as in escape from danger, or at the ripening of crops, the prayer takes the following form: 'Ye who are above, accept the food we have provided for you; smell our offering now burning, and grant us prosperity and peace.'"

Animals are not supposed to have souls; neither are inanimate objects. But spirits may reside in inanimate objects, and their presence has an influence on many customs and habits. A striking example of such influence was afforded during the rebellion of 1879, when Umhlonhlo, after the murder of the British Resident, was one day marching in a leisurely manner across country with his whole army. The forenoon was hot, and not a cloud was to be seen. Presently, the magicians noticed on the horizon a peculiarly shaped cloud :—"It rose rapidly in one mass and 'rolled upon itself.' Its movements were intently watched till it approached the zenith and passed over the sun. This was an evil omen. For some unknown cause the spirits were mortally offended, and had come over the army in shadow at noonday. In grief and sorrow their backs were turned upon their children, and the result of this would be certain defeat and disaster. There was, however, no immediate danger. That morning's scouts had reported that there were no troops within many miles of their line of march, and they could repair to some sacred place to offer sacrifices and make atonement. While they were discussing which place to repair to for this purpose, the van of a small column of cavalry appeared unexpectedly over a rising ground. Dismay struck into every heart. The war minister urged his men to form into order of battle. No one answered his summons. He did his best to organize an orderly retreat, but in vain ; not a blow was struck, and every man took to his heels, making for the nearest hiding-place in mountain or forest. That army never reassembled. Black-hearted fear utterly demoralized it."

Water or river spirits play a great part in South African mythology. They inhabit deep pools where there are strong eddies and under-currents. They are dwarfs, and are of a malignant disposition, which they display by greedily seizing on anyone who comes within their reach. They are, of course, greatly feared ; and the popular dread of them is shown in a way which has been known in many different parts of the world. Mr. Macdonald gives the following example :—

"Some years ago a number of Gcaleka girls were, on a fine summer day, bathing in the Bashee. One of them got beyond her depth, and began to struggle in the water and cry for help. Her companions promptly raised the alarm, and two men working close by ran down to the water's edge. She was still struggling feebly, but to the onlookers it was a clear case of being 'called' by the river, and they made no attempt to save her. The body was recovered by the magicians the same day, when it was found she had been drowned in less than 5 feet of water. All this came to the ears of C. G. H. Bell, Esq., the English Resident, and he cited the parties, magicians and all, to appear before him in court. The two men not only admitted that they could have waded to the spot where they saw her struggling, but also said the water would not be 'more than breast deep.' They had made no effort to save her, as it would be 'improper and dangerous to interfere when one is called by the river.' Mr. Bell tried to argue them out of such absurd notions, but to little purpose, and finally came to the conclusion that 'six months hard' might be more effectual in eradicating superstition than all his philosophy, and six months hard it accordingly was."

Mr. Macdonald says there is no periodical process of purging or driving away spirits. Without the presence and aid of magicians, ordinary people dare not interfere with these mysterious powers, however malignant and destructive they may become. Although a man is guarded by the spirits of his ancestors, they do not protect him from demons or from wizards and witches. A certain measure of protection can, however, it is supposed, be obtained by the use of charms provided by magicians. On one occasion, when war was being carried on with England, the magicians gave the soldiers a charm against English bullets. It was the blue flower of a species of rhododendron. "Those who carried this talisman rushed forward against columns of infantry without a shadow of fear or hesitation, and only when men began to bite the dust in all directions did the nature of the delusion break upon the army, and panic ensue."

THE ACTION OF LIME ON CLAY SOILS.

THAT lime promotes the fertility of heavy clay soils is a fact that has for many generations been well known to all agriculturists ; but the scientific reason for the beneficial action arising from its application has not, to the best of my belief, been at any time at all satisfactorily explained. The question, however, remains one of first importance in the science of soils, and I therefore make no apology for offering an explanation, or rather theory, which, to my doubtless somewhat partial mind, seems to go a considerable way towards the elucidation of the problem.

I take it for granted that all interested know that a clay soil is not by any means a pure clay (hydrated silicate of alumina), but a mixture of *impure* with pure clay (much more of the former than of the latter), plus sand, iron oxides, organic matter, &c. The clays which form its bulk have been derived from the natural decay or weathering of mineral silicates, containing, besides, aluminium, alkali, or alkaline-earth metals, and they occur in it in all stages of impurity or further decomposition. As an invariable rule, other things being equal, the greater the normal impurity of the clays the greater the fertility of the soil. A *pure* piece of clay is like pure quartz-sand—so much dead, inert matter ; a plant can make nothing of it, can take nothing from it. In no fertile clay soil, however, even of the heaviest description, does there occur at any time more than about 10 per cent. of *absolutely* pure clay. Well, then, what is the composition of the average clay particle? That depends on the mineral from which it was derived. If from the felspars, its most common origin, it will be a hydrated silicate of alumina plus silicate of potash, or, instead of the potash, soda and lime. I will suppose, for brevity's sake, that my clay particles have the former composition, and the explanation which I will offer with regard to their behaviour can be applied with very little difficulty to any of the other cases. Clay particles of the above composition, when subjected to the action of water containing carbonic acid gas, lose potash. That I have repeatedly proved by experiment. If the carbonic acid is in fair excess, it comes away altogether as carbonate of potash ; but if there is not a sufficiency of this anhydride, it is liberated partly as soluble silicate of potash (soluble glass). Should lime, however, in this latter case be present, the practically insoluble calcium silicate will be constituted, and the potash freed to form a soluble salt with any other acid that may be present and available, such as carbonic, sulphuric, nitric, &c. A grass plant growing in clay soil does not, it is evident, send sufficient carbonic acid through its root-hairs into the soil, as many other plants do, to completely convert the liberated potash into carbonate, and the consequence is that the soluble silicate of potash which is permitted to form is drawn into the vegetable, as well as the carbonate of that alkali. Now silica and silicates are decidedly injurious, to all vegetables doubtless, but particularly to agricultural plants. I say injurious ; the day has gone by for considering silica an essential, or useful, or even a merely innoxious accessory. A little examination of the plant-physiology shows that it is injurious. The organism tries to get rid of it as speedily as possible—that is, at least to get it out of the way of its general circulation ; it unfortunately has no means of casting it off altogether. Here, I need scarcely refer to the well-known experiments which have, over and over again, conclusively shown that the grass plant does not require silica as a supporting or strengthening material. Now we come to see the use of lime in the clay soil, especially in the case of the cultivation of cereals and pastural grasses. The lime added and mixed up with the soil acts on the soluble silicate of potash as it is formed, and combines with the silica, constituting, as I have already remarked, the practically insoluble silicate of lime, which, of course, being normally indissolvable in the soil, cannot pass into the body of the plant. Therefore, the organism profits by its exclusion, and as a consequence so does the farmer. The energies of the plant are not spent in getting rid of silica if there is no silica to get rid of, and its ordinary processes of nutrition can progress uninterruptedly.

The breaking up of the soluble silicate[1] could be as well accomplished by the perfect aëration of the soil so that every particle could be constantly exposed to fresh portions of aërial carbonic acid and oxygen ; and this is one great reason why fine deep tillage, where it is possible, so improves clayey soils, but of course a tillage that will bring about the perfect aëration of heavy clay, is all but impossible ; therefore the advantage of judiciously using lime.

The soluble alkaline silicate which, when undecomposed, passes into the plant in the water-stream through the roots, is evidently very soon split up by the vegetable, and the silica combined with some substance, such as an aldehyde, and carried on in solution in this state to the peripheries of the stem, &c., where, by the process of practically unrestrained evaporation, the compound is again split up, the aldehyde going off into the air, and the solid silica remaining stranded in the cuticle and the other walls, or occasionally even in the cavities of the epidermal layer.

[1] Only the alkali metals, of which potassium and sodium are the only two that normally occur in soils, form silicates soluble in water.

The silicate of lime formed in the above reaction itself ultimately undergoes decomposition by natural water containing carbonic acid, but the decomposition is always complete; it devolves entirely into carbonate of lime and free insoluble silica.

ALEXANDER JOHNSTONE.

Edinburgh University.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

OXFORD.—Prof. Sylvester is lecturing this term on the theory of numbers, and its application to the division of the circle into equal parts. Prof. Clifton and Mr. Baynes lecture on electricity, and Mr. Walker on physical optics. Prof. Odling's course is on ureas and uric acid, and Mr. Veley is lecturing on physical chemistry.

Prof. Ray Lankester is giving a general course on morphology, and Mr. Minchin a special lecture on Echinoderms. Dr. W. Benham has been appointed Demonstrator in the Morphological Laboratory in succession to Mr. P. C. Mitchell, who has been selected by the University Extension authorities as one of the lecturers who are to carry out the scheme of scientific education adopted by the County Council of Devonshire.

An examination for a Radcliffe Travelling Fellowship will take place before the end of Term. The Senior Mathematical Scholarship has been awarded to Mr. A. L. Dixon, Worcester College.

CAMBRIDGE.—The General Board of Studies announce the vacancy of the Lectureship in Advanced Morphology of Invertebrates, caused by the appointment of Mr. Weldon, F.R.S., to the Chair of Zoology in University College, London. The appointment is for five years, and the stipend £50 a year. Candidates are to apply to Prof. Sidgwick, Hillside, Cambridge, by February 3.

Prof. Macalister announces an introductory lecture on Thursday, January 29, at noon, by way of inaugurating the new anatomical lecture-theatre. His subject is "The History of Anatomical Study in Cambridge."

Prof. Roy announces six courses of lectures for the Lent and Easter terms in pathology and bacteriology, to be given by himself in collaboration with Mr. J. G. Adami, John Lucas Walker Student; Mr. E. H. Hankin, Fellow of St. John's; Dr. A. Gamgee, late Professor of Physiology at Owens College; and Mr. E. Lloyd Jones, Demonstrator of Pathology.

Prof. Ewing will lecture for the present in Sir George Stokes's lecture-room at the new Museum. He announces courses in strength of materials, theory of structures, mechanics, and geometrical and mechanical drawing.

The Botanic Garden Syndicate report that, while the new range of plant-houses, erected at a cost of £3000, has proved very satisfactory, it has been discovered that the remaining old houses are in a hopeless state of decay, and cannot with advantage be longer maintained. They propose that they be reconstructed at a cost of £2200.

The Special Board for Biology report that, during the five years ending Michaelmas 1890, the University's table in the Zoological Station at Naples, for which an annual grant of £100 has been made to Dr. Dohrn, has been occupied on eight occasions by Cambridge workers. In view of the importance of the opportunities there offered, and of the recent extensions and improvements that have been made, the Board propose that the grant be renewed for a further period of five years.

Dr. J. Griffiths, Assistant to the Professor of Surgery, is nominated an additional member of the Board for Medicine; Mr. W. N. Shaw, of the Board for Physics and Chemistry; Mr. S. F. Harner, of the Board for Biology.

Mr. T. Roberts and Mr. Acton, of St. John's, and Mr. Wilberforce, of Trinity, are appointed Examiners in Natural Science, in connection with the University Extension Scheme.

SCIENTIFIC SERIALS.

American Journal of Science, January.—On the alternating electric arc between a ball and point, by Edward L. Nichols. Let two wires, forming the terminals of the secondary coil of an alternate current transformer, be brought nearly into contact, one of them being armed with a point, the other with a ball. When the distance is such as to admit of a discharge between the two, a galvanometer in shunt around the ball and point will be found to indicate a considerable flow of continuous current, the direction being that which would result from a current flowing from the former to the latter. This phenomenon has recently been subjected to experiment by Messrs. Archbold and Teeple, who have determined the changes of electromotive force and current as the length of the arc formed between the ball and point is increased. Mr. Nichols also describes some observations made by Mr. F. C. Caldwell, from which it appears (1) that the discharge from the ball (positive) leaves the latter in a direction normal to the surface, but that it enters the other terminal at some distance from the apex; (2) that the discharge from the point (positive) leaves the apex of the latter, but is deflected into a course nearly 45° from the axis, and reaches the ball obliquely at some point on its side.—Deformation of the Algonquin Beach, and birth of Lake Huron, by J. W. Spencer.—The decimal system of measures of the seventeenth century, by Prof. J. Howard Gore. Evidence is adduced (1) that a priest, named Gabriel Mouton, of Lyons, proposed a system of measurement, based upon the scale of tens, about 1665; (2) that he derived his unit from the length of a minute of the terrestrial arc; (3) that he showed how this unit could be expressed in terms of the seconds pendulum.—On the Clinton Oolitic iron ores, by A. F. Foerste.—Effects of pressure on ice, by R. W. Wood, Jun. A solid steel piston was turned to work air-tight in a cylindrical cavity drilled in a block of cast-iron. A small hole, like the vent of a cannon, communicated with the bottom of the cavity. Ice was placed in the cavity, and the piston inserted. At a pressure of 4½ tons to the inch, small cylindrical pieces of clear ice spurted from the orifice. To test at what pressure ice at the melting-point would become fluid as a mass, a similar iron block, without a vent, was filled with ice, in which were embedded several small bullets. The pressures were carried up to twenty tons per square inch without the ice being reduced to a liquid state. When this point was reached, fine jets of spray spurted in all directions from the block of iron; the ice was afterwards found, however, to have had sufficient viscosity to support the weight of the shot. It is possible, however, that the piston got jammed in the cylindrical cavity, and thus the ice might not be under the pressure indicated by the gauge. The experiments lead Mr. Wood to the conviction that any theory is questionable that accounts for peculiar motions of glacial ice by supposing the existence of a layer of pressure-molten water beneath the mass.—A review of the Quaternary era, with special reference to the deposits of flooded rivers, by Warren Upham. The Quaternary era, according to many authorities, began with the change from the mild Pliocene climate to that of the Glacial period, has continued to the present time, and must extend far into the future. Mr. Upham traces, in a very concise manner, the succession of events, glacial and fluvial deposits, and the changes in altitude and climate, from the beginning of this era to the present time.—On the illuminating power of flat petroleum flames in various azimuths, by Alfred M. Mayer. The flat flame of a Hitchcock lamp, in which combustion is maintained by a blast of air driven against the flame by a fan moved by clock-work, and the flame of an ordinary petroleum lamp were experimented upon. The latter flame was surrounded by a chimney, the former was not so inclosed. The following is a comparison of the candle-power of each flame at three of the azimuths at which photometric measures were made. The angles were measured from the plane of the flat flame.

Azimuth.	Hitchcok flame.	Ordinary flame.
° 0	9·8	6·6
50	15·8	10·25
90	15·6	10·6

It therefore appears that the edges of the Hitchcock flame and the ordinary flame give, respectively, about 37 and 38 per cent. less light than the flat surface.—On the physical properties of hard-rubber or vulcanite, by the same author. The mean of twelve determinations of the coefficient of linear expansion of vulcanite, obtained by means of a specially devised piece of apparatus, gave the value 0·0000636, between the temperature at which the experiments were made, viz. 0° and 18° C. The cubical expansion of the substance is closely represented by the formula—

$$v_t = v_0 + 0·000182t + 0·00000025t^2.$$

The specific heat = 0·33125. The angle of maximum polarization of a polished surface of vulcanite was found to be 57° 29′. Hence the index of refraction = 1·568. The diathermancy has also been determined.—On some remarkably developed calcite crystals, by Louis V. Pirsson.

SOCIETIES AND ACADEMIES.

London.

Royal Society, January 15.—"Note on the Present State of the Theory of Thin Elastic Shells." By A. E. H. Love, M.A., St. John's College, Cambridge. Communicated by Lord Rayleigh, Sec. R.S.

This is a note in correction of the author's paper in Phil. Trans., A., 1888. In that paper it was shown that, when no surface tractions are applied to the surfaces of the shell, the potential energy per unit area can be expressed in the form $Ah^3W_1 + BhW_2$, where $2h$ is the thickness of the shell, and A and B are elastic constants. The function W_2 depends on quantities expressing the extension of the middle surface, and W_1 depends on quantities defining the changes of curvature; and it was shown that it is impossible to satisfy the boundary conditions which hold at a free edge, except by taking account of the term in W_2. A theory of the vibrations of bells was therefore proposed in which the term in W_2 was retained, and the term in W_1 rejected, *i.e.* the vibrations were supposed to depend mainly on the extension of the middle surface. This theory was in opposition to Lord Rayleigh's theory in Proc. Lond. Math. Soc., 1882, which was founded on the supposition that the middle surface remains unstretched. In December 1888 Lord Rayleigh proved from general principles that the mode of deformation corresponding to the gravest tone cannot be included among the extensional modes; but it has not yet been shown how, in any particular case, the boundary conditions can be satisfied by a mode of oscillation depending mainly on bending. The solution of the difficulty has, however, been recently pointed out by Mr. Basset and Prof. Lamb. Each of these writers has proved that, in particular statical problems relating to cylinders, the quantities expressing the extension can be very small everywhere except in the neighbourhood of an edge, and *there* they may increase with such rapidity as to secure the satisfaction of the boundary conditions, the total potential energy due to extension, which varies as the surface integral of hW_2 over the middle surface, being, nevertheless, negligible in comparison with that due to bending, which varies as the surface integral of h^3W_1. There is little doubt that, as Mr. Basset and Prof. Lamb suggest, all this will hold equally in the case of a vibrating shell under ordinary conditions. Some detailed corrections of the author's previous paper were given

Zoological Society, January 6.—Prof. Alfred Newton, F.R.S., Vice-President, in the chair.—The Secretary read a report on the additions that had been made to the Society's Menagerie during the month of December 1890.—Mr. Sclater exhibited some sketches made by Lieut. W. E. Stairs, R.E., of the horns of a large antelope, apparently new to science, which had been met with by the Emin Pasha Relief Expedition in the forest-district of the Aruwimi River.—Mr. G. A. Boulenger read the description of a new lizard of the genus *Ctenoblepharis* obtained in the Province of Tarapacà, Chili, by Mr. A. A. Lane, which he proposed to describe as *Ctenoblepharis jamesi*.—A second paper by Mr. Boulenger contained an account of some specimens of extinct and fossil Chelonians preserved in the Museum of the Royal College of Surgeons.—Mr. F. E. Beddard gave an account of certain portions of the anatomy of the Kagu (*Rhinochetus jubatus*) as observed in specimens lately living in the Society's Gardens.—Lieut.-Col. H. H. Godwin-Austen, F.R.S., read a paper on the land-shells collected in Borneo by Mr. A. Everett, Mr. Whitehead, and others. In this communication (the second of the series) the author gave a list of the species of the families Zonitidæ and Helicidæ as known from Borneo up to the present time. He described the anatomy of several species and defined two new genera (*Diukia* and *Everettia*), pointing out how they differ from previously known genera founded on anatomical characters.

Geological Society, January 7.—A. Geikie, F.R.S., President, in the chair.—The following communications were read:—On the north-west region of Charnwood Forest, with other notes, by the Rev. E. Hill and Prof. T. G. Bonney, F.R.S. The paper contains the results of a re-examination of the north-west region, when the authors had the advantage of using the six inch Ordnance-map, published since the completion of their former work. In this they had expressed the opinion that the rock of Peldar Tor and that of High Sharpley were somewhat altered pyroclastics, being much influenced by the non-igneous origin asserted for the "porphyroids" of the Ardennes. But in 1882 one of them had visited this region, and was then convinced that the porphyroids, which closely resembled the rock of Sharpley, were felstones which had been rendered schistose by subsequent pressure. The result of their subsequent work in Charnwood has convinced the authors that the rocks of Sharpley and of Peldar Tor are in the main of a like origin and history. The mass of Bardon Hill, where the quarries have been much enlarged, has also been studied, and some details in the section formerly published have been corrected. The schistose bands, on which the authors relied as marking horizons for stratigraphical purposes, prove to be zones of exceptional crush. The occurrence of a rock exactly resembling that of Peldar Tor is fully established. It is extremely difficult to decide upon the true nature of the rocks which are chiefly worked in the pit, but the authors remain of opinion that for most of them a pyroclastic origin is the more probable. Some notes are added upon the relations of the holocrystalline igneous and the sedimentary rocks of the Fore-t, upon the Blackbrook group, and upon the fragments and pebbles in certain of the coarser ashy deposits. Some remarks are made upon the glacial phenomena exhibited in the Forest region; these indicate that this cannot have been overridden by a great northern ice-sheet, and it does not afford the usual signs of the action of local glaciers. At the same time it has been a centre of dispersion for erratics, especially towards the south and southwest, these being found sometimes more than twenty miles away. Hence, in the opinion of the authors, the erratics have been distributed by floating ice during an epoch of general submergence. Some minor "corrigenda" in the earlier papers are noted, with certain changes in the names of localities, bringing them into harmony with the six-inch map.—Note on a contact-structure in the syenite of Bradgate Park, by Prof. T. G. Bonney. The author described a specimen, obtained at Bradgate Park, showing a junction of the syenite and slaty rock of Charnwood. The latter rock is very slightly altered; the former exhibits a number of grains of felspar and quartz set in a matrix which has now a "trachytic," now a devitrified structure. He traced the former into the "micrographic" structure observed generally in these syenites, and discussed its significance. His study of these structures in this and many other instances led him to infer that they generally indicated that the rock, at a late stage, had consisted of a mixture of previously formed crystalline grains and a viscous magma, that the temperature of the mass had been comparatively low, that it had cooled rather gradually, and that the condition of the magma—*i.e.* one of very imperfect fluidity—had not permitted of free molecular movements among its constituents. Thus this structure, together with certain others mentioned, might be regarded as indicative of "crystallization under constraint." The reading of these two papers was followed by a discussion, in which Prof. Blake, Dr. Callaway, Mr. Gregory, General MacMahon, the President, and Prof. Bonney took part.—On the unconformities between the rock-systems underlying the Cambrian quartzite in Shropshire, by Dr. C. Callaway. In the course of a discussion on this paper, some remarks were made by Prof. Blake, Prof. Bonney, Dr. Hicks, and the author.

Anthropological Institute, January 13.—Mr. E. W. Brabrook, Vice-President, in the chair.—Mr. Lewis exhibited a specimen of the stone used by Admiral Tremlett to cut marks on the granite of which the Breton dolmens are composed.—Mr. R. B. Martin exhibited a fire-syringe from Borneo.—Mr. C. H. Read exhibited some specimens of worked jade from British Columbia, and a bored stone from San Juan, Teotihuacan.—Mr. J. Edge Partington and Mr. C. Heape exhibited an ethnographical album of the Pacific Islands.—Mr. F. W. Rudler read a paper on the source of the jade used for ancient implements in Europe and America. Its object was to call the attention of anthropologists to certain mineralogical discoveries which have been made within the last few years, and which tend to overthrow the well-known theory which suggested early intercourse with the East as the source of the jade objects found in the lake-dwellings of Switzerland, the prehistoric burial-places of France and Germany, and the ancient Indian graves on the north-western coast of America. Herr Traube, of Breslau, first recorded the occurrence of jade *in situ* at Jordansmühl, in Silesia, and afterwards discovered it at the arsenical-pyrites workings at Reichenstein. Rough pebbles have also been found in the valleys of the Sann and the Mur, in Styria. Dr. G. M. Dawson has described the occurrence of boulders of jade, partly sawn through, at Lytton and Yale, on the Fraser River; and Lieutenant Stoney has actually found the mineral *in situ* at the Jade Mountains, north of the Kowak River, in Alaska. These discoveries prove that, contrary to general belief, jade does occur in the rocks of Europe and of North America, thus supporting the view so long held by Dr. A. B. Meyer, of the Royal Zoological Museum in Dresden, and accepted in America not only by Dr. Dawson, but by Prof. F. W. Clarke and Mr. Merrill, Mr. Kunz, and others. In England, most anthropologists have hitherto inclined to the exotic rather than to the indigenous origin of the prehistoric jades.

Linnean Society, January 15.—Prof. Stewart, President, in the chair.—The President exhibited a bunch of holly berries which were remarkable for being perfectly black instead of red, but which in no other respect looked abnormal. The peculiarity was attributed to the effect of a fungus.—Mr. J. E. Harting exhibited a male specimen of the wigeon (*Anas penelope*) which had been shot in Ireland, and which had a tassel of feathers about an inch in length depending from the under side of the neck. The explanation suggested was that it was the result of a former shot wound, when the pellet, as often happens, plugged the wound with feathers, and the skin had grown round and below the obstruction.—A paper was then read by Dr. P. H. Carpenter, on certain points in the morphology of the *Cystideæ*, which were admirably demonstrated with the aid of diagrams. A discussion followed, in which Mr. H. Bury and Mr. Bather took part.—On behalf of Mr. Thomas Kirk, of Wellington, New Zealand, the Secretary read an interesting report of a botanical visit to the Auckland Islands.

Royal Meteorological Society, Jan. 21.—Annual Meeting. —Mr. W. H. Dines, Vice-President, in the chair.—Dr. Tripe read the Report of the Council, which stated that the progress of the Society during the past year had been of a satisfactory character. Among the investigations carried on by the Society are the following: the organization of a large number of meteorological stations, the observations from which are examined and reduced by the staff, and printed in the *Meteorological Record*; the regular inspection of these stations by the assistant secretary; the collection and discussion of phenological observations; and an inquiry into the thunderstorms of 1888 and 1889. An exhibition of instruments is held annually in March. During the year a complete catalogue of the library, extending to 222 pages, has been compiled and published. The library has so much overgrown the present limited accommodation, that the Council have been obliged to consider the question of obtaining more commodious rooms, and have consequently inaugurated a "New Premises Fund," which is being well supported by the Fellows. —After the adoption of the Report, the Officers and Council for the ensuing year were elected.——At the ordinary meeting the following papers were read:—Note on a peculiar development of cirrus cloud observed in Southern Switzerland, by Mr. R. H. Scott, F.R.S.—Some remarks on dew, by Colonel W. F. Badgley. These are notes on observations which were made to discover whether all dew is deposited from the air, or if some also comes from the earth and plants, and also what quantity is formed during the year. The conclusions which the author deduces from his observations are: (1) that the earth always exhales water vapour by night, and probably a greater quantity by day; (2) that the quantity of water vapour given off by the earth is always considerable, and that any variation in the quantity is mainly due to the season of the year; (3) that the greater part of the dew comes from the earth vapour; and (4) that plants exhale water vapour, and do not exude moisture. The total quantity of dew collected on the author's grass plates in the year was 1·6147 ins.

Entomological Society, January 21.—Fifty-eighth Annual Meeting.—Lord Walsingham, F.R.S., President, in the chair.—An abstract of the Treasurer's accounts having been read by Mr. H. Druce, one of the auditors, the Secretary, Mr. H. Goss, read the Report of the Council.—It was then announced that the following gentlemen had been elected as officers and Council for 1891:—President, Mr. Frederick DuCane Godman, F.R.S.; Treasurer, Mr. Robert McLachlan, F.R.S.; Secretaries, Mr. Herbert Goss and the Rev. Canon Fowler; Librarian, Mr. Ferdinand Grut; and as other members of the Council, Prof. R. Meldola, F.R.S., Mr. Edward Saunders, Dr. D. Sharp, F.R.S., Mr. Richard South, Mr. Henry T. Stainton, F.R.S., Colonel Charles Swinhoe, Mr. George H. Verrall, and the Right Hon. Lord Walsingham, F.R.S. It was also announced that the new President had appointed Lord Walsingham, Prof. Meldola, and Dr. Sharp, Vice-Presidents for the session 1891–92.—Lord Walsingham, the retiring President, then delivered an address. After alluding to some of the more important entomological publications of the past year, and making special mention of those of Edwards and Scudder in America, of Romanhoff in Russia, of the Oberthürs in France, and of Godman and Salvin in England, the President referred to Mr. Moore's courageous undertaking in commencing his "Lepidoptera Indica," on the lines adopted in his "Lepidoptera of Ceylon." Attention was then called to the unusual development during the past year of the study of those problems which have been the object of the researches of Darwin, Wallace, Weismann, Meldola, Poulton, and others, and to the special and increasing literature of the subject. In this connection allusion was made to Mr. Tutt's "Entomologist's Record and Journal of Variation," to Mr. Poulton's valuable book "On the Meaning and Use of the Colours of Animals," and to the interesting and important papers and experiments of Mr. F. Merrifield on the subject of the variation in Lepidoptera caused by differences of temperature. After alluding to the International Zoological Congress held at Paris during the past year, and to the rules of nomenclature which had been once more reviewed and revised, the President concluded by referring to the losses by death during the year of several Fellows of the Society and other entomologists, special mention being made of Dr. J. S. Baly, M. l'Abbé de Marseul, Mr. Owen Wilson, M. Lucien Buquet, M. Eugène Desmarest, Prof. Heinrich Frey, Dr. R. C. R. Jordan, Mr. W. S. Dallas, Dr. L. W. Schaufuss, Dr. Hermann Dewitz, M. Louis Reiche, and Herr Peter Maassen.—A vote of thanks to the President and other officers of the Society having been passed, Lord Walsingham, Mr. Goss, and Mr. Grut replied, and the proceedings terminated.

PARIS.

Academy of Sciences, January 19.—M. Duchartre in the chair.—On the estimation of mineral matters contained in vegetable moulds and on their *rôle* in agriculture, by MM. Berthelot and G. André. The authors have previously described methods for accurately estimating phosphorus, sulphur, carbon, silica, aluminium, iron, soda, potassium, and other substances, in soils, vegetable moulds, and plants. They now devote special attention to the determination of alkalies and oxides, after eliminating silicates by treatment with hydrofluoric acid.—On the presence and *rôle* of sulphur in vegetables, by MM. Berthelot and G. André. The results of a series of experiments indicate, among other things, that the proportion of sulphur increases to the time of efflorescence, when it attains a maximum, and then decreases.—Experiments on the mechanical actions exercised on rocks by gases at high temperatures and pressures and in rapid motion, by M. Daubrée. The author has continued his researches on the effects produced upon rocks in contact with gases suddenly developed by means of such explosives as gun-cotton and dynamite. Temperatures of 2500°, and pressures of 1100 atmospheres, thus obtained, have been sufficient to fuse and pulverize the rocks experimented upon in a very marked manner. The results lead M. Daubrée to believe that the perforated pipes or *diatrèmes*, diamantiferous, volcanic, or otherwise, and much of the subaërial dust and oceanic deposits are formed by such actions as he has obtained in the laboratory. He also shows that rocks may acquire an apparent plasticity under the influence of pressure.—Contribution to the botanical history of the truffle; second note, *Terfas*, or the truffles of Africa and Arabia, of the genera *Terfezia* and *Tirmania*, by M. A. Chatin.—Description and employment of the Eucalyptus, by M. Ch. Naudin. About eighty species of Eucalyptus have been cultivated at Thuret. Of these fifty-six are described in a memoir presented by M. Naudin. The memoir will be of great service to applied botany. —Influence of dissolvents on the rotatory power of camphols and isocamphols, by M. A. Haller. Of eleven dissolvents used, only methyl alcohol exercised an influence on the rotatory power of left-handed α-camphol. The action exercised by different liquids on left-handed isocamphol appears to vary with their constitution, but is the same for each homologous series.—On the destruction of sugar in the blood *in vitro*, by MM. R. Lépine and Barral.—Memoir on the constitution of albuminoids, by Dr. H. Arnaud.—Observations of a star having a brightness comparable to that of Regulus, and situated in the same constellation, by M. E. Lescarbault. (See our Astronomical Column.)—*Résumé* of solar observations made at the Royal Observatory of the Roman College during the last six months of 1890, by M. P. Tacchini. (See our Astronomical Column.)—Observations of sun-spots made in 1890 with the Brunner equatorial (0·18 metre aperture) of Lyons Observatory, by M. E. Marchand.—A new gyratory apparatus, called the alternating gyroscope, by M. G. Sire.—On the telephonic reproduction of speech, by M. E. Mercadier.—Researches on a sulphur derivative of olein called *l'huile pour rouge*, by M. Scheurer-Kestner.—On the experimental production of exophthalmia, by M. H. Stilling.—On the variations of the pelvis of Cachalots, by MM. G. Pouchet and H. Beauregard.—On the character of the conchological fauna of the Sahara, by Dr. P. Fischer. M. J. Dybowski explored the environs of El Goleah last year, and made a collection of land and water mollusks in the sub-fossil state. These animals testify to the existence, in relatively recent times, of ponds and watercourses in a region which may be taken as a type of many others. The inhabitants of the neighbourhood have a tradition that at some past age El Goleah was in the middle of a fertile and well-watered region, and this opinion seems now to be confirmed.—On the development of larvas of Ascidiæ, by M. A. Pizon.—On two new zoospores, parasites of the muscles of fishes, by M. P. Thélohan.—On the presence of native nickel in the sands of the Elvo torrent, near Biella (Piémont), by M. Alfonso Sella. An examination of auriferous sand from the Elvo torrent showed to M. Sella small metallic grains consisting of native nickel associated with iron. The mineral is analogous to certain meteoric irons, such as the Ovifak, but appears to be of terrestrial origin.

DIARY OF SOCIETIES.

London.

THURSDAY, January 29.

Royal Society, at 4.30.—The Bakerian Lecture, "On Tidal Prediction: Prof. G. H. Darwin, F.R.S.

Institution of Mechanical Engineers, at 7.30.—Annual General Meeting.—On some Different Forms of Gas Furnaces: Bernard Dawson.—On the Mechanical Treatment of Moulding Sand: Walter Bagshaw.—Fourth Report of the Research Committee on Friction; Experiments on the Friction of a Pivot Bearing.

Royal Institution, at 3.—The Little Manx Nation: Hall Caine.

FRIDAY, January 30.

Institution of Mechanical Engineers, at 7.30.—Annual General Meeting.—On some Different Forms of Gas Furnaces: Bernard Dawson.—On the Mechanical Treatment of Moulding Sand: Walter Bagshaw.—Fourth Report of the Research Committee on Friction; Experiments on the Friction of a Pivot Bearing.

Institution of Civil Engineers, at 7.30.—The Counterbalancing of Locomotive Engines: Edmund L. Hill.

Royal Institution, at 9.—On the Rejuvenescence of Crystals: Prof. J. W. Judd, F.R.S.

SATURDAY, January 31.

Royal Institution, at 3.—Pre-Greek Schools of Art: Martin Conway.

SUNDAY, February 1.

Sunday Lecture Society, at 4.—The Life and Death of Worlds: Mrs. S. D. Proctor.

MONDAY, February 2.

Society of Arts, at 8.—The Construction and Capabilities of Musical Instruments: A. J. Hipkins.

Royal Institution, at 5.—General Monthly Meeting.

TUESDAY, February 3.

Zoological Society, at 8.30.—On the Question of Saurognathism of the Pici, and other Osteological Notes upon that Group: Dr. R. W. Shufeldt, C.M.Z.S.—On Two New Species of Parrots of the Genus Platycercus: Count T. Salvadori.—On a Collection of Birds from Tarapacà, Northern Chili: P. L. Sclater, F.R.S.

Institution of Civil Engineers, at 8.—Ballot for Members.—Electric Mining Machinery: Llewelyn B. and Claude W. Atkinson.——At 9.—Reception by the President and Council.

Royal Institution, at 3.—The Structure and Functions of the Nervous System; Part I. The Spinal Cord and Ganglia: Prof. Victor Horsley, F.R.S.

WEDNESDAY, February 4.

Geological Society, at 8.—The Geology of Barbados and the West Indies; Part I. the Coral Rocks: A. J. Jukes-Browne and Prof. J. B. Harrison.—On the Shap Granite: A. Harker and J. E. Marr.

Entomological Society, at 7.—The Life-history of the Hessian Fly: Frederick Enock.—On some Recent Additions to the List of South African Butterflies: Roland Trimen, F.R.S.—Additions to the Carabideous Fauna of Mexico, with Remarks on Species previously recorded: Henry W. Bates, F.R.S.—Notes on the Genus Xanthospilopteryx, Wallgr.: William F. Kirby.—On the Rhyncophorous Coleoptera of Japan: Dr. David Sharp, F.R.S.—On Mimetic Resemblances between Species of the Coleopterous Genera Lema and Diabrotica: Charles J. Gahan.

Society of Arts, at 8.—Decimal Coinage, Weights, and Measures: J. Emerson Dowson.

THURSDAY, February 5.

Royal Society, at 4.30.

Linnean Society, at 8.—On the Tree Ferns of Sikkim: J. Gammie, Jun.—Life-history of Two Species of Puccinia: A. Barclay.

Chemical Society, at 8.

Royal Institution, at 3.—The Little Manx Nation: Hall Caine.

FRIDAY, February 6.

Geologists' Association, at 7.30.—Annual Meeting.—Further Notes on the Geological Record: The President.

Royal Institution, at 9.—Some Applications of Photography: Right Hon. Lord Rayleigh.

SATURDAY, February 7.

Geological Field Class, at 4.15.—The Gravel Beds of the Thames and its Tributaries in Relation to Ancient and Modern Civilization: Prof. H. G. Seeley, F.R.S.

Royal Institution, at 3.—Pre-Greek Schools of Art: W. Martin Conway.

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