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THE ZOOLOGICAL COLLECTIONS IN THE INDIA HOUSE

IN former days the "Hon. East India Company," in their House in Leadenhall Street, possessed a valuable Museum of Natural History. It contained specimens in all branches of science from the Company's Oriental possessions, partly contributed by public servants who had been attached as naturalists to missions and deputations sent out by the Indian Government, and partly by gentlemen of the civil and military services of the Company, as presents to the Court of Directors.

The following well-known names were amongst those who contributed to the collection :—Dr. Francis Buchanan Hamilton, Dr. Horsfield, Sir Stamford Raffles, Mr. Wallich, Mr. Reeves, Mr. McClelland, Dr. Helfer, Mr. T. T. Pearson, Dr. Falconer, Mr. Hodgson, Col. Sykes, Mr. Ezra Downes, Gen. Strachey, Col. Tytler, and Dr. Cantor. The list of contributors embraced, in fact, all those naturalists and collectors to whom science is mostly indebted for the knowledge we at present possess of the Fauna of India and the adjoining countries.

Amongst collections of special importance belonging to the East India Museum, may be noticed Dr. Horsfield's collections from Java, those made by Mr. Finlayson during Crawford's Mission to Siam, those of Col. Sykes during his survey at the Dukhun, the entomological collections made by Dr. Cantor in Chusan, and the same naturalist's collections from Singapore; the zoological collections of Sir W. Snow Harris, made during his mission to Abyssinia, and those of Commander Jones during his survey of the Euphrates and Tigris.

In 1851 the late Dr. Horsfield, who up to the time of his decease was Curator of the Museum, published a catalogue of the mammalia in the collection, which, in addition to an exact enumeration of the specimens, contains many valuable notes upon the habits, range, and other peculiarities of the species. This was followed a few years later by a catalogue of the birds of the collection, which was prepared by Mr. F Moore, the assistant in the museum, under Dr. Horsfield's superintendence. Of the catalogue of birds two volumes were published, the first in 1854, and the second in 1858. The third, which was intended to have completed the work, has never appeared. More than a thousand species, however, are catalogued in the two first volumes, most of them represented by several specimens.

When after the Indian mutiny the absorption of the "Honourable East India Company" by Her Majesty's Government took place, the museum of the Company was moved to Fife House, Whitehall, as a temporary resting-place. The natural history collections were exhibited in this building in a very imperfect way, but it was well understood that they were only deposited here pending the construction of the new India Office, where abundance of space for their display was promised.

The time arrived when the square-towered palace in St. James's Park was finished, and the various branches of the India Office moved into it. So far, however, from there being any more space found for the natural history collections it was now discovered that there was no room for them at all. The whole of them were packed up in boxes and placed in store, and so remain to the present day, so that it is impossible to get at them for any available purpose even when the examination of a particular individual specimen is specially required.

On more than one occasion in the course of scientific work the writer has had occasion to examine some of the specimens in the collection, but has been informed that they could not be got at amongst the mass of packages. Other working naturalists have met with similar replies to their applications, and even a Russian entomologist, I have been informed, whose principal motive in coming to England was to examine some of the insects in the collection, had to return with his mission unaccomplished.

In 1871 the late Lieut.-Col. Sykes, having had his attention called to the subject by a letter addressed to the *Times*, asked the Under-Secretary of State for India in the House of Commons "when the zoological collections in the India House would be accessible to zoologists." The following is stated in the *Times* of March 15, 1871, to have been the reply given by the Under-Secretary :—

"In reply to my honourable and gallant friend, I have to say that the zoological collections belonging to the Secretary of State in Council, are, to a *certain extent*, even now available to men of science, who can readily obtain admission to examine them. They examine them however, I am sorry to say, under great difficulties, and difficulties of which I do not see the end : for even if the Secretary of State in Council were to erect on his property in Charles Street, as he has sometimes been advised to do, a building more worthy to contain the great museum and library which he possesses, than the garrets in which they are now stowed away, nearly the whole available space would be occupied by those Indian productions which it is important to bring under the notice of the commercial classes of this country, and pure science would, I fear, come off very badly."

The "*certain extent*" to which, according to this reply, the collections are "*even* now available to men of science," may be judged of from what has been already stated. But in fact, it was ultimately admitted by the Under-Secretary, after a little pressure on the part of the questioner, that the collections were "boxed up;" nor has any change been made in their condition since that period.

It must, I think, be obvious to all those who have read the statement above given that a gross wrong has been perpetrated in the present case. When the Imperial Government took possession of the late East India Company's establishment, they were manifestly bound to perform the duties attached to it. To nail up the whole of the natural history collections in closed cases, and deposit them in a cellar is a strange way of accepting the *officium cum onere*. It is a wrong, not only to the labourers in science who have occasion to consult the collections, but also to the many distinguished officers of the late Company's service, who contributed to form them. The longer the present state of things continues, the greater will the wrong become, as it is almost impossible to prevent the ravages of insects in the case of specimens of natural history of any sort that are stowed away without periodical examination.

It being, however, hopeless to expect that the India

Office, in its present economical fit, will spend the money necessary to build a Museum for the proper exhibition of its collections of manufactures and natural history, the following two solutions of the difficulty may be suggested.

(1) That an arrangement be made with the Commissioners of the Exhibition of 1851 to exhibit the collections at South Kensington, either in one of the existing buildings, or in one to be constructed for that purpose. The French have an "Exposition des Produits des Colonies" in part of the former Palais de l'Industrie in the Champs Elysées, and there is no reason why we should not follow so desirable a precedent.

(2) If this cannot be effected, the whole of the collections should be transferred to the trustees of the British Museum. It is, of course, quite certain that the trustees could not exhibit them, looking to the crowded state of their galleries in Great Russell Street. But at all events they would be thus saved from risk of further deterioration, and might be rendered accessible to working naturalists who have occasion to consult them. P. L. S.

*UNIVERSITY OARS**

III.

WE have stated that in our opinion the evils of boat-racing as now practised are traceable to two causes, 1st to a misconception of the nature of the demands which it makes on the several energies of the body; and 2nd, to the system of preparation, or, as it is technically called, *training*, which is undertaken to enable the body to meet these special demands upon its energies.

In our remarks last week we stated at some length wherein lay the first of these misconceptions, namely, in the nature and extent of the effort made by the muscular system and the respiratory and circulatory system, respectively, showing that while the exertion was slight, if not actually inadequate to the requirements of the former, it was both in amount and character severe, if not absolutely dangerous, in the latter.

The origin of the first misconception, and the reason why it should have lived so long, and should still live, we think may be thus explained. When rowing was first adopted by lads at schools and young men at universities as a regular mode of exercise, and friendly matches of speed and dexterity were organised, the boats used, probably, were not greatly different in size, in shape, or in other points of construction, if in any, from those at the time in use by professional watermen; and the manner of rowing was also, very probably, after the waterman's type. If this were the case then rowing furnished abundant exercise, not only to those portions of the rower's frame which still receive a fair share of employment, but to those also which are at present virtually excluded from the task, or have a very inferior part to play in it; for the heavy, bulky, broad and deep boats, clumsy, unwieldy, and unskilfully arranged oars and rowlocks, would necessitate a slow and protracted stroke, and both upper and lower limbs would have their part to play and their work to do in dragging the oar through the water. Gradually, changes and improvements would be introduced, lessening the labour, heightening the art, until art and labour in boat propulsion attained their present positions and proportions, the former reduced to a minimum, the latter standing eminently high: but just in proportion to the prominence of these conditions are its merits as an exercise in an inverse ratio to be estimated. There was plenty of muscular exertion for the whole frame in lugging along the old-fashioned boats. There was little or no distress to heart or lungs in its protracted stroke and deliberate pace. We frankly confess that there would be little in the old style of boat-racing to create and sustain the enthusiasm at present displayed in these contests; and we are expressing no regret at the changes that have taken place, and no wish to return to their primitive, albeit safe conditions: what we do wish is to let rowing remain as it is, nay, to let it pursue its onward course of change and improvement like all other things, but to see if the old order of safety cannot be retained with these advancements, by obtaining from other sources those properties which recent changes have altogether eliminated or reduced to inefficient proportions.

To glance at the reason why the misconception regarding the actual nature of a boat-race as now rowed, should have so long existed, and should still exist, we think it needs only to be pointed out that only quite recently has any really critical inquiry been instituted on the subject, and when the results of this inquiry were made known, they savoured to the oarsman like the prescribed "nasty medicines" to the child; *i.e.* whatever good they may have been calculated to effect, they were nevertheless unpalatable, and if not actually rejected were at any rate swallowed with dislike. But rowing men are not singular in this respect, in claiming for their favourite exercise, through all its changes, in all its attributes, *perfection*; they are claiming no more than all enthusiastic votaries of a special exercise claim, and many with less excuse and less right to an indulgent hearing than the oarsman. "It gives exercise to every muscle of the body," say they, "No exercise whatever," we reply, "does this." No single exercise gives more than employment to a portion of the body, and to that portion sometimes a very inadequate share.

The errors involved in the second misconception in a great measure originate in the first, and their nature is revealed, and the manner of their connection explained as we proceed in making ourselves acquainted with it. Thus an oarsman at a given time will be called upon to row a race which will tax his bodily energies *such as he knows them, or believes them, to be*, to the uttermost; the effort will be quite exceptional in its severity and he therefore desires to prepare for it, to fortify himself for it, by every means in his power. Now it need hardly be said that if he is ignorant of the nature of the demands which the effort will make upon him, he cannot rightly prepare himself for that effort; nay, he may, and probably will, go wrong, for advice will be pressed upon him at all hands, and here at any rate, "In the multiplicity of counsel there is *not* wisdom." When it is remembered that this preparation or training embraces the administration, or use, of all the material agents which sustain life and give health and strength, it will not be wondered at that mistakes have been made in this direction, and that man should have come to speak

* Continued from p 418.

of the *ordeal* (!) of training as of a trial as great if not greater than the effort itself for which the training was instituted. Thus one of Dr. Morgan's correspondents who rowed bow at Putney in 1849, Rev. D. Wauchop, Wadham College, Oxford, and a friend of our own of long standing, writes: "A curious circumstance with regard to training I would mention, and that is that one of the most sinewy and lasting men of my friends, who had been accustomed to rowing since he was little more than a child, and who was a particularly steady and temperate man, and so good an oar as to be chosen stroke for a time, never could stand training. After a few days of it he invariably broke down, and therefore never rowed in a race."

It will therefore be easily seen how great must be the advantages to rowing of clearing up what we have called the *first misconception*, in the light of its effects upon the health of the men engaged in it—the only light which would justify our having entered upon the subject at such length in the columns of a purely scientific journal. Thus while it was imagined that rowing entailed tremendous muscular exertions upon the oarsman, rules as to *diet*, *sleep*, and *exercise* were laid down to meet such exertions, one authority recommending men to be in bed ten or eleven hours; for diet underdone meat in vast quantities, and without vegetables—"not even a potato"—was prescribed, while exercise of any or all kinds put together was cut down to less than one hour in the twenty-four. Thus did the first misconception sustain and prolong the existence of, if it did not give origin to, the second.

The errors in *sleep* and in *diet* are being rapidly cleared away. They are destined soon to be numbered among the vagaries of the past, and in this place we may already pronounce them undeserving of serious exposure or condemnation. With the other agent of health named above, however, as affected by a want of true knowledge of the exertion undergone in rowing, namely, exercise, the case is different. The errors on this head are still many and grave, and to the correction of them we must look before we can expect to see any material improvement in the hygienic value of rowing; it is to exercise we must look to restore the lost equilibrium of rowing on the several systems of the body; to exercise we must look to equalise the partial developments of the frame now caused by rowing as exclusive of muscular exertion; to exercise we must look for that increase in vigour and power and functional capacity generally, now wanted to enable the organs of circulation and evaporation to sustain the extreme effort which they are called upon to fill during a boat-race.

We will assume that we have established that in rowing the chest and upper limbs receive an inadequate share of the exercise, and therefore in accordance with the organic law regulating material development and functional capacity,—that "*these will be in relation to employment*,"—an advancement in these respects will be shown in those regions, inferior to what is observable in other parts of the body when the employment is greater. This assumption being admitted, it will also be admitted that any want of development or capacity experienced in these regions—whether in the power of the muscles aiding respiration, in the size or conformation of the thoracic cavity, or in the size, conformation or capacity of the organs which they contain,—would affect, and affect in an increasing ratio with its extent, the respiratory effort during a boat-race.

We admit that we are somewhat at issue with Dr. Morgan, inasmuch as he does not go with us so far as to acknowledge this partial division of the labour, and consequently of the reward to the parts engaged, in the act of rowing; but he *does* acknowledge that if it *did* exist, the right way to its rectification would be to supply to the parts found wanting, employment elsewhere and in other form. This is nearly all that we can desire—perhaps more than at this date we have yet a right to expect from a devoted oarsman, jealous of his craft. His language is emphatic and significant:—

"In examining patients for insurance companies, I have frequently refused the lives of young persons on the ground that their chests were narrow and shallow. In several instances, however, these thoracic defects have been corrected by a systematic course of gymnastic exercises, justifying me at a later period in recommending their acceptance. At no time and in no place could every useful variety of exercise be more advantageously carried out than at Oxford and Cambridge; they might, for the class by which they are frequented, serve as valuable national gymnasia."

Dr. Morgan might have taken a wider base for his congratulations on the establishment of gymnasia than Oxford and Cambridge; the greater number now of our public schools are also so provided, namely, Uppingham, Radley, Cheltenham, Clifton, Marlborough, and Rugby. We place them here in the order in which they have been carried out, Rugby being our last organisation. From all these schools men are coming up to the Universities, after having continuously, during the most important period of their growing time, received a course of carefully systematised bodily training, carried out in buildings specially designed for this purpose, and conducted by teachers duly prepared, and bearing certificates of qualification. All the youths will bring with them not only chests "larger and deeper," with hearts and lungs stronger, ampler, and more vigorous, but the knowledge of what a good strong, or well-formed chest is, how it is got, and how it may be lost; and this with the similar advantages of the Universities, and shared in by University men, will surely in time enable us to overcome the evil of rowing, the danger to rowing men: for the whole question is now narrowed to one point. Give to men who now take rowing as exclusive exercise such other exercise as will develope the parts of the body which rowing but imperfectly employs, namely the chest, and you at once endow with vigour and strength the parts that are dangerously taxed in the boat-race. We have known men standing 5 ft. 9 in., with chests measuring 32 in. only, rowing in their college eights! And men standing over 6 ft. in their stockings, with chests measuring 35 in., rowing in the inter-University race at Putney! To what end can these lead? to what but danger to the men, alarm to their friends, and injury to the name and to the interests of the art to which they affect to be devoted. We repeat here what we uttered years ago—"No man of ordinary stature and fair growth should be allowed to put hand upon an oar in a racing boat until his chest has the minimum

girth of 36 in.; less will not give him space adequate to the full and fair action of the vital organs within, in the work upon which he would engage; less no man of ordinary stature and fair growth need pass his eighteenth year without possessing."

In bringing these remarks to a close, we desire heartily to congratulate Dr. Morgan on his book, both in conception and execution, and also to congratulate University oarsmen in having a work of this character dedicated to investigations of the doubtful and disputed points of their favourite exercise. If he has not succeeded in showing that the Putney course is quite free from danger, he has shown that it is not so perilous as it was pronounced to be,—*i.e.* not the *via mala* which it had been named. To the disputants on both sides we would say with the peace-loving innkeeper in Silas Marner, "Ye are both right and both wrong; shake hands and be friends."

ARCHIBALD MACLAREN

THE MAMMALIAN SKULL

Zur Morphologie des Säugethier-Schädels, von Joh. Chr. Gustav Lucae. With three lithographic plates and eight woodcuts. (Frankfort, 1872.)

THIS contribution to the anatomy of the Mammalian skull treats chiefly of the comparative proportions of those of Carnivora and Ruminants. After quoting Prof. Huxley's dictum on the importance of making longitudinal sections of every skull in an ethnological museum, the author justly insists upon its applicability to comparative osteology; and begins by a discussion on the true cranio-facial axis. He reviews the definitions adopted by other writers, and describes it as extending from the anterior margin of the *F. magnum* to the *F. cæcum*, thus including the basi-occipital, basi-sphenoid, pre-sphenoid, and cribriform plate of the ethmoid bone. He regards it not as a mere imaginary line drawn through the centres of these links in the chain, but as the actual solid elongated mass which they form when the surrounding parts are removed. Hence he speaks of the upper surface of the cranio facial axis, or, as he prefers to call it, the base of the skull, turned towards the brain, and its lower surface turned towards the pharynx and face.

The discrepancies between the different anatomists who have written on this subject have been chiefly due to the different objects for which the structure of the skull has been studied. To the morphologist, guided by a knowledge of embryology and comparative anatomy, it appears monstrous to include the diameter of a foramen as part of the base of the skull, formed of a series of bones which agree in their relations and partly in their development with the centra of the vertebræ. On the other hand the descriptive zoologist, and especially the ethnologist, to whom "transcendental anatomy" is apt to appear harsh and crabbed, asks fairly enough that he may be allowed to fix upon such a base-line as shall give him the most useful and convenient method of comparing the shape of different skulls. And if the practical physician tries as well as he can to ascertain the dimensions of the cranium during life, he is obliged to content himself with the best base-line he can get, which is probably that from the root of the nose to the most hollow part below the occipital protuberance.*

* See an interesting paper by Dr. Gee in the St. Bartholomew Hospital Reports for last year.

Prof. Lucae's object is a morphological comparison between the skulls of man and certain other mammals, and for this purpose we think his cranial basis is well chosen. It agrees with the "cranio-facial axis" adopted by Prof. Flower in his "Osteology of the Mammalia" (pp. 104, 105), in the chief point in which it differs from Huxley's "basi-cranial axis" (Journal of Anat. and Phys., Nov. 1866, p. 67, and "Anatomy of Vertebrated Animals," p. 23), namely, by the inclusion of the mesethmoid bone. And it differs from Prof. Cleland's "base-line" (Phil. Trans., 1869, p. 122), by the exclusion of the foramen magnum, as well as in being an actual mass of bones instead of a line drawn for purposes of measurement.

The most important question is, whether the line of bones which continues the centre of the vertebræ forward should be considered to stop with the pre-sphenoid or no. Having passed the basi-sphenoid, with which the notochord ends, and admitted the pre-sphenoid into the cranial axis, there seems no good reason from the development, the structure, or the relations of the bones, for not including in the series the next in order. And this must be the mesethmoid: for the claims of the vomer to be considered the centrum of a nasal vertebra may be put aside, because unlike the rest of the axis it is developed from membrane, because it takes no part in supporting the cerebrospinal axis, and because it is not articulated with the frontals or even with the anterior end of the pre-sphenoid.

Having defined the cranial basis, Prof. Lucae proceeds to compare the inclination of its four segments to each other and to a right line joining its two ends. This line, which in man of course will fall *below* the base of the skull, falls *above* it in Carnivora, and more or less completely *in* it in Ungulata. The differences chiefly depend on the greater or less inclination of the brain to the medulla oblongata, and the more or less horizontal position of the face and hence of the olfactory nerves. Careful measurements are given of the dimensions of the segments of the cranial axis and of the angles they make with each other in six Carnivora and eight Ungulata.

Next follows a comparison between the vault of the cranium and the facial bones in the wolf and antelope (*Redunca ellipsiprymna*). The compact osseous structure of the former is contrasted with the more spongy character of the latter; and it is shown how the position of the centre of gravity is altered by the great canine teeth of the carnivora and the horns of ruminants. A short section follows on the changes brought by age; and then come measurements of the cranial angles in various marine Carnivora, in Rodents, in the pig, barbirussa, and *Hyrax*. The last section treats of the skulls of monkeys and of man. Here the cranial axis, which in the seals is somewhat concave above, in otters almost flat, and gradually more bent in Carnivora and in Ruminants, has become strongly convex above, so as to make the cribriform plate and the foramen magnum horizontal instead of vertical, while the length of the vault of the skull in comparison with its base (as above defined) has enormously increased. The remarkable twisting down of the face under the cranium in some Ruminants (for it is little marked in the deer tribe), which is here noticed, has been already well described by Prof. Flower in the work above quoted. It is a remarkable character, but certainly

not enough to warrant us in pushing the Ruminants between the Carnivora and the lower apes.

The woodcuts and lithographic figures of this paper are not very clear, even with the aid of red ink to distinguish the outline of the section of a skull from its profile, when printed together; and there are several printers' errors, e.g., *Hydracherus* for *Hydrochoerus*, and what is more important, *hintre* is put for *mittlere* (p. 27).

Prof. Lucae modestly compares his work to that of a hodman, who has plenty to do when kings build their palaces. These royal castle-builders are of course the more or less adventurous theorists who construct their *Stammbäume* by help of such anatomical details as are here collected. All zoologists, whether, like Lamb's nurse, "wise and wondrous skilled in genealogies," or contented to work out the raw material which is always necessary, will welcome such contributions to osteology as the present, which forms so excellent a continuation of the author's previous labours on *Raçenschädel*, and will hope that they may be still further extended in the same direction.

P. H. PYE-SMITH

SYMONDS' RECORDS OF THE ROCKS

Records of the Rocks. Notes on the Geology, Natural History, and Antiquities of North and South Wales, Devon, and Cornwall. By Rev. W. S. Symonds, F.G.S. (London: John Murray.)

MR. SYMONDS is an enthusiast, and one of the best type. In the intervals of his clerical work he is pretty sure to be found either with his hammer among quarries, ravines, and railway cuttings, or exploring some crumbled ruin or mouldered encampment, or lecturing volubly to a hill-side auditory on the rocks beneath their feet, or showing his well-known features at the sectional meetings of the British Association. Such have been his favourite pursuits for some thirty years. In the present volume he gives us jottings from the note-books which record his doings during that long period. The book is not a formal scientific treatise, nor does it follow any definite geographical sub-division in the districts described. An introductory chapter of a somewhat miscellaneous kind is followed by ten others devoted to the various palæozoic formations of Wales and the South-west of England. But the writer does not confine himself to the geology of the various districts, he has much to say about antiquities and natural history, and says it pleasantly enough. Nor does he restrict his remarks to those parts of the country mentioned in the title-page, for he has been away up even into the wilds of Sutherlandshire, and tells about the rocks there and the alpine plants, and the minerals, and the old glaciers, and how he broke a trusty rod in fishing for salmon there. He makes his way cheerily wherever he goes, and duly chronicles the kindness shown to him. The perfect honesty and candour of the writer are conspicuous throughout. Now and then, however, the delight with which he has seen a fact for himself leads him to write as if nobody had seen it before him. For instance, on p. 91, he tells that "on an expedition two years ago in company with Captain Price, I ascertained that the quartz-rock of Queenaig with its tubes rests unconformably on Cambrian sandstone." A very good observation, Mr. Symonds, but not unknown before you and the Captain were up there.

The illustrations, which are numerous, have been largely taken from Murchison's "Siluria;" but we can specially commend some new engravings from drawings by Sir William Guise—admirable both for their artistic conception and geological truth.

OUR BOOK SHELF

Yarrell's History of British Birds. Revised by Alfred Newton, F.R.S., Professor of Zoology in the University of Cambridge. Part V.

THE improvement which Prof. Newton's excellent edition of Mr. Yarrell's work is undergoing by passing through the hands of its accomplished and assiduous editor, is evident on every page, and the care with which the large mass of literature on the subject of most of the species has been studied, must be evident to all readers. The chief features of this part are the following. The author has entered with considerable detail into the puzzling question of those forms or species of blue-throat, *Ruticilla suecica*, *R. leucocyana* and *R. wolfi*—of which the first only can be said with certainty to have occurred in this country. The so-called "Melodious Willow Wren," of which two examples have been met with in the British Isles, is shown on Mr. Dresser's authority to be the Icterine Warbler (*Hypolais icterina*), and its distinction from the nearly allied Polyglot Warbler (*H. polyglotta*) is carefully pointed out, and it may be mentioned that these two birds have only a superficial resemblance to the true Willow-wrens, among which they have been erroneously placed by most British authors. The evidence as to the occurrence of the Marsh Warbler (*Acrocephalus palustris*) in England is shown to be very defective, and the editor declines admitting it at present to our fauna. The Aquatic Warbler (*A. aquaticus*) on the other hand, seems to have been obtained some three if not four times. The history of that very interesting species Saddler's Warbler (*A. luscinioides*) is fully given, more so than is done in any other work with which we are acquainted. It was doubtless in former days a regular, though never a very abundant summer visitant to the eastern counties of England, until the drainage of the meres and fens unfitted wide districts for its habitation. The first example of the species ever brought to the notice of naturalists was obtained early in the present century by a party of Norfolk observers, including the late Sir William Hooker. This specimen was in 1816 shown to Temminck, then on a visit to London, and by him said to be a variety of the Reed Wren, a bird from which it may be fairly separated generically. Some years after, Salr described it from Italian examples, and it has always had the reputation of being a southern species. But it is to Englishmen that we owe nearly all the information we possess concerning it. Its nest and eggs were discovered near Cambridge in 1845, three years before anything was published about them on the Continent, and its peculiar habits have been chiefly described by Englishmen, from their own observation, whether in this country or abroad. The account of this species has been written *de novo*, and great pains has indeed been taken to bring the history of all the other birds treated in this part (fourteen in number) up to our present state of knowledge of them.

LETTERS TO THE EDITOR

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. No notice is taken of anonymous communications.*]

Cave-deposits of Borneo

THE following letter from Mr. Everett to myself was accompanied by a plan and section of one of the caves visited by him and partially excavated. The deposits were as follows:

	ft.	in.	ft.	in.
1. A thin layer of stalagmite.				
2. Black impure guano	0	3 to	1	0
3. White clay with *Potamides decollatus*	1	0 ,,	2	6
4. Guano		variable		
5. Débris of clay and guano, with fragments of limestone and stalagmite in abundance...	?2	0 to	3	0
6. Pure yellow felspathic clay	4	0 ,,	5	0
7. Limestone floor.				

This particular cave could not be readily worked owing to the influx of water, but other caves exist at higher levels which would be more promising. The expense for six months' work, according to Mr. Everett's estimate, would not be more than the mere passage-money of anyone going out from England. I may add that Mr. Everett quite understands the proper mode of working, having had personal communication with Mr. Pengelly on the subject at Kent's Cavern. He is now thoroughly familiar with the country and the workmen to be employed, and it seems a great pity that advantage should not be taken of his residence in so interesting a locality, the proper exploration of which may throw light on a variety of biological problems.

ALFRED R. WALLACE

"You will recollect that some three years ago I came to Sarawak with the object of making general collections of natural history and, more particularly, of investigating the cave-deposits of Borneo.

"From time to time I made excavations in various caves situated in Upper Sarawak, being assisted pecuniarily by the Rajah to a certain extent. These excavations varied in depth from 4 ft. to 14 ft., and were made in different situations in the caves. No remains of interest, however, were discovered beyond some teeth of a Hystrix, and bones of man, bats, geckoes, &c., in the most superficial deposits, and the only result worth recording was the find of a stone axe-head in a bed of river-gravel. This celt was forwarded to Sir C. Lyell, and such remains as were obtained from the caves were sent to Messrs. Busk and Pengelly at intervals; but the latter, together with a recent tooth of Rhinoceros and two collections of miscellaneous specimens, appear to have been wrongly transhipped in Singapore, and I have never been able to trace their whereabouts.

"After considerable observation and experience I now wish to state with all frankness my belief that my work was not carried on as it should have been, and that the non-existence of ossiferous deposits in the Bornean caverns is very far from being a proven fact. The inquiry as conducted by myself was not *thorough*, and it was unsatisfactory partly because I was in serious pecuniary difficulties myself, and partly because what I saw of the poverty of the Government and the remarks I heard dropped about the folly of expending money on such objects made me very shy of taxing the Rajah's liberality. I was, and am still, persuaded that the expense of cave-working in a country like this would have proved very much heavier than the Rajah had any idea of, and hence I worked with inadequate support.

"In the event of those who are interested in the exploration being desirous of having it continued, I venture to suggest that the person chosen for the work must either possess considerable private means or he must be employed at a regular salary; and further, that the work should be carried on with sufficient funds to render it independent of any assistance the Government here might afford. Money is so scarce here, and public wants so many and pressing, that assistance for purely scientific objects is not to be expected. Coolies are not procurable now under a wage of 2*l.* a month, and, owing to the rivers being the only roads, travelling expenses are heavy. For tools, lights, gunpowder for blasting, and such preliminary expenses, a sum of 15*l.* would be sufficient; and the monthly working expenses would vary from 10*l.* to perhaps as much as 15*l.*, according to the accessibility of the cave to be explored; so that for working a cave for three months a sum of 65*l.* would probably be required.

"As I am now employed in the Government service, I do not think I could undertake the work unless a formal application was made to the Rajah for the necessary leave of absence. Even were leave obtained, I do not suppose that I should continue on Government pay, and I could not afford to undertake the work under a salary of 25*l.* per month. The cheapest way of conducting the exploration would be to send out a gentleman of independent means who would do the work for its own sake, and then only the actual working expenses need be subscribed for. Supposing remains were ultimately found, the item of freight would have to be added to the working expenses.

"I am induced to write you this letter from reading a note in NATURE for June 13, 1872, with regard to the Victoria caves, in which two years of constant but seemingly fruitless work has in the end proved successful. Trusting that another exploration may be attempted in this far more important field, and with like success, I remain, &c.,

"A. EVERETT

"To A. R. Wallace,

"Sarawak, February 1, 1873"

A Fact for Mr. Darwin

THE interesting fact contained in the following passage appears to me to deserve disinterment from the pages of a very large book, a work too, which, so far as I know, has never been translated. It occurs in the "Erpétologie Générale" (Par Duméril et Bibron, tome vi. p. 467), and I met with it while employed in working out a collection of reptiles, which I was engaged in classifying. The passage is as follows:—"Dans les villes d'Égypte, on rencontre souvent des charlatans exposant à la curiosité publique des Eryx javelots vivants auxquels, afin de les faire passer pour des Cérastes, ils ont en le soin d'implanter, en manière de corne, audessus de chaque œil, un ongle d'oiseau ou de petit mammifère, par le même procédé que celui qu'on emploie dans nos fermes pour fixer deux ergots sur la crête de certains coqs quand on les chaponne.

"C'est d'après des individus ayant la tête ainsi armée de deux fausses cornes, qu'Hasselquist a fait son Anguis cerastes. Nous avons dans les collections du muséum des individus dont la tête porte ainsi des ongles recourbés d'oiseau, avec leur cheville osseuse, dont l'adhérence à la peau est parfaite."

Here is a fact, not only well authenticated, but capable of verification, demonstrating such close affinity of intimate structure and function between animals of *different classes*, that the skin appendage of one has been actually engrafted upon the skin of the other; the claw of a bird has formed perfect union with the skin of a snake. A good illustration of the affinity between birds and reptiles pointed out by Prof. Huxley.

I do not notice that statement about the claw of a small mammal being used for this purpose, because specimens illustrating it are not referred to.

The snakes alluded to in the passage are the *Eryx Jaculus* (one of the Erycidæ or sand-snakes of Dr. Günther), which is perfectly harmless: and the *Cerastes Hasselquistii*, a small but fierce and venomous viper; both inhabiting Egypt, and the latter supposed to have been the "asp" of Cleopatra. The Cerastes obtains its name from the so-called "horns," peculiar to the males, which are developed from modified scales over the centre of each orbit, attaining the length of about half an inch. The Eryx is about the same size as the Cerastes, for which it is passed off by the Egyptian snake-charmers, when manufactured as above described.

H. D. MASSY

Grenada Villas, Netley, near Southampton

The Phœnician Vademecum

IT is gratifying to see (vol. vii. p. 351) that you express a doubt whether the Cowrie shells in the Pomeranian barrows must necessarily, as Wagner supposes, have been brought by the Phœnicians. Because the earliest Greek historians introduced the Phœnicians to us they have been employed as a universal machinery for carrying out all kinds of operations. This theory is in fact incompatible with our present knowledge of the duration of the human race, and, we may say, with the relative antiquity of the Phœnician epoch, which can date but little beyond the historic period. Thus we are led to neglect the evidences of skulls, weapons, tools, monuments, and languages, which show that there must have been communications between distant regions long before the rise of the Phœnicians. There are many prehistoric races which had a sufficiently wide distribution to provide for the dissemination of such a small object as the Cowrie. Among these may be named the dwarf or short races, of which the Mincopies of the Andamans are a type; the race now represented by the Agavs of the Nile, Avkhass of Caucasus (Achivi), and Omagua and Guarani of Brazil; and the Dravidian race. Populations which could distribute men over the continents and islands of Europe, Africa, Australia, and the Americas must have been capable of distributing cowries and beads without Phœnician intervention. At present the Phœ-

nicians are blocking the road to prehistoric research, as the Hebrews formerly did.

HYDE CLARKE

32, St. George's Square, S.W.

Earthquake Waves

THE observations at p. 385, on the operation of self-resisting tide-gauges of the U. S. Coast Survey, in illustrating the phenomena of earthquake waves, suggest the expediency of the same means being adopted in the basin of the Mediterranean. This could possibly, by a little correspondence and agitation, be effected at Naples, Athens, Constantinople, and Alexandria. The Turkish and Egyptian Governments are very likely to listen to any representations on behalf of the cause of science. Although the Mediterranean is considered tideless, there is a daily fluctuation of two feet in parts of the Levant, but what is material is that earthquake waves are known to have been manifested at Smyrna.

If our Government could be induced to encourage observations at Gibraltar and Malta, we should obtain a combination of points of contact for two allied regions.

HYDE CLARKE

Spectrum of Aurora

I WISH to make a correction with reference to my observations on the spectrum of the aurora, as given by J. R. Capron on p. 182; for he has credited them with greater accuracy than they profess to have: I have no doubt that my line No. 5, seen at wave-length 500 or 510, is the same as Lord Lindsay's and Elger's No. 4, and probably as Procter's. This is the more likely, seeing that the two former placed the principal line much nearer the red end than I did; for I assumed Angström's position (5567) to be correct. This leaves but one observer of No. 5 (Barker), and possibly his line also is the same; in that case his No. 4 will be the same as Lord Lindsay's No. 3.

I have seen published the following determinations of the positions of the auroral lines, in addition to those J. R. C. has given:—

	Wave-length.
No. 1. R. J. Ellery	635
No. 2. O. Struve	5545
Angström	5567
German North Polar expedition	5569
Peirce (as reported by Winlock)	557
Respighi	5573
R. J. Ellery	560

No. 3. Peirce has two lines near here—5315 and 5205; the latter is probably Lord Lindsay's "line near E," and possibly A. Clark, Jun.'s line also.

	Wave-length.
No. 6. Peirce	464
No. 7. Peirce	431

Peirce also gives lines at 545 and 486.

My latest determinations from my own observations are as follows:—

	Wave-length.
No. 1.	606
,, 2.	566
,, 3.	5165
,, 4.	5015
,, 6.	4625
,, 7.	4305

I have never seen a line at 532 again.

As to the continuous spectrum, it reaches from No. 2 to No. 7, being brightest from a little beyond No. 2 to No. 6. This part of the spectrum does not give me so much the idea of a true "continuous spectrum broken up by dark bands," as of a series of bright bands too close to be distinguished.

Sunderland T. W. BACKHOUSE

Spectrum of Nitrogen

IN a paper communicated to the Royal Society by Mr. Arthur Schuster, it is stated that the line spectrum of nitrogen may be obtained under all pressures and temperatures if every trace of oxygen be removed by heating sodium in the vacuum tube.

I should be glad to learn whether any of your readers have successfully treated Mr. Schuster's experiments.

My friend, Mr. Lee, and myself have, on several occasions, attempted to do so, but always without success.

On heating the sodium we invariably find that an increase of pressure takes place from the liberation of hydrogen which, although very greatly lessened, is not entirely removed by drying the gas with sulphuric acid. On again exhausting we obtain, with the simple current, a spectrum of lines, not of nitrogen, but, in every instance, those of the second so-called hydrogen spectrum first described by Plucker, and afterwards noticed by Wullner and Angström.

This spectrum disappears as soon as the Leyden jar is used, and only the ordinary hydrogen spectrum is then visible.

The only effect which the sodium appears to produce is the liberation of hydrogen; for the same line spectrum can be obtained by exhausting a tube filled with hydrogen, or even with unpurified atmospheric air.

I was struck by the fact that only a few of the lines given by Mr. Schuster in his table of wave-lengths coincide with those of the known spectrum of nitrogen, while many of its most brilliant lines, including that which is its chief characteristic, the double green line (wave-length 5005-5002, Thalen) are not represented in his spectrum.

That the line spectrum of nitrogen can be obtained at all pressures, has been shown in a paper by Mr. Lee and myself, which has been sent elsewhere for publication; but that it can be obtained at all temperatures, by which, I presume, Mr. Schuster means either with or without the Leyden jar, is certainly contrary to our experience.

Liverpool C. H. STEARN

Instinct

The Heredity of Instincts

THE following may perhaps serve as a contribution to the question so much discussed of late concerning the transmission or acquirement of likes and dislikes amongst the lower animals. It is an extract from a letter of a brother of mine, an officer in India:—

"I have at present a little tiger-cub, about the size of a spaniel, a most interesting pet, though it will soon be a dangerous one. He made friends at once with my fox-hound puppies, and romps with them incessantly. When he sees a cow or a goat his real nature betrays itself. He has no fear whatever of any dog; *but, strange to say, is thrown into a paroxysm of terror at the sight of a kitten or a tiger-skin.*"

This hardly seems to bear out the assumption so commonly made, that manifestations of this kind must have a history in the experiences if not of the animal itself, at least of its ancestors. We can hardly suppose the parents of this cub to have adopted a frame of mind respecting the race of tigers equivalent to misanthropy amongst ourselves, and the experience of cats or kittens must be small indeed in the jungles of the Decan.

St. Asaph, N. Wales J. G.

Sense of Direction

IN Mr. Darwin's article in NATURE for last week there is a passage about "the sense of direction being sometimes suddenly disarranged," that brought to my mind assertions I had frequently heard made when travelling some years back in the wild parts of the State of Western Virginia. It is said that even the most experienced hunters of the forest-covered mountains in that unsettled region are liable to a kind of seizure; that they may "lose their head" all at once, and become convinced that they are going in quite the contrary direction to what they had intended, and that no reasoning nor pointing out of landmarks by their companions, nor observations of the position of the sun, can overcome this feeling; it is accompanied by great nervousness and a general sense of dismay and "upset;" the nervousness comes after the seizure, and is not the cause of it. I was present in a company of hunters when a tale of this "getting turned round" was told as a good joke against one of the party—a Nimrod of renown—the leading features of which he was reluctantly obliged to confess to the truth of, while denying some minor points that had been added to embellish it, as making him more ridiculous than he was: it would take up too much of your space to tell the particulars of the story. The feeling is described as sometimes ceasing suddenly, and sometimes wearing away gradually. Would it not be strange if it should appear that there is a "sense of direction" other than an acquired sense of

direction the result of unconscious observation, and that some animals possessed the first in a pre-eminent degree? The wonderful faculty hunters possess of finding their way through immense mountainous tracts so thickly wooded that one cannot see farther than a few yards at a time, may perhaps be accounted for by this power of unconscious observation alone; but is it so easy to account for a sudden derangement of the sense of direction, and the peculiar distress it occasions, even when there is no ground for alarm on the score of safety? This appears a kind of converse of the instance Mr. Darwin gives of the case of old persons losing their way. HENRY FORDE

The Walk, Lyme Regis, April 6

Destruction of Rare Birds: White Tom Cats

MANY of our birds are now protected by law, at certain seasons of the year. But unhappily rare visitants are mercilessly killed. Last year a pair of Hoopoes frequented my grounds both in the spring and autumn. It was a great pleasure to see this bird (of which Horapollo wrote that it was worthy to be "the sceptre of the gods on account of its gratitude"), on the lawn, busily searching for insects, or alighting on the surrounding trees. Every lover of nature will sympathise with my household and myself, in our distress that they have been shot; not even for the miserable satisfaction of the mere collector, but far worse, that their plumage might be stuck on a lady's head-gear. To shoot storks, spoonbills, bee-eaters, hoopoes, &c., which might be regular visitants and nest here, is a very different thing from securing chance arrivals from remote regions, which could never be naturalised in England.

One of your correspondents wrote recently of the deafness of white Persian tom cats. I possessed such an one for years which was not deaf; another, in a house near me, is not deaf, and I now have a grand fellow, a true Persian, in possession of all his faculties. A neighbour's pussy having walked into the house, with characteristic Oriental hospitality he went to the larder, and selecting a fish which he doubtless thought would be a *bonne bouche* for his guest, laid it before his friend, and did not himself partake of it.

Trebah, Cornwall, March 31 C. F.

Phosphorescence in Wood

IF some one would be good enough to give me a little information concerning the following (to me novel) phenomenon, he would oblige.

A heap of sticks intended for firing, lay in a corner of our boiler-house, and among them were some round pieces of Scotch fir (*Pinus sylvestris*) about 6 or 8 inches in diameter, and 18 inches long. These had been sawn from a pole which had lain out in the wet, and being consequently rather damp, the cut portions were placed in the warm boiler-house to dry. The blocks I speak of appeared quite sound. From the circumference of three or four of them the bark was rubbed off, here and there in patches, and a few chips were broken away from the edges. The fresh surface beneath was covered with a thin layer of the ordinary sticky resin, which so copiously exudes from this and other trees. When it was dark the steward happened to enter the boiler-house, and looking towards the sticks he was surprised to see a pale steady light emitted by some of them. At first he thought it was the reflection of the moon which shone through the window. Closer examination, however, proved: (1) that the moon did not shine on the sticks at all; (2) that the sticks were self-luminous; (3) that it was only the Scotch fir blocks which emitted any light; (4) that the light was confined to the resinous surface, exposed beneath the bark and chips; (5) that the surface beneath the chips (that is where more than the bark had been removed) was brightest. The steward carried the block which appeared most brilliant to an outhouse, where it still continued to "shine." He then broke off some small loose chips with his fingers from this block, and each separate chip sent forth the same steady pale light. My informant states that the phenomenon was very "curious." Perhaps this species of phosphorescence may not be unusual after all; but not being well "up" in the subject, I would with your permission, sir, merely ask is it common, and if so, how is it explained in the instance I mention? I may state that the steward gave me all the information. I saw the blocks afterwards but not the curiosity. RICHARD M. BARRINGTON

Fassaroe Bray

Indices of Journals

PUBLISHERS of periodicals, scientific or other, issue general indices only after intervals of ten or twenty years. In the ninth or nineteenth year the investigator of bibliography has to turn over every volume, a fearful waste of time. I have consulted with the librarian of this University, and the proposal we have to make is that the publishers should send, at least to the libraries, a duplicate copy of the annual index of each journal, or better a revised proof in slips, to be cut up and pasted into a volume which would thus be annually extended for nine years, and superseded in the tenth by the general index. The addition to the expense in a library is very trifling, and a small payment for the extra copies of the indices would protect the publishers against loss.

Glasgow University JOHN YOUNG

THE DUTCH SOCIETY OF SCIENCES

THE following account of the history of the Dutch Society of Sciences at Harlem has been drawn up by the Secretary, E. H. von Baumhauer, for publication in England. It shows the progress of science in Holland, and the great interest taken in its advancement both in that country and abroad, as proved by the award of so many valuable gold medals, and by the recent establishment of a central bureau for the exchange and transmission of books; all which activity is maintained without any of the expense falling on the scientific members.

In the middle of the last century the greater part of the aristocracy of Harlem were desirous of finding recreation in physical experiments and scientific researches. Along with several regents of the town they decided in 1752 to establish a self-supporting society, for the collection of written essays, and the bestowal of prizes on those of meritorious character. At the first meeting, May 21, 1752, the preacher, C. C. H. van der Aa, was appointed secretary, and many other protectors of the sciences and learned men in other parts of the country, were invited to become members, amongst whom were Musschenbrock, Gambius, Alberti, and others, so that by the end of the year the Society was already formed of twenty-three directors and members. The design was to include all branches of science, and to search for everything necessary for the present and future prosperity of the Republic, both in its internal and external relations, in peace and in war. Even communications on theological subjects were not excluded, treated in such a manner as not to offend Christians of any sect. The motto of the Society was *Deo et Patriæ*. By the help of many wealthy persons the Society was enabled to crown several prize essays, published in the transactions. In July 1754 the protectorate was conferred on the young hereditary governor, William Prince of Orange.

Several very eminent native and foreign men became members of the Society, and the first volume of the Transactions was so favourably received that a second edition was necessary. It was also in great part translated into German. The prize questions excited much interest in other countries, so that several were answered by foreigners. Since 1772 an annual programme has been published in both Dutch and French.

After an existence of twenty-five years the Society founded a sub-division, more specially devoted to commerce, agriculture, and industry, under the name of the Commercial Branch. This was the origin of what was afterwards called the Dutch Society for the Promotion of Industry, which in 1877 will celebrate its centenary festival.

The parent institution continued in a flourishing state until 1780; but the mournful political situation of the country for some time after that had a most injurious effect, so that the very name of this Society was continually changed. From 1798 it was called the Bavarian Society. King Louis called himself perpetual President of the Royal Society of Sciences; but in 1820, by order of the Emperor's Governor, the Prince of Plaisance, the name of the Dutch was again adopted, and has been re-

tained till now. William I. willingly accepted the protectorate, and his example has been followed by his successors.

The Secretary Van der Aa, who had been the soul of the Society from 1751 to 1794, was succeeded by the renowned Physical Professor Martinus van Marum, who at his death in 1837 was succeeded by the Professor of Geology, T. G. S. van Breda, who took his dismissal in 1864, when the Professor of Chemistry, E. H. von Baumhauer, was appointed to the office.

From 1754 to 1793 the Society published thirty volumes of Transactions, of which registers by the celebrated T. T. Martinet were issued in 1773 and 1793. These Transactions contain essays on all branches of science, and also many on theology. It was principally through the influence of Van Marum that since then a more predominating share has been taken by physical subjects. From 1799 to 1844 a first series of 24 volumes in octavo, and from 1841 to 1866 a second series of 25 volumes in quarto, and since 1870 a third series of "Physical Transactions" have been published by the Society. In 1802 a volume in octavo of "Mechanical and Mathematical Transactions" was published, and in 1821 and 1822 two volumes in octavo of "Philosophical Transactions." From 1815 to 1820 three volumes in octavo on literary and archæological subjects, and since 1851 2 volumes of "Historical and Literary Transactions" in quarto have been published. The second and third series of "Physical Transactions" are especially distinguished by the memoirs written by the most eminent men in Europe, mostly illustrated by excellent plates.

The revenue of the Society is derived from the interest of capital, for which it is indebted to the kindness of the directors and from the annual subscriptions of the actual directors. It receives no pecuniary assistance whatever from the Government.

With these means the Society endeavours to make known to the world excellent writings on physical subjects, which otherwise would be published with difficulty on account of their special character and the costliness of the illustrations.

Besides supporting such works, the Society encourages scientific researches, and since 1866 has published a journal in the French language, edited by the Secretary, under the title of "Archives Néerlandaises des Sciences Exactes et Naturelles," of which already 7 volumes have appeared. This journal is destined to make known to the world all that is produced in the Netherlands and the Dutch possessions related to physical science. This is of great service to the Dutch scientific men, since their researches, being for the most part written in a language so little known generally as the Dutch, would otherwise obtain only a very partial publicity.

The Society is composed of an indefinite number of directors, for the greater part gentlemen of wealth and social importance, who pay an annual contribution of fifty gulden (about four guineas) and manage the finances, which, however, now are especially under the charge of five directors living in Harlem, presided over by the president. There are also sixty native and sixty foreign members, who are chosen in the General Assembly, held on the third Saturday of May, from a list of candidates made by the directors and members. These members pay no contribution whatever, and receive free all the publications of the Society. This membership of the oldest and most important Dutch society is esteemed a great distinction by learned men. The English members are Davidson, Davis, Kirkman, Hooker, Lyell, Owen, Sorby, Tyndall, and Wheatstone. The president of the Society is chosen every three years by the directors. At the present time the office is filled by Baron F. W. van Styrum. When a vacancy occurs in the secretaryship, the native members nominate six from amongst themselves from whom the secretary is chosen by the directors. He also acts as treasurer and librarian, and is the only paid officer, living in Harlem in the magnificent building belonging to the Society.

The Society exchanges its publications with almost all the foreign academies and learned institutions, and to facilitate the interchange of books, the Secretary has instituted a central bureau in imitation of the American Smithsonian Institute.

As already named, the Society has regularly published a list of prize questions, the meritorious answering of which is rewarded by a gold medal of the value of about twelve guineas, to which may be added an equal sum or more, in money. At the present time no less than twenty such medals and prizes are offered for an equal number of subjects.

At the centennial festival in 1852 the Society offered a prize of 1000 gulden for the most important work in one of the branches of physics, which should be published during the next four years, and a second of 2,000 gulden for the best in four following years. In the General Assembly of 1857 it was decided that this latter prize should not be bestowed upon anyone, but that M. Foucault should be informed that the Society regretted that his communicated discoveries had not happened in the specified time, but would bestow on him the gold medal as a proof of the high value placed on his researches. On the contrary, the first prize was doubled, on account of the difficulty of deciding between two authors of transmitted works, M. A. Decandolle of Geneva, and Herr O. Heer of Zurich, who were both judged to be deserving of the 1,000 gulden offered to each.

In the general assembly of 1869 the Society resolved that quite independently of the medals bestowed on crowned prize questions, two new medals should be established, of the intrinsic value of 500 gulden (about 40 guineas), one to bear the name and image of Huygens, and the other those of Boerhaave. These medals will be bestowed alternately every two years on learned men in the country or abroad, who shall be thought by the Society to have made themselves particularly meritorious during the last twenty years in a fixed subdivision of the mathematical and physical sciences, by their researches, discoveries, or inventions. The Huygens medal was to be assigned in 1870 to the branch of physics, and will be assigned in 1874 to chemistry, in 1878 to astronomy, in 1882 to meteorology, and in 1886 to pure and applied mathematics.

The Boerhaave medal was to be assigned in 1872 to geology and mineralogy, and will be assigned in 1878 to botany, in 1880 to zoology, in 1884 to physiology, and in 1888 to anthropology; after which the same order will be repeated over and over again in the case of both medals, so that one medal will be given every twenty years for each of ten different subjects. The judgment is to take place by a Commission to be appointed by the directors, of which Commission the Secretary of the Society is always to be a member. The award is to be made in the General Assembly, in accordance with the pre-advice of the Commission, accompanied with a particular account of the motives which have led to the choice.

The first Huygens medal was awarded in 1870 to Rodolph Julius Emmanuel Clausius, Professor at the University of Bonn, as founder of the mechanical theory of heat; and in 1872 the first Boerhaave medal was given to Henry Clifton Sorby of Sheffield, for having made himself particularly meritorious by his microscopical researches in connection with geology and mineralogy, during the last twenty years.

The portrait of Huygens was taken from a copper-plate engraving by Edelink, and that of Boerhaave, from an oil painting by Troost, now in the Academy at Leiden. Independent of their size (3 in. in diameter, 9 oz. troy) both these medals are most creditable to all parties concerned as fine works of art.

ON THE SPECTROSCOPE AND ITS APPLICATIONS

VII.

ANOTHER point was also very obvious to those who are familiar with these inquiries, namely, that if these prominences really consisted of gas, by the use of a powerful spectroscope it was perfectly unnecessary to wait for eclipses at all. The reason for this will be clear on a little consideration; if we take a continuous or unbroken spectrum and apply successively a number of prisms, the spectrum will become proportionately lengthened, and therefore more and more feeble, and in fact we can thus reduce the light to any degree required; if now, on the other hand, we take a spectrum which consists only of bright lines, say of one line in the red and another in the blue, and as before apply successively a number of prisms, we shall, it is true, increase the length of the spectrum, that is the distance between the two lines, but this will be all; the additional prisms have no power to alter the width of the lines themselves, for we have seen that these are simply the images of the slit, Their light, therefore, will only be slightly enfeebled. owing to reflection merely. Thus if we have a mixed light to analyse, part of which comes from a source giving out a continuous spectrum, and the rest that of a glowing gas, although when working with a single prism no lines may be visible on account of the brightness of the con-

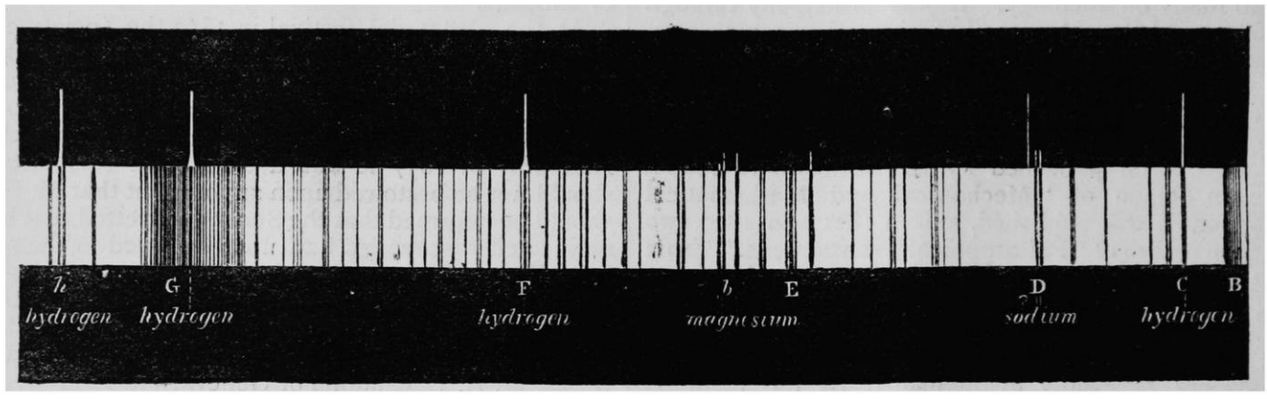


FIG. 40.—Spectrum of the Sun's Photosphere (below) and Chromosphere (above).

tinuous spectrum, yet by using say five or seven prisms we can so dilute the continuous spectrum as to render the bright lines of the glowing gas clearly visible. The case of the red flames round the sun is a case in point. They are invisible to the naked eye and in telescopes on account of the intensely illuminated atmosphere which also prevents anything like bright lines being observed from these red flames, until the bright continuous spectrum has been much reduced, when this has been done the bright lines of the spectrum, should there be any, will appear on a

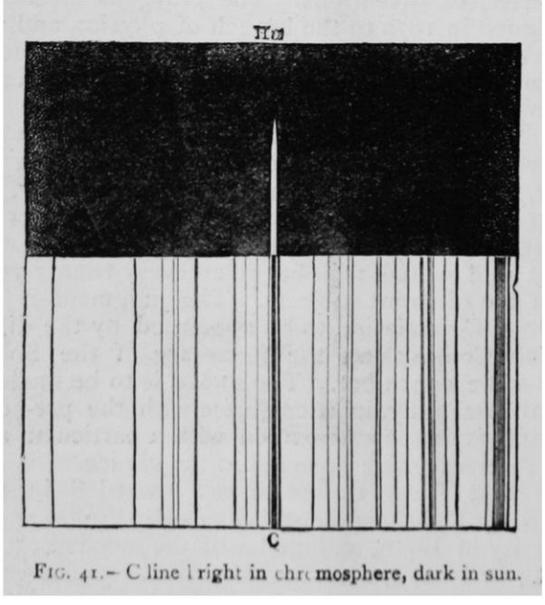


FIG. 41.—C line bright in chromosphere, dark in sun.

comparatively dark background. M. Janssen, who was sent out by the French Government to observe the eclipse which was visible in India in 1868, Major Tennant, and others, had no difficulty in recognizing in a moment, when the sun was eclipsed, that these things really did consist of gases or vapours, and M. Janssen, a very careful observer, had no difficulty in determining that the gas in question was really hydrogen gas. M. Janssen and myself were also enabled to determine this by observations on the uneclipsed sun, by means of the new method I have just sketched out. The accompanying woodcut (Fig. 40) shows the spectrum which is observed from these solar prominences. The spectrum of the prominences is shown in the upper, and that of the sun in the lower half of the engraving. This method is very easy to understand if you bear in mind the engraving of the spectroscope for solar work, and recollect that when we wish to examine the regions round the sun, the light of the sun is allowed to fall on the slit in such a way that

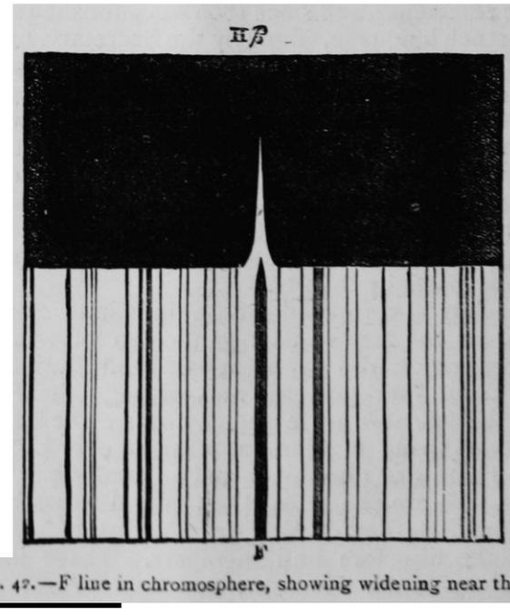


FIG. 42.—F line in chromosphere, showing widening near the sun.

one half of the slit at the focus of the object glass of the large telescope is occupied by the brilliant image of the sun, and the other half is fishing, so to speak, around the limb or edge of the sun, so that if there is anything at all around the limb, the spectroscope, in the—to the eye—unoccupied part outside the image, picks up this something, and gives us its light sorted out into its proper bright lines in the spectrum. This spectrum shows that there is first a bright line, Fig. 41, in

the red, marked C, which is absolutely coincident with a prominent dark line in the solar spectrum. Now this is a black line which, by repeated observations, we know corresponds in degree of refrangibility exactly with one of the lines given out by glowing hydrogen, when examined in one of these tubes with the electric spark. When, therefore, we get any substance around the sun reporting its light to us, it is perfectly obvious, I think, that if the bright line really be coincident with this dark line, that something is probably hydrogen. This was one of the first lines determined by M. Janssen in the eclipse of 1868. There is another bright line absolutely coincident with a dark line known to correspond in refrangibility with another line given out by hydrogen in the green part of the spectrum, marked F in the figure. This, then, is further proof in favour of hydrogen; and now notice a great difference between the shape of this line and the red line which I drew your attention to just now. An enlarged representation of this line is shown in Fig. 42.

You will bear in mind what I told you about the effect of pressure in altering the spectrum of hydrogen, and that one of the most obvious effects of increased pressure was to increase the thickness of what is called the F line—the line now under consideration, you will see here that the widening of the F line, the green line of hydrogen, really indicates a thickening due to pressure. In that way we have been able to determine approximately the pressure of these circum-solar regions which the spectroscope has determined to be occupied by an envelope of hydrogen gas, mingled sometimes with other vapours, which envelope I have termed the chromosphere. When the pressure of the chromosphere is completely determined, we shall be probably enabled to determine the temperature of the sun.

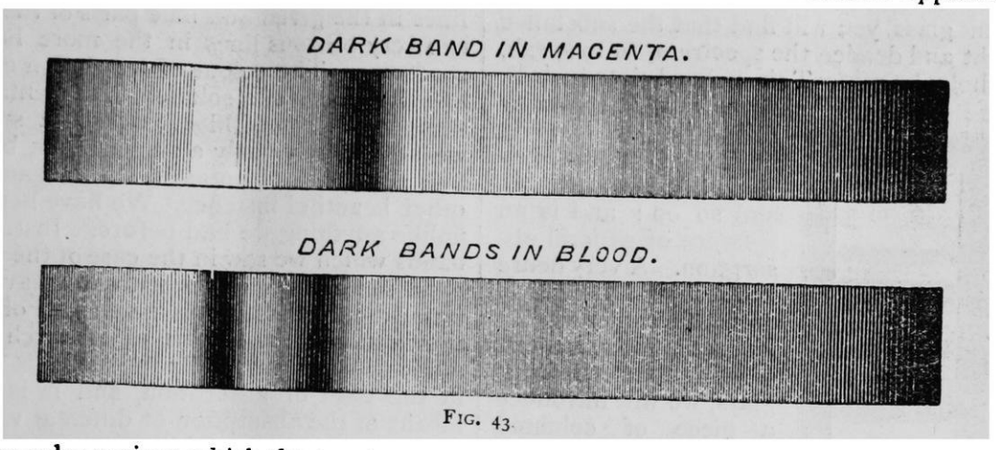


FIG. 43.

A line again in the violet corresponds with a dark line in the solar spectrum, which is coincident with a third line of glowing hydrogen which we have before spoken about, and there is still another coincident line. A line in the yellow of the spectrum will also be noticed. This is one which has caused a great deal of discussion, for it is not coincident with any line of any known terrestrial substance. A number of short lines are also shown in the engraving which will be seen to correspond to the part of the chromosphere which is denser, for then the F line of hydrogen has become broad where these lines are seen; these lines show that in the layers of the chromosphere nearest to the sun a number of other substances exist, amongst which may be mentioned magnesium, iron, and sodium. The reason that bodies do not reach up so far from the body of the sun is that their vapours are very much heavier than the gas hydrogen, which is the lightest terrestrial substance known. Such are a few of the practical applications of the spectroscope as applied to the radiation of light. There are other classes of facts relating to the absorption of light, on the consideration of which we shall now enter.

The subject with which we have just been dealing is the radiation or giving out of light by bodies in different states—that is to say, by solid or liquid bodies, or gaseous or vaporous ones. We have now to deal with the action of the prism upon light under some new conditions—conditions which I purposely withheld from you in the last lecture. Light is not only given out, or *radiated*, but it may be stopped or *absorbed* in its passage from the light-source to our eye, if we interpose in the path of the beam certain more or less perfectly transparent substances, be they solids, liquids, gases, or vapours. I will recall one or two of the experiments which have been already described in order that you may see exactly how the perfectly distinct classes of phenomena due to radiation and absorption really run together. You will recollect that I pointed out to you that radiation, or the giving out of light, might be continuous or might be selective, and I am anxious now to show you that radiation is exactly equalled by absorption in this matter; that absorption may also be continuous or selective. We have before taken as an instance of continuous radiation a continuous spectrum obtained by using the electric lamp or a lime-light; that is to say, an example of the general radiation which you get from an incandescent solid—the carbon points of which the poles

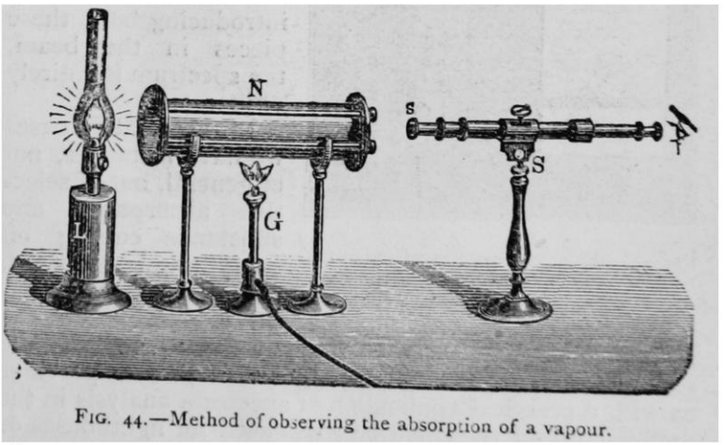


FIG. 44.—Method of observing the absorption of a vapour.

of the lamp are composed, or the solid lime. You will remember that if we take the spectrum of a vapour—as, for instance, that of strontium or thallium—we find that the continuous spectrum is altogether changed, and that in the place of that beautiful rainbow band, continuous from the red end of the spectrum to the violet, we really only get lines here and there, which are due to the selective radiation, and opposed to the general radiation which we spoke of in the continuous spectrum just now. I might have chosen other substances besides strontium and thallium, but I mentioned the spectra of these substances when we were considering the question of radia-

tion. What I have to dwell on now is, that the absorption or sifting of light by different bodies is very like radiation in its results—that is to say, in some cases we have an absorption which deals equally with every part of the spectrum, and in other cases we have absorption which only picks out a particular part of the spectrum here and there to act upon. But there is one important point to be borne in mind; when dealing with absorption we must always have a continuous spectrum to act upon. If we had a discontinuous spectrum to act upon, the thing would not be at all so clear. Having this continuous spectrum, the problem is, what the action of the different substances on the light will be. Let me give you an instance of general absorption. If we take the continuous spectrum above referred to, and interpose a piece of smoked glass, or better, a piece of neutral-tint glass, you will find that the substance will cut off the light and deaden the spectrum, so to speak, throughout its whole length. This neutral-tinted glass, then, has the faculty evidently of keeping back the light, red, yellow, blue, green, violet, and so on; and is an instance of general absorption. A very dense vapour would furnish us with another similar instance. Now, instead of using the neutral-tint glass, we will introduce a piece of coloured glass, the action of which, instead of being general throughout the spectrum, will be limited to a particular part of it. I have now interposed a piece of red glass, which cuts off nearly all the light except the red; and now I interpose a piece of blue glass, which cuts off everything except the extreme violet. By introducing both these pieces in the beam, the spectrum is entirely obliterated.

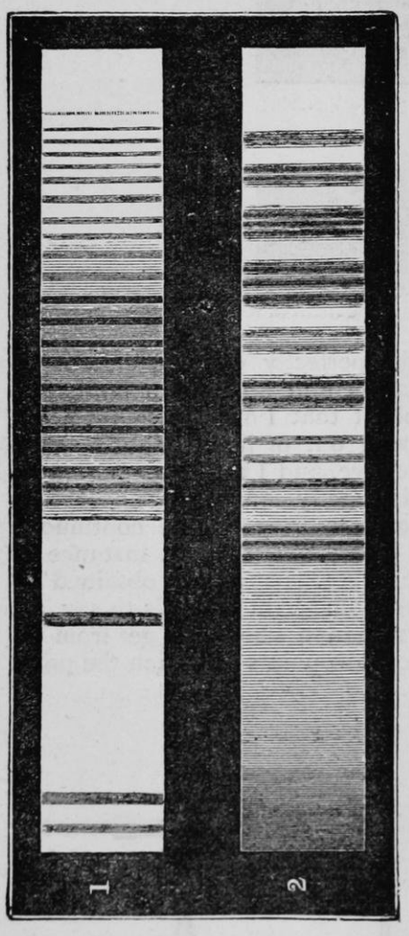


FIG. 45.—Absorption spectra of iodine and nitrous fumes.

In these latter cases we have instances, not of general, but of selective absorption, one substance cutting off everything but the red, and the other cutting off everything but the violet. Now the fact that we can absorb any definite part of the spectrum by properly tinted glasses provides us with a practical application of spectrum analysis in the manufacture of the coloured glass used for lighthouses or signals. Further, if astronomers could find a glass of a certain red, or a glass of a certain green colour, we should be able to see the solar prominences every day without a spectroscope.

The first practical application which springs out of these phenomena of absorption is this, that as different substances are known by the effects which they produce on radiation, so also chemists find it perfectly easy to detect different substances by means of their absorption; for instance, the absorption spectrum of nitrous fumes can be shown by taking first our continuous spectrum, which we must always have to start with, and introducing some nitric peroxide between the source of light and the prism. The nitric oxide, immediately it comes in contact with the air, produces dense red fumes, and numbers of fine black lines will be seen immediately crossing the spectrum at right angles to its length, and to a certain extent resembling the solar spectrum with its Fraunhofer lines. Iodine is another substance which gives a coloured vapour, the absorption spectrum of which is very definite and well defined. Fig. 45, Spectrum No. 1, shows the absorption spectrum of iodine vapour, and No. 2 that of nitrous fumes. We are not limited to these substances; we will try something else—blood, for instance, about which I shall have something more to say presently. We shall find that the action of blood upon the light is perfectly distinct from the action of those fumes which we have spoken of; and instead of having typical lines in the green and blue parts of the spectrum, we have two very obvious lines in the more luminous part of the spectrum. The colour of a solution of blood is not unlike the colour of a solution of magenta; but if, instead of using a solution of blood, we use a solution of magenta, we should have only a single black band. The absorption spectrum of potassic permanganate solution is another beautiful instance. We have here something totally unlike anything we had before. Instead of the two dark bands which we saw in the case of the blood, or the single band in the case of magenta, we have four very definite absorption bands in the green part of the spectrum. So that you see the means of research spectrum analysis affords as far as regards radiation, is entirely reproduced in the case of absorption, and it is perfectly easy, by means of the absorption of different vapours and different substances held in solution, to determine not only what the absorbers really are, but to determine the presence of an extremely small quantity. Further, by allowing the light to pass through a greater thickness of the absorbing substance, the absorption lines are thickened and new regions of absorption are observed. This fact was discovered by Dr. Gladstone, who used hollow prisms containing the substance.

J. N. LOCKYER

(*To be continued.*)

PROFESSOR ZOLLNER ON THE CONNECTION BETWEEN COMETS AND METEORS

PROFESSOR F. ZÖLLNER alludes in the commencement of his paper read before the members of the "Kön. Sächs., Gesellschaft der Wissenschaften" to the epoch which Schiaparelli's discovery of the concordance of the orbits of some small comets with those of periodically returning showers of shooting stars has made in the astronomical world. He quotes an instance in proof of this, namely, Biela's Comet. On November 27, last year, the earth was crossing the exact spot in her orbit, which had been cut by Biela's Comet two and a half months before. Observers aware of the coming event were on the alert with their instruments, but no good results were obtained owing to the unfavourableness of the weather.

From these facts, he says, we must naturally conclude that the physical constitution of these bodies is the same, and we are strengthened in our conclusions by Schiaparelli's discovery of the identity of the envelopes and tails of comets with clouds of meteors seen by reflected sunlight, the separate elements of which only become visible at a shorter distance.

Observations, however, with the spectroscope, contradict this assumption; the light given out by comets is found not to correspond with that of the sun; it is a light peculiar to them, like that of a glowing gas.

Further on he quotes Schiaparelli's own words to some length, with respect to the attraction exercised by other bodies on the matter composing the nuclei of comets,

which is drawn from them in directions other than that of their orbits. Schiaparelli maintains most distinctly that the tails of comets and meteoric aggregates are not identical.

Professor Zöllner points out that if we are not to suppose that the physical constitution of both phenomena is the same, there only remains their identity of origin as an explanation of the remarkable coincidence of these bodies in space. Pursuing this argument and accepting its veracity, there is no reason to disbelieve the materials of which they are formed, to be the same. Schiaparelli supposes the nuclei of comets to consist of a solid substance, which being subject to a kind of "weathering process," finally becomes broken up into separate pieces, which are turned into a meteoric swarm by the attraction and atmospheric resistance of a large planet. To this effect he again quotes Schiaparelli. Further on he expresses it as his opinion that comets and meteorites are the remains of planets, the former being their fluid and the latter their solid constituents. It must be left to future observers to decide whether the apparent disappearance of Biela's comet has any connection with the rich fall of stars observed on November 27, last year.

It is possible that the vapour left in consequence of the gradual evaporation of a comet would condense, in the absence of any powerful centre of attraction, into a number of separate centres, as a cloud is dissolved into raindrops on the increase of cold. In this way the condensed portions of cometary vapour would present the phenomenon of numerous shooting stars as they penetrate the earth's atmosphere in a solid or perhaps still fluid condition.

PHYSICO-CHEMICAL RESEARCHES ON THE AQUATIC ARTICULATA *

IN NATURE, vol. iv. p. 245, we gave a brief notice of some investigations M. Plateau had been making on the above subject. Since that time he has been continuing his researches in the same direction, and sends us an abstract of the results so far as concerns three problems in the life of aquatic Articulata.

I. Experiments to ascertain the length of time that aquatic insects can remain under water without coming to the surface to breathe.

The swimming aquatic Articulata which breathe air come frequently to the surface to renew their supply. The questions, How long may they with impunity remain submerged? what is their power of resisting asphyxia, as compared with that of terrestrial insects? are answered by the following experiments. At the bottom of an open vessel, of one litre capacity, full of ordinary fresh water, is placed a very small vessel, containing about 200 cubic centimetres. A piece of cotton netting so covers the mouth of the latter, that an insect, placed in the small vessel, is in reality in the general mass of the water, but cannot ascend to the surface. Terrestrial insects placed in these conditions, impelled by their specific lightness, rise to the lower surface of the network; the movements of their legs soon cease, they do not appear to suffer, and they quickly grow torpid. The Coleoptera and aquatic Hemiptera, on the contrary, instead of submitting passively to their fate, endeavour to quit their prison, swim rapidly about, exert themselves to come to the surface, and keep struggling until their strength is enfeebled, and end by lying at the bottom as if dead.

In order to recover from its state of general torpidity an insect which has been submitted to prolonged immersion, it is necessary, after having taken it out of the water, to place it upon absorbing paper. If the time of its immersion has not passed a certain limit, the animal gradually recovers its energy, retaining no sensible trace of the experiment to which it has been submitted. M. Plateau repeated the experiment upon many individuals and for various lengths of time, for the purpose of discovering, in the case of each species, the limit of time beyond which immersion caused the death of the insect. He arrived at two curious conclusions, supported by a great number of trials:—

1. The terrestrial Coleoptera recovered from complete submersion continued for a very long time, in several cases for 96 hours. 2. The aquatic swimming Coleoptera and Hemiptera, far from presenting a greater resistance to asphyxia by submersion than the terrestrial insects, in most cases succumbed very much sooner.

The cause of this unexpected inferiority in the case of the aquatic insects M. Plateau thinks is due exclusively to their greater activity in the water, causing as a consequence a more rapid loss of oxygen.

II. Influence of Cold: Effects of Freezing.

The results of M. Plateau's experiments in this direction are that the aquatic Articulata of the latitudes of Belgium exist for an indefinite period in water maintained at zero (centigrade) by means of melting ice; while they cannot remain alive in ice for any length of time—not for half an hour at the utmost. The latter phenomenon appears to be accounted for by the fact that the insects are completely deprived of all power of motion, thereby losing completely their animal heat.

III. Action of Heat.

Under this head M. Plateau tries to show the maximum temperature of water in which fresh-water Arachnoids can live. He finds that the highest temperature they can endure without injury oscillates between 33°·5 and 46°·2 centigrade. Comparing these results with those which have been obtained by experimenting with animals belonging to other groups, M. Plateau finds that the greatest temperature which aquatic vertebrata, articulata, and molluscs can support probably does not exceed 46° centigrade.

* By M. Felix Plateau.

NOTES

WE have received a communication from Dr. Rein, Director of the Lenckenberg Society of Naturalists at Frankfort, which amusingly illustrates the perils that accompany the honours of the translation into a foreign language of a scientific work. Our informant relates that the well-known publisher, M. R. Oppenheim, of Berlin, having recently obtained the sanction of Mr. Poulett Scrope for the publication of a German translation of his work on "Volcanoes," of which a new issue lately appeared in this country, confided the work of translation to Prof. G. A. von Klöden, who accordingly performed the task. The translation was printed, together with a preface written by M. von Klöden himself—which preface, in the hurry of business, and in reliance, of course, on the good faith of the translator, the publisher forebore from examining. The volume in due course appeared, and was circulated by the publisher; and not till then was it discovered that the preface aforesaid consisted of a severe and indeed bitter critique of the work to which it was prefixed, and of the author's views as therein stated of the theory of volcanic energy, and its external development in the formation of cones and craters, &c. The explanation is that Prof. von Klöden happens—unluckily for the author whose work he undertook to translate—to have been all his life an earnest advocate and teacher of the famous "Erhebungs-Krater," or "upheaval crater" theory of Humboldt and Von Buch, which Mr. Scrope, together with Sir C. Lyell, Constant Prevost, and other geologists have persistently opposed, and are, we believe, generally considered to have satisfactorily refuted. Of course it is open to Prof. von Klöden to expound and defend his own opinion on this subject to the fullest extent in any independent publication; but it does seem to be stretching the liberty of free expression on

scientific questions in an unprecedented manner, when a gentleman employed to translate a scientific work takes advantage of the opportunity to append to the translation, in the disguise of a preface, a pamphlet of nineteen pages containing an elaborate refutation, according to his own ideas, of the bulk of the views contained in the work itself. Mr. Scrope, we understand, on becoming aware of this strange conduct of Prof. von Klöden, has endeavoured to meet the attack thus unfairly made on his work, by circulating as widely as possible through the scientific world of Germany, a translation of his essay on the formation of volcanic cones and craters, originally read before the Geological Society of London in February 1859, and published in the journal of the Society for that year, a paper in which the theory of "Erhebungs-Kratere" was amply discussed. But even here the author appears to have had but scant justice done to him, if it be true, as Dr. Rein assures us, that "the German of this translation is *very bad!*"

An Icelandic gentleman sends to the *Scotsman* an account of the eruption of the Skaptar Jokull in Iceland, which took place in January last. On January 9, about three o'clock A.M., there was observed from Reykjavik a great fire in the E.N.E. The fire shot up like lightning, displaying beautiful evolutions in combination with the electricity above. So bright was it, that during the dark morning hours it was thought it must be very close to Reykjavik. But when daylight dawned, and the mountains could be discerned, a thick and heavy column of vapour or steam was observed far in the background, beyond all the mountains, so that it was clear that it was far off, and, according to the direction, it seemed most likely to be in Skaptar Jokull, the west part of Vatna Jokull—the great waste of glaciers in the east and south of the island. Morning and night this grand display was visible during the 9th, 10th, 11th, and 12th, and during the day the column of steam and smoke stood high in the sky. All agreed that the eruption must be in Skaptar Jokull, and from various observations it was concluded that the position of the crater ought to be between 67° 7′ and 67° 18′ deg. north lat., and 30° 45′ and 30° 55′ west long. from the meridian of Copenhagen. In the east, near Berufjord, some shocks were felt, and fire was seen from many farms. Ashes, too, had fallen over the north-east coast so abundantly that pasture fields were covered, and the farmers had to take their sheep into the huts and feed them. In the south, however, no earthquakes were felt, or noises heard in the earth, as far as Markarfljol (near Eyjafjalla Jokull). Nowhere has been observed any fall of ashes or dust, but all aver a bad smell was felt, which was also the case in Reykjavik on the forenoon of the 10th. At Reykjavik the air was felt to be very close, with a smell of sulphur and powder. No change was observed in the sun, moon, &c. The sky was clear all these days. The direction of the wind was from N.W.—W.S.W., and the weather fine.

Baron Liebig is seriously ill, and on the 15th inst. there had been a great change for the worse in his condition.

On Tuesday, Dr. James Murie, late Prosector to the Zoological Society, was unanimously elected by the Town Council of Edinburgh, Professor of Anatomy and Zootomy to the Veterinary College of that city, *vice* Professor Davidson, M.D., deceased.

Prof. Ansted, whose unfortunate accident we noticed last week, has recently received from the King of the Greeks the brevet and insignia of the Hellenic order of the Sauveur, of which he has been nominated an officer, in recognition of his services in reference to the Laurium question.

M. Lœwy has been elected a member of the French Academy of Sciences in room of the late M. Delaunay.

A Committee was formed last autumn with a view to secure some provision for the five children who were left unprovided for by the untimely death of Mr. John Cargill Brough. A meeting of this Committee was held at the London Institution on Tuesday last, and the report of the Honorary Secretaries showed that the subscriptions amounted to a sum which, after deducting all expenses, will stand at nearly 2,000*l.* In this sum are included a grant of 150*l.* from the Royal Bounty Fund, 200*l.* contributed by members of the Savage Club, and nearly 400*l.* collected in answer to an appeal to the Pharmaceutical Chemists. A deed of trust of the usual character was approved by the Committee, and trustees were appointed. Votes of thanks were passed to Mr. McArthur, M.P., who has given a presentation to Christ's Hospital, to Mr. Deputy Webster, and to Sir John Lubbock, Bart., M.P., F.R.S., who has kindly acted as treasurer of the fund. The secretaries stated, in concluding their report, that the names of the gentlemen who have acted on the Committee, as well as the kindly expressions of sympathy which have from time to time reached them, afford evidence of the respect and affection in which Mr. Brough's memory is held.

Among the candidates for the Professorship of Anatomy to the Royal Academy are Dr. B. W. Richardson, F.R.S., and Mr. John Marshal, F.R.S.

Dr. B. W. Richardson, F.R.S., has been elected by the President and Council of the Royal Society, Croonian Lecturer on the subject of muscular motion.

The third part of the great map of Switzerland ("Topographischer Atlas der Schweiz"), containing the sheets Binnenthal, Helsenhorn, Andermatt, Six Madun, S. Gotthard, Faido, Olivone, Hinterrhein, Mesocco, Jungfrau, Adelboden, and Lenk, has recently been issued at Berne. These sheets are all on the scale of $\frac{1}{50000}$. Those called Andermatt and S. Gotthard have a special and general interest at the present time from embracing the course of the Great St. Gotthard tunnel, and exhibit in the clearest manner, by means of their contour lines, the nature and altitudes of the overlying land. Thirty-eight sheets are now published out of the 546 which will compose this magnificent map.

Mr. E. L. Layard, H.M. Consul at Para, well known for his zoological researches in different parts of the world, has returned to England, resigned his consulate in that place, and accepted the charge of the British interests in the Fiji Islands. During the short time he has held his office in South America, he has made a valuable collection of birds, of which we understand an account will be given in one of the forthcoming numbers of the *Ibis*.

The new gate to the Zoological Society's Gardens in the Albert Road, opposite Primrose Hill, and the new canal bridge, opened on Easter Monday for the first time, were found very convenient to those of the 42,320 visitors on that day who arrived from the north, as they were saved the trouble of going over the rather out-of-the-way bridges of the Regent's Canal, which they previously had to do.

We understand that Mr. Severzow, a well-known Russian naturalist of Moscow, is preparing a work on the zoology of the vertebrata of Turkestan, which will be accompanied with illustrations of the new and interesting species which have been the first-fruits of the new Russian Expedition and Annexations in that part of Asia.

The Lucasian Professor of Mathematics (Mr. Stokes) at Cambridge, will deliver a course of lectures on hydrostatics, hydrodynamics, and optics, commencing Friday, April 25, and they will be continued, with a few exceptions, on all week days except Thursday, at the hour of 1 P.M., in the New Museum. Gentlemen who wish to attend are requested to leave their names with Messrs. Deighton. Mr. J. W. Clark will commence his osteo-

logical demonstrations in the Museum of Zoology and Comparative Anatomy, on May 12. The Demonstrator of Comparative Anatomy will resume his class for practical work on May 1, and continue the same on Thursday, Friday, and Saturday. Courses of lectures on History, Languages, and the various sciences, will be delivered at Cambridge to women during the Easter Term. The fee for each course is one guinea, but a reduction of one-half may be obtained on application by persons engaged in or preparing for the profession of education.

WE hear that a Natural History Society and Field Club is about to be formed among the members of the Working Men's College, Great Ormond Street. The list of classes in the College for the term commencing April 21, announces a series of Saturday afternoon geological excursions, under the guidance of Mr. Logan Lobley, F.G.S. A course of lectures in Physiology is to be begun by Mr. S. D. Darbishire, M.A., Ball. Coll. Oxf. Mr. T. Hughes, M.P., who is now the Principal, will preside at the meeting with which the term opens on Monday evening next, and to which the public are admitted.

WE have received from Prof. Cope several photographs of the cranium of the hugh horned Proboscidians of Wyoming, named by him *Loxolophodon cornutus*. This genus differs from *Dinoceras* of Marsh, which it very closely resembles in all respects, in having the nasal horn cores flat and horizontal, overhanging the apices of the nasal bones. The maxillary horn cores are also proportionately longer, and are not a continuation in direction of the enormous canine teeth, but are turned somewhat forward. Prof. Cope divides the short-footed Ungulates, or Proboscidians of the North American Eocene, into two families, the Eobasiliidæ and the Bathmodontidæ, the former possessing no incisors and no third trochanter to the femur, the latter having the full complement of incisors and a rudimental third femoral trochanter. He further divides up the Eobasiliidæ into the genera Loxolophodon, Eobasileus, Uintatherium, and Megaceratops, and the Bathmodontidæ into Bathmodon and Metalophodon. From a comparison of the photographs above mentioned with Prof. Marsh's drawing of *Dinoceras mirabilis*, we fail to see any points sufficient to justify their generic separation. On photograph shows clearly that in the molar teeth the outer wall was not present, and that the transverse ridges were fully developed, being straight but not parallel, meeting on the inner border of the tooth to form a >-shaped surface.

THE Museum of Comparative Zoology, of Cambridge, U.S., in addition to the Bulletin of its proceedings, issues a series of "Illustrated Catalogues," in small folio form. In this several valuable papers have already appeared; but by far the finest and most important is one just out of press entitled "A Revision of the Echini," by Alexander Agassiz. This embraces an exhaustive account of the bibliography of the subject, as well as its synonymy, followed by detailed descriptions of the genera and species, both as regards the external form and internal anatomy. It is illustrated by forty-nine plates, of which seven represent the geographical distribution of the various groups of *Echini*, the remainder being devoted to representations of the species. A very important experiment has been made in this work as to the availability of different methods of photographic printing for natural history work, and, we may indeed say, with complete success. About one-third of the illustrations of species are crayon drawings on stone, one-third are Albert-types, prepared under the direction of Mr. E. Bierstadt, of New York, and the remainder are Woodbury-types, executed by Mr. John Carbutt, of Philadelphia. Nothing can exceed the perfection of finish and detail of the plates prepared by both these methods, and we are sure the work will mark an era in the history of scientific publications. The expense of even an approximation to the accuracy of these figures, on stone or metal, would have been enormous.

THE Special Correspondent of the *Daily News* on board the *Challenger*, writing from St. Thomas on the 24th ult., states that the vessel was to proceed on her voyage that afternoon. All the scientific staff had been busy, and a large collection of interesting and beautiful objects had been made. On the previous Saturday morning the *Challenger* stood out to sea for the purpose of making magnetic observations, returning in the afternoon, and mooring in the inner harbour in readiness to sail the next day. Late in the evening, however, the *Challenger* acted the Good Samaritan to a dilapidated ship and her crew, lying fifteen miles off.

PROFESSOR AGASSIZ sends us part of the correspondence which took place between himself and Mr. Anderson, the gentleman who made the princely gift of a beautiful island and 50,000 dollars to Prof. Agassiz, referred to in the letter from a New York correspondent in last week's NATURE. The whole affair has been gone about in the most simple and modest way by Mr. Anderson, who, in a letter to the Professor, hopes the school to be established on Penikese Island "may be destined in future ages not only to afford the required instruction to the youth of our own country, but may be the means of attracting to our shores numerous candidates from the Old World, who may find here, in the school to be established by you, those means of fitting themselves for the teaching of Natural History by Nature herself, which, by a strange oversight, appear to have been overlooked in the schemes (generally so well conceived and executed) of education there."

THE course of twenty-four lectures on Zoology, given during the past winter by Mr. J. E. Taylor, F.G.S., in the Museum, Ipswich, has been a great success. Every Friday night the great hall and galleries have been crowded, the audiences increasing as the lectures advanced, so that latterly upwards of 500 people have been in the habit of attending—a very satisfactory audience for a town of the size of Ipswich.

M. FAYE has written to contradict a report in the *Revue Scientifique* that he had demitted his post of President of the Commission on the Transit of Venus, because he saw that the necessary instruments would not be ready in time. He was compelled to take this step on account of his many other public duties, and declares that he has no doubt whatever of the success of the French preparations.

M. BOILLOT, in making some experiments with ozone, has discovered that a litre of pure oxygen yields only 7 milligrammes of ozone, while the same quantity of air gives 37 milligrammes. Thus, *Les Mondes* says, oxygen mixed with air is in a condition more favourable to its being converted into ozone.

ACCORDING to the *American Artisan*, measures are pending at Washington seeking to secure an international coinage of silver, for the immediate use of nations in America and Europe, now embracing a population of more than one hundred and sixty millions, and for the eventual use of all the civilised countries of the world.

MR. W. F. DENNING of Bristol sends us the following meteorological notes. A correspondent writes him that, on November 27, 1872, he was in latitude 43° 24′ north, and longitude 13° 55′ west, when at about $5^h\ 30^m$ to 6^h he witnessed a magnificent shower of meteors, which continued without intermission till nearly 8^h. Most of them were colourless, but some were tinted with a pale bluish hue. The seeming directions were from about N.E. by E., true, to S.W. by W., but the sky appeared so full that it was hard to tell. On April 6, at $9^h\ 8^m$, a meteor nearly as bright as Venus was observed by Mr. Denning at Bristol. Beginning of observed path = R.A. 85°, D. 43°+, end of ditto = R.A. 56°, D. 31°+, length of path = 24°. Duration 1·5 sec. Mr. Denning observed displays of aurora

borealis on the evenings of April 1 and 2. On April 1 it was first noticed at $8^h\ 49^m$, when an intense auroral glow pervaded the N. sky and gave an effect similar to moonrise. At $8^h\ 51^m$ a broad streamer became visible, reaching a height of 11°. This streamer was situated 2° N. of β Cassiopeiæ, and appeared to be connected with an auroral arch under Cassiopeia, running from N.W. to N. On the following evening, April 2, the auroral light was again intense in due N.

THE additions to the Zoological Society's Gardens during the last week include a Bacha Eagle (*Spilornis bacha*) from Malacca, presented by Mr. W. Jamrach; a Madagascar Porphyrio (*Porphyrio Madagascariensis*) from Madagascar, presented by Miss Furlonger; a Cuttle-fish (*Octopus vulgaris*) presented by the Brighton Aquarium Co.; a great grey Shrike (*Lanius excubitor*) presented by Mr. Hawkins; a Crested Pelican (*Pelecanus crispus*) from S. Europe, presented by Dr. Doyle; a Vulpine Phalanger (*Phalangista vulpina*); a great Kangaroo (*Macropus giganteus*); a yellow-footed rock kangaroo (*Petrogale xanthopus*); and some Tibetan Wolves (*Canis laniger*) born in the Gardens; two Hunting Crows (*Cissa venatoria*) from India; a Cocoi Heron (*Ardea cocoi*) from the W. Indies; a Broad-banded Armadillo (*Xenurus unicinctus*) from Brazil; two Rock Whiting; a Whiting Pout, two Lump-fish, and six Bream all purchased.

*ON AN AIR-BATTERY**

THIS battery is founded on a reaction, brought by the authors before the Royal Society† last spring, in which it was shown that if pieces of copper and silver, in contact, were immersed in copper nitrate solution in presence of oxygen, a deposit of cuprous oxide took place on the silver plate with a corresponding solution of the copper plate, resulting from the decomposition of the copper nitrate in the manner shown in the following formulæ:—

Before contact is made

$$mAg \mid O \mid Cu2NO_3 \mid Cu2NO_3 \mid nCu$$

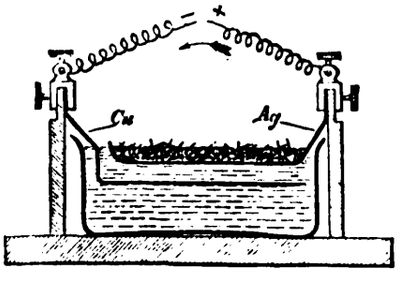
After contact

$$mAg \mid Cu_2O \mid Cu2NO_3 \mid Cu2NO_3 \mid (n-2)Cu$$

It is evident that this action is continuous until either the copper or the oxygen is exhausted.

It was stated in that paper, that a galvanic current passed through the solution from the copper to the silver, and also that this was only one case of a large class of similar reactions.

The battery takes the form of a shallow circular vessel containing the solution, and the plates are arranged horizontally, the silver plate being at the surface. It will be apparent on glancing at the above equations, that the combination of the oxygen only



takes place in the neighbourhood of the silver; hence it was evidently desirable to increase as much as possible the proximity of the silver plate to the air, and also the surface exposed by the silver. This was accomplished as shown in the adjoining sketch. The silver has the form of a shallow tray, full of crystals of silver, and perforated to allow the circulation of the copper solution. The tray is arranged so that the crystals should just rise above the surface, and being, of course, always wet, they very much increase the absorbing surface of the liquid.

The whole arrangement is put upon a wooden stand, and the plates are attached to two uprights fixed in the stand.

The strength of the copper nitrate solution is 6 per cent. This gives about the maximum of effect; a 24 per cent solution gives only half the current; and a 30 per cent solution gives two-thirds. A solution stronger than 6 per cent. is also apt to produce a deposit of subnitrate instead of suboxide.

The best proportionate areas of the silver and copper plates was investigated in two series of experiments, in one of which the silver remained the same, while the copper surface was diminished by varnishing, and in the other set the copper remained the same while the silver was diminished. The following table gives the results in the latter case. The deflections are those of a Thomson's galvanometer:—

Proportion of Surfaces.		Deflection.		
Copper	Silver.	Expt. 1.	Expt. 2.	Expt. 3.
1	0·25	—	—	7°·5
1	0·5	—	—	16°·0
1	0·75	—	—	21°·0
1	1·0	33°	32°	28°·0
1	1·33	41°	40°	—
1	2·0	56°	54°	—
1	4·0	96°	92°	—

It thus appears that an increase in area of the silver plates causes a proportionate increase in the current. It was also found that heat greatly increases the activity of this cell, a cell giving a deflection of 40 at 20° C., gave one of 250 at 50° C.; and the increase in the higher degrees of this range of temperature was much greater than in the lower.

From the nature of the reaction it might be expected that the current would gradually diminish on account of the using up of the oxygen in the neighbourhood of the silver. Such a diminution always does take place at first—agitating the liquid ought, under these circumstances, to increase the action. It does so.

It might also be expected that upon breaking contact for some time, so as to allow oxygen to diffuse itself from other parts of the solution, the current upon again making contact would be as strong, or nearly so, as before. This also was found to be the case.

An experiment was made by putting a cell, with plates connected by a wire, under a bell-jar full of air over mercury. It was expected that the mercury would rise inside the jar from absorption of the oxygen. The mercury did rise, and the oxygen was so completely removed that a lighted taper was immediately extinguished in the remaining gas. The apparatus used in this experiment was exhibited to the Royal Society.

Comparative experiments were made with aërated and deaërated copper nitrate solution. It was found that the amount of action in the latter case was little or nothing, and what small action there was was clearly attributable to the difficulty of completely excluding air.

Two experiments were made alike in all respects, except that in one case the cell used was filled with a solution simply deprived of oxygen, while the other cell was filled with a solution through which a current of CO_2 was passed for some time. The first was placed in the air, and gave a deflection of 110 rising to 115, but the second was placed in a vessel full of carbonic acid gas, and gave a deflection of 20, which gradually fell to 3.

It was proved experimentally that the cuprous oxide deposited on the silver was compensated by an equivalent solution of the copper plate. The cuprous oxide is sometimes deposited in crystals visible to the naked eye, and shown by a lens to be regular octahedra.

One cell having plates two inches in diameter was found sufficient to decompose such metallic salts as the nitrates of copper, silver, and lead, platinum being used for the negative electrode, and for the positive the same metal as existed in the salt experimented on. Six cells were sufficient to decompose dilute sulphuric acid and dilute hydrochloric acid pretty quickly, copper electrodes being employed.

The theoretical interest of this battery lies in the fact that it differs from all other galvanic arrangements, inasmuch as the binary compound in solution is incapable of being decomposed

* Abstract of paper read at the Royal Society, Thursday, April 3, by J. H. Gladstone, Ph.D., F.R.S., and Alfred Tribe, F.R.S.

† Proc. Roy. Soc. vol. 20, p. 290.

either by the positive metal alone or by the two metals in conjunction, without the presence of another body ready to combine with one of its elements when let free.

Grove's gas battery is essentially different from this, if the oxygen and hydrogen condensed on the platinum plates play the part of the two metals; but it closely resembles this if hydrogen acts the part of the positive metal, and platinum that of the negative; the dilute sulphuric acid will then be decomposed on account of the simultaneous presence of the oxygen which can combine with the liberated hydrogen. Viewed in this manner, Grove's gas-battery is only a special case of the reaction mentioned in the communication to the Royal Society, and the formulæ will be—

Before contact—

$$m\,Pt \mid O. \mid H_2SO_4 \mid n\,H$$

After contact—

$$m\,Pt \mid H_2O \mid H_2SO_4 \mid (n-2)\,H.$$

The practical interest of this arrangement lies in the fact that it is an approximation towards a constant air-battery. Should it ever come into use it would, of course, not be in the form described in this paper, but probably in a combination of copper and zinc, with an aërated solution of zinc chloride, which has an electro-motive force six times that of the silver-copper cell, and three quarters that of a Daniell's cell. Chloride of zinc is preferable to the sulphate, as it offers less internal resistance, and a solution of 20 per cent. is about the best conductor. A single cell of this kind decomposes dilute sulphuric or hydrochloric acid, with copper electrodes.

The power is thus obtained at a minimum of expense, for the oxygen which combines with the zinc costs nothing.

Such a battery would appear to be specially applicable to cases where the galvanic current has to be frequently broken, as in telegraphy, for, at each period of rest, it renews its strength by the absorption or diffusion of more oxygen from the surrounding air.

SCIENTIFIC SERIALS

Zeitschrift für Ethnologie.—The second number of this journal for 1872 scarcely possesses the same scientific value as former numbers. We have, first, the concluding part of Dr. E. von Martens' lecture, read before the Anthropological Society of Berlin, December 1871, on the different uses of the Conchylia. The paper is characterised by true Germanic exhaustiveness, but it indicates a want of appreciation on the part of the author of the relative value of authorities, ambiguous allusions in Longfellow's "Hiawatha" being adduced as evidence, side by side with the statements of scientific travellers. Dr. Martens passes in review every use to which shells have been put in ancient or modern times, and in civilised or uncivilised countries.—Dr. Robert Hartmann continues his notice of the remains found in the Lake Dwellings of Switzerland, and draws attention to the absence of the domestic cat from the more ancient fauna of Europe. The most numerous animal remains belong to the common European stag (*Cervus elephas*), but are of colossal size, and so nearly akin to *Cervus Canadensis* as to raise the question whether the *C. elephas* of the Swiss Lake deposits may not be identical with *C. canadensis*. No trace of reindeer has been discovered, although that animal was common in Switzerland during the glacial period.

In the third number (1872) of the journal, we have an interesting report of the remains of pile dwellings in the Archipelago of North Celebes, which have been examined by the Dutch "Assistant Resident," J. G. F. Riedel. The paper is illustrated with drawings of these huts, and of the different types of head most commonly observed among the North Celebes tribes in the present day. It would appear that the Aborigines were not lake-dwellers. The Toun Singals, however, who were of foreign origin, and arrived in the country between the 12th and 13th centuries, although they at first dwelt on the strand of the present Negeri Atep, soon left their original settlements, and built themselves pile-huts on the great Minahasa Lake, where they were secure from the pursuit of the robber tribes of Djailolo, whose incessant attacks had been the chief incentive to their immigration. The remains of these lake-dwellings give evidence of their solidity, for Herr Riedal found that the piles were for the most part 3 ft. in diameter, and 20 ft. in height above the surface of the lake; the length of each hut was nearly 70 ft., and the breadth 40 ft. Among other events the enforced conversion to Christianity of the Toun Singals in 1830 has separated them still more from the habits of their race, and the memory of the older pile-dwellings seems to be fast dying out among them.

Dr. Bastian gives us in the third number a very complete and carefully elaborated paper on Comparative Philology. He begins by treating of the physiological formation of speech; and of the widely differing groups of emotions which respectively find expression in vocals and in consonants. He passes in review the various nations, whose original language exhibits a preponderance of either of these distinctive characters. Among the older races of America and Africa consonants largely predominate, while in the Malay Polynesian dialects vocal sounds are strongly in the ascendent. The phonetic character of a language influences its grammatic peculiarities.

Herr Rade, who has spent eight years in endeavouring to discover among the Kaukasian tribes some fixed type of their nation, finds from his prolonged investigation of living and dead skulls that the mingling of races has been so continuous in these regions, that it is impossible any longer to recognise the "Kaukasian Race" as it was defined by Blumenbach. Herr Rade has hitherto failed in detecting certain evidence of the existence of Lacustrine dwellings in any of the Kaukasian lakes which he examined.

Dr. Virchow, at a recent special meeting of the Anthropological Society of Berlin, read an interesting paper on the results of a series of explorations made by himself and his sons in the course of last year in the little island of Wollin, lying off Pomerania, in the Baltic. Wollin or Julin as the locality in which the sea-kings or Vikingar had established their once formidable republican settlement of Jomsburg, has always presented special features of interest for Northern inquirers and historians. The early chroniclers of Northern Germany and Scandinavia make frequent allusion to the enormous wealth and great importance of the trading ports of this small island. After ages of decay and desertion the island is again acquiring some slight amount of recognition through the recent establishment of baths near the little town of Wollin. It is here that Dr. Virchow and his sons found unmistakeable evidences of the early existence of a large and wide-spread population. Near the little lake of Vietzig, under a surface of loam or clay-mud, Dr. Virchow came upon a bed of *débris* from 4 to 7 ft in depth, which was entirely formed of fish and animal bones, broken vessels, and all the ordinary adjuncts of the Kjokkenmöddinge as they have been revealed in the Lacustrine deposits of Pomerania. At some places where the hills have been cut, the exposed surfaces seem composed almost entirely of the scales and bones of fishes and other animal remains. At one spot, on the S.E. of the present town, a burying ground was discovered, on which 60 grave-hillocks could still be counted. On penetrating below the surface a heap of burnt and fractured bones was found at a depth of 18 to 20 in., but in no grave, explored by Dr. Virchow, was any trace of urn, stones, or textile fragment to be seen; although remains of fused bronze were met with. A small grant of money has been made by the Society for the purpose of continuing the exploration of the island, and if the work should be placed under the direction of Dr. Virchow we may anticipate valuable results from a more systematic investigation of this site of the most formidable piratical republic ever founded in Northern Europe.

In a paper laid before the Societé d'Anthropologie de Paris by M. Broca, on the Toulouse form of narrow or flat-head deformities, the author enters at length into the consideration of the probable effect on the cerebral functions produced by the ligatures, with which the peasant mothers of some parts of south-west France still compress their children's heads.

THE *Zoologist* for April, after a reprint from the *American Naturalist* of Prof. N. S. Shaler's paper, "Notes on the Right and Sperm Whales;" and ornithological notes from Lincolnshire and Devon, enters further into the discussion of Dr. Baldamus' theory as regards the cuckoos' egg. Mr. Hewitson replies sharply to Mr. Smith's paper in the preceding number; Mr. G. D. Rowley opposes the theory, and thinks that "birds are only too glad to sit on cuckoos' eggs," as they will sit on nothing rather than not incubate. Mr. Doubleday writes to the same effect, as does also Prof. Newton in a quotation from the *Field*. Mr. Smith acknowledges that in writing his former letter, he had not seen Prof. Newton's article on the subject in NATURE (vol. iii. Nov. 1869), but still maintains that British

ornithologists have not yet investigated the question "in the systematic way, and after the excellent example of painstaking and diligence set us by Dr. Baldamus and Dr. Rey." The editor, referring to a note on the Liberian Hippopotamus which appeared in this periodical a month ago, states that the author has made a mistake in calling it a true hippopotamus. The context clearly shows how the term is meant, and it is an undoubted fact that the English name has a wider meaning than its Latin equivalent. Chœropsis is as true a hippopotamus as Rhinaster or Ceratorhinus are true rhinoceroses, and they are so undoubtedly in the English acceptation of the words, so we think Mr. Newman too ready in discovering errors.

THE *Canadian Naturalist and Quarterly Journal of Science*, vol. vii. No. 1.—The first paper in this number is one which we have already received in a separate form, viz. Principal Dawson's Address as President of the Natural History Society of Montreal. He discusses, (1) The present aspect of inquiries as to the introduction of genera and species in geological time. (2) The growth of our knowledge of the Primordial and Laurentian rocks and their fossils. (3) The questions relating to the so-called glacial period. This is followed by a paper on Some Results of the last Solar Eclipse, in which the author, Mr. G. F. Armstrong, sums up briefly the results which have been obtained from the eclipses of 1865 and succeeding years. In a paper on Cuba Mr. G. F. Matthew makes some contributions to our knowledge of the natural history of that island. There is a geological paper on Huron County, Ontario, and another on the Mineral Region of Lake Ontario. The last paper in the journal is the obituary notice of the late Prof. Sedgwick, which appeared in NATURE.

SOCIETIES AND ACADEMIES

LONDON

Geologists' Association, April 4.—Professor Morris, F.G.S., vice-president, in the chair.—"On the Diamond Fields of South Africa," by Mr. G. C. Cooper.—The theory of an igneous action upon the spot at which the diamonds are now found being the explanation required to solve the problem of their origin was opposed by the author, who adduced facts from his observation in support of the opposite conclusion. He did not consider that the numerous trap dykes which characterise the South African Diamond Fields broke through the present surface, which, on the contrary, had been produced by the accumulation of materials brought by aqueous agency subsequent to the volcanic action which gave rise to the dykes. These materials consisted of a surface layer of red sand overlying a bed, from five to seven feet thick, of fragments of "lime and clay stone;" and beneath this the diamantiferous marl or "stuff" is reached. Steatitic or magnesian matter forms a considerable proportion of the "stuff" which it was contended may have been brought from magnesian rocks at a considerable distance by water and possibly by ice action, and deposited in the hollows formed by the trap dykes, and that these magnesium rocks may have been the original matrix of the diamonds.—"On some Fossils from the Chalk of Margate," by J. W. Wetherell. The author had devoted some time and attention to the exploration of the chalk in the immediate neighbourhood of Margate, and had obtained, as a result, a large number of species of fossils, a list of which was given, with remarks as to relative abundance. In addition to many genera usually abundant in the Upper Chalk, *Belemintella* appears to be well represented in the Margate chalk, and ammonites are also found; but perhaps the most abundant fossil is the *Coscinopora globularis*, which varies in size from that of a walnut to a pin's head. Crystals of selenite were found as well as concretions of iron pyrites, but minerals are by no means common in the chalk of Margate.

Mathematical Society, April 10.—Dr. Hirst, F.R.S., president, in the chair.—Prof. Clifford made a few remarks in correction of a statement he had made at the March meeting during the discussion on Mr. Hayward's paper on an extension of the term *area*.—Mr. J. W. L. Glaisher then proceeded to read a paper on the calculation of the value of the theoretical unit angle to a great number of decimal places.—The following papers (in the absence of the authors) were discussed by Messrs. Clifford, Cotterill, Merrifield, and the president:—On systems of porismatic equations, algebraical and trigonometrical; Note on epicycloids and hypocycloids; Locus of point of concourse of perpendicular tangents to a cardioid; Elliptic motion under acceleration constant in direction; Prof. Wolstenholme, on the theory of a system of electrified conductors; On the focal lines of a refracted pencil, Prof. J. Clerk-Maxwell.

Royal Horticultural Society, March 26.—Special general meeting, Lord Alfred Churchill in the chair.—The business practically consisted in the consideration of two bye-laws proposed by the Council. The first, giving to all the fellows the right of vote by proxy (hitherto restricted to ladies), was rejected. The second, impowering the fellows to elect to vacancies on the Council at a general meeting other than the annual general meeting, if more than half their number resign at any one time, was carried. Great excitement and disorder was manifested throughout the prolonged discussions.

April 2.—General Meeting, Mr. W. Saunders, F.R.S., in the chair.—A communication was read from Mr. Cocks, on budding vines. It was shown (1) that the extirpation of all the buds of the budded plant gave the inserted buds a better chance of success by removing competition, and (2) that there was no advantage in inserting new buds in the seats of those removed.

Scientific Committee, Dr. J. D. Hooker, C.B., F.R.S., in the chair.—Mr. Smee exhibited lemons infested with *Coccus limonii*, which caused the green colour of the unripe fruit to persist round the points of attachment, and injured the lemons for preserving purposes.—The Rev. M. J. Berkeley stated that the new potato disease described by Hallier in his "Parasitenkunde," was no doubt identical with the "copper-web" of the asparagus-growers of the Isle of Ely. It had been described as *Rhizoctonia*.—Dr. Hooker read a portion of a letter from Mr. Woodrow, stating that a succulent composite, *Notonia grandiflora*, had a great reputation as a cure for hydrophobia in the neighbourhood of Bombay.—Prof. Thiselton Dyer pointed out that the seeds of the Sooly Qua were not identical with those of *Luffa acutangula*; they much more resembled those of *Luffa ægyptiaca*.

April 6.—Special general meeting, Lord Alfred Churchill in the chair.—The following new members of Council were elected on the proposition of Lord Strathmore.—Viscount Bury, M.P., Hon. R. Chetwynd, Mr. Hardcastle, M.P., Sir C. Lindsay, Mr. W. A. Lindsay (Secretary), Sir A. Slade, Mr. Hellock, Mr. A. Smee, Mr. H. Little, Mr. R. Warner.

Institution of Civil Engineers, April 8.—Mr. T. Hawksley, president, in the chair. The paper read was "On the Rise and Progress of Steam Locomotion on Common Roads," by Mr. John Head, Assoc. Inst. C.E., and was divided into four parts:—1. Road locomotives for conveyance of passengers, also locomotives for use on tramways. 2. Road locomotives for conveyance of goods, heavy weights, &c., also steam road rollers. 3. Locomotives for use in agricultural operations, steam ploughing, &c. 4. Locomotives for military purposes.

Cambridge Philosophical Society, March 3.—Notes on the Hippopotamus, by Mr. J. W. Clark. The author exhibited the mounted skeleton, and some portions of the visceral anatomy, of the female hippopotamus which died in the London Zoological Gardens in January 1872, and made some remarks on the specimens.—"On the Foraminifera and Sponges of the Cambridge Upper Greensand," by Mr. W. J. Sollas. The author described the green grains abundant in the formation, and showed that, like those in many other rocks, they were to a large extent the casts of foraminifera. He then discussed the formation of the so-called coprolites, and showed that in a great number of instances these nodules were phosphatised sponges, just as the flints of the chalk were silicified sponges. He thought that the phosphate of lime might have been derived from the erosion of volcanic rocks in the south of Scotland which had been brought by a current from the north.—"On a Boulder in a coal seam, South Staffordshire," by Mr. Bonney. This boulder, found in the black coal of the Cannock and Rugeley Colliery, a seam nearly 3 yards thick, weighed 13 lbs. 13½ oz., was about 19 in. in girth either way, and about 4½ in. thick, it was of a compact grey quartzite, apparently identical with one of the rarities in the Bunter conglomerates of the district. He considered that the boulder, which was quite solitary, had been brought to its present position (probably during a flood) entangled in the roots of a tree—and discussed the bearings of its occurrence upon the physical geography of England in the carboniferous and triassic times.

MANCHESTER

Literary and Philosophical Society, April 1.—R. Angus Smith, Ph.D., F.R.S., vice-president, in the chair. "Note on an Observation of a small black spot on the sun's disc," by Joseph Sidebotham, F.R.A.S. On Monday, March 12, 1849, our late member Mr. G. C. Lowe and I saw a small circular black spot cross a portion of the sun's disc. We were trying the mounting and adjustments of a 7 in. reflector we had been making, and used an ink box between the eye-piece and the plane speculum. At first we thought this small black spot was upon the eye-piece, but soon found it was on the sun's disc, and we watched its progress across the disc for nearly half-an-hour. The only note in my diary is the fact of the spot being seen—no time is mentioned, but if I remember rightly, it was about four o'clock in the afternoon.—Mr. Baxendell said in a letter which Mr. Sidebotham had received from Prof. Hamilton L. Smith, of Hobart College, Geneva, New York, the writer suggests the use of iron or bell metal specula, coated with nickel, for reflecting telescopes. He says, "I ground and prepared a bell metal speculum, which I coated with nickel, and this, when polished, proved to be more reflective (at least I thought so) than speculum metal. The two objects which I sought were—first to have a polished surface unattackable by sulphuretted hydrogen (this, for example, is not injured by packing with lucifer matches), and secondly, for large specula, doing most of the work by the turning-tool and lathe. I really think a large, say 3 ft. mirror, coated with nickel, but cast of iron, and finished mostly in the lathe, while it would not cost the tenth of a similar sized speculum metal, would be almost equal to silvered glass of the same size, and vastly more enduring as to polish.—Prof. Williamson, F.R.S., referring to Mr. Binney's remarks at the meeting of March 4, said:—Mr. Binney, after pointing out that I had identified a certain type of stem-structure with *Asterophyllites*, and that Prof. Renault had discovered the same structure in *Sphenophyllum*, Mr. Binney proceeds to say, "I am not in possession of the facts from which the two learned professors came to *such different conclusions*, but I am inclined to consider the singular little stem as belonging to a new genus *until the leaves of Sphenophyllum or Asterophyllites are found attached to it*. When this comes to pass of course there can be no doubt of the matter." I have italicised the two important points in the preceding quotation. In the first place I cannot understand how Mr. Binney has overlooked my statement, made primarily in the Proceedings of the Royal Society, and repeated in the last number of the Proceedings of your meeting of February 4, that I *had* got a number of exquisite examples, showing not only the nodes *but verticils of the linear leaves so characteristic of the plant*." These leaves I have obtained attached to the stems in question in at least a dozen examples. Secondly, Mr. Binney considers that my conclusions and those of my friend Prof. Renault are *different*, whereas they mutually sustain each other in the strongest possible manner. E. W. Binney, F.R.S., said that after having heard Prof. Williamson's remarks his opinion expressed at the meeting of the Society on March 4 last was not altered.

GLASGOW

Geological Society, March 27.—Mr. James Thompson, F.G.S., vice-president, in the chair.—Mr. David Robertson, F.G.S., read some further notes on the post-tertiary fossiliferous beds of the West of Scotland. He first alluded to the brick-clays at Jordanhill, about a mile to the north-west of Partrick, and 145 ft. above the present sea-level. The clay here is wrought to a depth of from 12 to 20 ft., in some places rather more. One point of interest in examining the clays of this locality is the position in which the shells of the common mussel (*Mytilus edulis*) are found. This mollusc is commonly thought to have its zone or position near the surface, and to lie above the post-pliocene Arctic shells in the clays of the Clyde district. This no doubt is frequently the case, but it also occurs at greater depths, and overlaid by Arctic shells. Here it is found at a depth of 14 ft., while at a little distance in the same field Arctic shells occur within 6 ft. of the surface. Another feature of interest in the clays of this neighbourhood is the presence of portions of oak trees, some of considerable magnitude. Such pieces of oak, it is well known, are abundant in the peat of every district, but he was not aware of their having been previously found associated with Arctic shells in the clays of any part of the country.—Mr. Robertson then described the cuttings of the Maryhill Gasworks and Stobcross Railway, giving particulars of the beds exposed, especially in the latter, where interesting sections of boulder clay, gravel, sand, and laminated clay have been laid open during the excavations now in progress. The animal remains are sufficient to show the truly marine character of the deposit.—Mr. John Young read a paper on the probable derivation of certain boulders found in the till near Glasgow. He said the great majority of the boulders in the till of the Glasgow district had evidently been derived from tracts that lay to the west and north-west of the city. At the same time it was interesting to note that the ice which had travelled over the district had not proceeded exclusively from western or north-western sources, as the glaciated surface lately discovered at Possil clearly proved. There the rock is striated both from a north-west and a north-east direction; and he showed that the mineral constituents of the till quite corresponded with and confirmed these variations observable in the striæ.

MONTREAL

Natural History Society, Jan. 27.—During the past summer Mr. J. Richardson, of the Geological Survey of Canada, has made unusually large collections of the fossils, minerals, and other objects of interest from Vancouver and Queen Charlotte. Mr. A. R. C. Selwyn said that these collections establish conclusively the fact that the coal fields of the two islands belong to the same geological horizon. In each case the coal fields are of the same age as the chalk formation of Europe and elsewhere. Further, the coal of Queen Charlotte Island is found to be a true anthracite, and it is the first instance on record of the occurrence of anthracite in formations, as new as the chalk. The coal seams of Vancouver rest directly upon crystalline rocks, in which limestones predominate. Mr. Richardson estimates the Comox coal field, in Vancouver, to have an area of 300 square miles. It is underlaid by coal seams of from 2 to 10 ft. in thickness, which would probably yield an average of 11,840,000 tons per square mile. The total production of this field, to a depth of 1,500 ft. from the surface, is computed to be about 3,552 millions of tons. The Nanaimo coal field has an estimated area of 90 square miles, and contains three or more seams of from 3 to 10 ft. in thickness. Specimens of carvings in wood and stone made by Queen Charlotte Islanders were exhibited. These evince considerable constructive ability, and are almost invariably of a grotesque character.—Mr. Billings gave a description of the distribution of the cretaceous rocks of North America, He then called attention to some of the characteristic fossils of the Vancouver and Queen Charlotte strata, and showed a series of some of the most striking specimens. Among these were large ammonites, nautili, and various marine shells, of the same genera for the most part as those which are frequent in the European chalk formation. He remarked that in the present collection he had not detected any remains of large reptiles, or any sea urchins, both of which are common in the cretaceous rocks of other localities.

PHILADELPHIA

American Philosophical Society, September 20, 1872.—The following papers were read by Prof. E. D. Cope—Third account of Vertebrata from the Bridger Eocene; notices of new extinct Vertebrata from the upper waters of Bitter Creek, Wyoming; from the upper waters of Bitter Creek, Wyoming; "On the existence of *Dinosauria* in the transition beds of Wyoming Territory." In the last it was shown that the coal series of Bitter Creek belonged to the cretaceous formation.—Prof. Houston described a sensitive waterfall in Pike Co., Pennsylvania.—Prof. Chase communicated observations on some new planetary and stellar distances.

October 18.—Two papers from Prof. Cope were read, viz.: "On a new Genus of Vertebrata from the Upper Green River Basin," and descriptions of new extinct reptiles from the same. The former embraced the description of a new genus of *Lemuridæ* or allied group, having the dental formula $\frac{2-1-2-3}{}$.

November 1.—Prof. Lesley presented a record of authentic data respecting fourteen oil wells in West Pennsylvania.—Prof. Chase presented a paper, "A first approximation to a normal curve of temperature in the northern regions of the continent."—Aubury H. Smith described his observations on the sub-alpine botany of the north shore of Lake Superior, and of its absence in the Lake Nibbegong region farther north, which he had explored in 1872, which he believed was due to the greater coldness of the waters of Lake Superior.—Dr. Leconte gave a hygrometric explanation for the phenomenon, believing similar ones known

to him to depend on the difference between dry continental air, and damp winds from sea coasts.

November 15.—Mr. Gabb described the results attained in tabulating Miocene fossils from Santo Domingo. He described 217 extinct and 19 living species, the latter found on both sides of the barrier of Central America, which is capped by Miocene rocks.

December 20.—Prof. Cope read a paper on the zoological regions of the earth, and especially those of North America, agreeing as to the first with Drs. Sclater and Wallace in the main, adopting the Australian, Neotropical, Ethiopian, Neoarctic, and Palæartic (including Palætropical of S. and W.), stating that all the southern continents present marked distinguishing characters. In North America he adopted the Pacific, Lower Californian, Sonoran, Central, Eastern, and Austroriparian, which in the main agreed with those of Baird, the last being the southern part of his eastern, as far north as the isothermal of 773 F. The subdivisions were the Floridan, Louisianian, and Texan; those of the eastern after Allen, Carolinian, Alleghanian, Canadian, and Hudsonian.—Prof. O. C. Marsh gave an account of his discoveries in the Rocky Mountains since 1870, which included the first American *Chiroptera*, *Marsupials*, low forms of *Quadrumana*, birds with biconcave vertebræ, and several species of a new order, *Dinocerata* allied to the *Proboscidia*, but with horns and canine teeth.

January 3.—Prof. P. Fraser read a paper on a hydraulic problem, near Bethlehem Penna.

California

Academy of Sciences, Dec. 18, 1872. "On the Parasites of the Cetaceans of the N.W. coast of America, with Descriptions of new Forms," by W. H. Dall, U. S. Coast Survey. Among the parasites most widely known as infecting the Cetacea, two classes may be recognised, viz., those which are true parasites, deriving their subsistence from the animal upon which they are found, such as the Pycnogonoids and Cyami, and those which are merely sessile upon the animal, and derive no nourishment or other benefit from it which might not equally well be furnished by an inanimate object, such as the various cirripedes.

Vienna

I. R. Geological Institute, Jan. 21.—"Fossil Remains of Sirenoidæ found in the Venetian Territory," by Ach. Barone de Zigno. Besides the ribs and other bones of Halitherium which had been discovered many years ago in the upper tertiary beds of the Venetian Alps, the author succeeded in gathering a very rich collection of different species of Sirenoidæ in the lower tertiary beds (with Serpula spirulæa) of the Monte Zuello, near Montecchio, and in the glauconitic limestone of the basin of Belluno. The glauconitic strata of this basin had been taken till now for Eocene; but fossils found therein by Jaramelli —as *Clypeaster placenta* Des., *Scutella*, *Subrotunda* Lam, &c. —prove that they are of Miocene age.—"On the Eruptive Rocks of Styria," by R. von Drasche. The author gives an accurate petrographical analysis of the different eruptive rocks of Southern Styria, which by former observers had been taken for older porphyries, but which M. Stur has proved to be of tertiary age. They are andesites and trachytes. Some of these rocks resemble indeed very much older porphyries, and prove again the difficulty of discerning by mere petrographical or chemical properties eruptive rocks of different geological age.—A. Redlenbacher presented a memoir on the Cephalopods of the Gosau-strata of the Alps. Since the last publications on this matter by Fr. von Hauer, the number of species in our collections has more than doubled. Only eight of them are identical with species out of non-Alpine cretaceous strata, and they belong all to Senonian beds.

Feb. 18.—M. Tschermak gave an accurate description of the slates, quartzites, and limestones, along a section through the so-called Graywacke Zone of the North-eastern Alps, in the vicinity of Reichenau and the Semmering mountain. These rocks had been thought to belong to the Silurian formation, but in the opinion of M. Tschermak part of them were of a still older age. The study of the oldest sedimentary slates and other rocks of the Alps, promises, he thinks, valuable information about the genesis of the crystalline slates.—M. Fr. Foetterle "On the copper and iron ores of Ferriere in the province of Piacenza, in Italy." The valley of the Nure, extending from Piacenza in a south-west direction into the central part of the Appenines, in the upper part of its course is bounded by high mountain ranges, which consist of grey sandstones, alternating with bituminous slates and marls. They belong to the so-called macigno (Vienna and Carpathian sandstone) and are probably of Eocene age. In the highest parts of the valley, in the environs of Boli and Ferriere, the macigno is traversed by numerous masses and dykes of an eruptive rock which is partly gabbro, consisting of large crystals of amphibol and feldspar, and partly serpentine. These eruptive rocks are of a more recent age than the macigno, which is very much altered by contact with them. Partly in the eruptive rocks and partly in the adjacent altered macigno are to be found masses of copper- and iron-pyrites, and of magnetic iron ores; they form boulders of some size, but nowhere regular layers or veins. The mines which have been opened to gain these ores, M. Foetterle thinks, promise no great success.—O. Feistmantel on the relations between the carboniferous and the Permian formations in Bohemia. In some of the Bohemian coal-basins, *e.g.* that of Radowenz at the foot of the Riesengebirge, in the north-western environs of Prague, in the basin of Pilsen, &c., two layers of coal are known, both accompanied by vegetable remains of a pure carboniferous type; but the strata between these layers contain remains of fishes, as Xenacanthus, Acanthodes, Palæoniscus, &c., which belong to the Permian fauna. The author concludes that the upper coal layers of the Bohemian coal-basins belong to the Permian formation, and the lower only to the carboniferous formation, and that both formations are most intimately allied by their identical flora.

DIARY

THURSDAY, April 17.

Linnean Society, at 8.—Burmese *Orchideæ*, from the Rev. C. P. Parish: Prof Reichenbach.—Perigynium of *Carex*: Prof. McNab.

Chemical Society, at 8.—On Heat produced by Chemical Action: Dr. Debus, F.R.S

Numismatic Society, at 7.

Zoological Society, at 4.

SUNDAY, April 20.

Sunday Lecture Society, at 4.—The Theory of Wind Instruments: Dr. W. H. Stone.

MONDAY, April 21.

London Institution, at 4.—Elementary Botany: Prof. Bentley.

Geologists' Association, at 8.—Visit to Museum of Practical Geology.

TUESDAY, April 22.

Royal Institution, at 3.—Music of the Drama: Mr. Dannreuther.

Institution of Civil Engineers, at 8.—Discussion on Mr. Head's paper on Steam Locomotion on Common Roads.—On the Delta of the Danube, and the Provisional Works erected at the Sulina Mouth.—Sir C. A. Hartley.

Anthropological Society, at 8.—Religious Beliefs of Ojibois or Santeux Indians resident in Manitoba and at Lake Winnepeg: A. P. Reid, M.D.—Danish aspect of the Nomenclature of Cleveland: Rev. J. C. Atkinson.—Rock Inscriptions in Brazil: John Whitfield.

WEDNESDAY, April 23.

London Institution, at 7.—On some Phenomena connected with Magnetism: W. F. Barrett.

Society of Arts, at 8.—On Silk-Worm Grain: M. Alfred Roland.

Archæological Association, at 8.

Society of Antiquaries, at 8.30.—Anniversary.

Royal Society of Literature, at 8.30.—The Serio Comic Satirical Poetry of the 18th and 19th centuries: Sir Patrick de Colquhoun, Q.C., LL.D.

Society of Telegraph Engineers, at 7.30.—On the Block System of Working Railways: W. H. Preece and Capt. Mallock.

THURSDAY, April 24.

Royal Institution, at 3.—Light: Prof. Tyndall.

Royal Society, at 8.30.

CONTENTS