THURSDAY, FEBRUARY 26, 1891.

DOGS, JACKALS, WOLVES, AND FOXES.

Dogs, Jackals, Wolves, and Foxes: A Monograph of the Canidæ. By St. George Mivart, F.R.S. With Woodcuts, and 45 Coloured Plates drawn from Nature by J. G. Keulemans. (London: R. H. Porter, and Dulau and Co., 1890.)

THE group which Prof. Mivart has selected for a handsome, and, as far as materials are available, fairly exhaustive monograph, is one which has the advantage of being, in the present condition of the world's fauna, of strictly definite limits. On the other hand, the very numerous minor variations which occur within these limits give rise to many problems difficult of solution. While there is no difficulty in deciding what animals should be admitted into the *Canidæ*, the questions as to how many distinct specific modifications of the family should be accepted and what their relations are to one another are as difficult to answer in this case as in almost any other in zoology. It may indeed be doubted whether there will ever be any general accord upon such subjects in respect to any group of modern origin, and in which variation and differentiation are still rife. It is only in the ancient groups where extinction has played havoc among the members, and long-continued isolation has stereotyped certain definite forms that we can meet with species which will be universally recognized as such. In such a group as the *Canidæ*, therefore, opinions are sure to differ as to the number and limits of the species, and these opinions will be continually liable to modification in accordance with the amount of material upon which they are based.

We are glad to read in the preface of this work of "the rich and unrivalled stores of canine animals accumulated in the British Museum of Natural History," but we see ample evidence throughout the work that, far superior as this collection is at present to any which is available to a monographer of the group, much remains to be done before it can be considered exhaustive. The following observation under the head of *Canis azaræ*, is also applicable to other sections, and should be taken to heart by all concerned. "It is greatly to be desired that a numerous collection should be made of all the kinds of South-American dogs, the locality and sex of each individual being noted, as well as the time of year when it was obtained, the skull not being extracted from the skin, save at the Museum in which it may be deposited."

The present monograph has the great merit of placing in an accessible and attractive form all that is really known of the *Canidæ*, on what may be called a strictly conservative basis. If it only brings together, without greatly advancing our knowledge, it does absolutely nothing, as so many similar attempts have done, to confuse and retard it. Not a single new generic term, and only two new specific names are proposed—a mercy for which future zoologists may well be thankful. There are scarcely any speculations and certainly no assumptions on unknown and problematical subjects such as the ancestral history of the group treated of, or even on that very interesting but at present quite unsolved problem, the origin of the domestic dog. With regard to the first the author candidly avows, "Phylogeny, or the science of such evolution of forms of life, seems to us to be not merely in its infancy, but rather at a low stage of embryonic development. We have already seen the overthrow of a great many promising and carefully drawn out genealogical trees of life, and therefore feel little inclined to attempt now to construct the pedigree of the dog family."

The already established, though perhaps not universally admitted generic distinctions of the few aberrant forms, which can be definitely defined either by the number of the toes or of the teeth differing from those of typical *Canis*, are retained. These are *Lycaon*, with but four digits instead of five on the fore-feet, *Cyon* with two lower molars instead of three, *Icticyon* with a molar deficient, and *Otocyon* with one added, in either jaw. The whole of the other members of the group remain under the generic appellation of *Canis*, no value being attached to the numerous divisions of Gray, Burmeister, and others. Of this genus thirty species are admitted, including *C. domesticus*, upon the origin of which, as hinted above, Dr. Mivart is most cautious in hazarding any opinion of his own, though fairly stating the different views (amounting to eight in number) which have been or may be held by others, and adding:—"For our part we think that the evidence is as yet insufficient for us to enunciate any judgment in the matter. We have endeavoured to point out that it is possible that the origin of the dog may have been single or multiple, but we refrain from declaring that we regard either the one or the other as preponderatingly evident. Nevertheless our judgment inclines to the view that the domestic dog is a form which has been evolved by human effort from at least two, probably more, wild species, though it is possible it may be but a modification of one which has long become extinct save in its domestic and feral progeny."

Each of the recognized species is carefully described, mainly from specimens in the British Museum, both in its typical and varietal forms where such occur, and much useful information is given as to its general history, habits, and geographical distribution. Moreover, and this will be considered by many possessors of the book as one of its most valuable features, a coloured illustration is given of every species, and in some cases of several of the best marked varieties of each, there being forty-five of such plates. Fourteen of these are drawn from the actual type on which the species was founded. Of these figures, which are all original and hand-coloured, many are excellent, but it is difficult to say the same of all. In constructing drawings of animals from skins or indifferently stuffed specimens, although accuracy in detail of colouring may be secured, much must be left to the artist's skill as to the proportions, attitude, and expression, which in such a large number of figures of similar forms must tax his resources to the uttermost, and it is no wonder that some of them are rather stiff and wanting in life-like character. Perhaps we may be considered hypercritical in such matters, but we may instance Plate I., the common wolf, as a scarcely adequate representation of that familiar animal. On the other hand, the numerous woodcuts, giving details of cranial and dental characters, leave nothing to be desired, either in accuracy or artistic finish, and the book is, taken altogether, one which should be found in every complete zoological library.

PRIMITIÆ FL. SHAN.

On a Collection of Plants from Upper Burma and the Shan States. By Brigadier-General H. Collett, C.B., F.L.S., and W. Botting Hemsley, F.R.S., A.L.S. In Journal of the Linnean Society, vol. xxviii. (November 5, 1890). Pp. 1–150, tt. 1–22, with a Map.

UPPER BURMA is an arid plain, with an annual rainfall of about 30 inches, containing some isolated mountains. On the east of it are the Shan States, consisting of plateaus, mostly 3000–4000 feet above the sea, traversed by ranges of mountains, attaining 6000–7000 feet, running north and south, and having an annual rainfall estimated at 60 inches. The Shans occupy a large area of this hill country having Siam on the south, Tonquin on the east, and Yunnan on the north and north-east; they are a tribe of the great people denominated (generically) Kookies by Colonel MacCulloch, who extend (in the hills almost universally) from the bend of the Brahmapootra (at the west extremity of Assam) to the mountains north of Canton; the Kalangs in Java and the Mundas of Chota Nagpore may be outlying remnants of this people. The Shan States (or rather the south-west portion of them, for the political boundary of China is hereabout uncertain) had been more or less dependent on Burma. After the annexation of Upper Burma by the English, the Shans had to be got in; and, as is nearly always the case with imperfectly civilized peoples, it was found a necessary preliminary to the establishment of a beneficent despotism that a few should be shot. This duty, in 1887–88, fell to the lot of General H. Collett. No officer could have been selected who would have performed it more mercifully; he is a botanist. In the Shan States during this anxious service, and in the adjacent plain of Upper Burma (including the isolated Mount Popah, alt. 5000 feet), General Collett collected the 725 species of Phanerogams which form the *materies* of the paper we have under notice. Of these 87 are new to science, and several others were very imperfectly known previously. The richness of this collection is due to the fact that General Collett is not a mere collector, who gathers up everything in a new country that comes to his hand, and then sends it to Kew to be matched and named; but a botanist who could (in this remote ground almost cut off from books) determine the genus of most of the plants he lighted on *in the field.* But having to proceed to India to command the province of Assam, General Collett was obliged to leave the description of his collections largely to Mr. Hemsley.

The climate of the plain of Upper Burma is very much drier than that of Bengal and Assam; and the flora, only imperfectly known from the collections of Wallich and of Griffith, contains some plants of the north-west, central provinces, and south of India not known to inhabit the intermediate wet area of East Bengal, Assam, Chittagong, &c. Mr. Hemsley estimates that 25 species out of the 725 collected by General Collett are of this class; but this is perhaps rather an over-estimate, for out of the four *species* he names as absent in the connecting intermediate region, two, viz. *Priva leptostachya* and *Anisopappus Chinensis* are in quantity in the Khasi and Naga Hills (in Assam). But the fact, of a connection between the flora of the Upper Burma plain and that of the drier region of India, whether north-west, central, or south, is as Mr. Hemsley states it.

The flora of the Shan Hills is much richer, more interesting, and novel than that of the Upper Burmese plain. The country lies in a botanic *regio incognita* between the (more or less) known floras of Assam, Burma, and Tonquin (with Yunnan). The plateaus at 3000–5000 feet elevation are often bare; and, as is clear from General Collett's description, exceedingly like the open bare Khasi plateau (depicted by Sir J. D. Hooker in his "Himalayan Journal," vol. ii.). The flora is also very closely allied. It is difficult, without abstracting the entire list of new species, to give a worthy notion of them; but the most interesting having been selected for figuring, we give here the list of plates of the *new* plants:—

2. *Capparis Burmanica*, Coll. et Hemsl.
3. *Hypericum pachyphyllum*, Coll. et Hemsl.
4. *Impatiens ecalcarata*, Coll. et Hemsl.
5. *Crotalaria perpusilla*, Coll. et Hemsl.
6. *Neocollettia gracilis*, Hemsl.
7. *Phylacium majus*, Coll. et Hemsl.
8. *Bauhinia tortuosa*, Coll. et Hemsl.
9. *Rosa gigantea*, Coll.
11. *Lonicera Hildebrandiana*, Coll. et Hemsl.
12. *Inula crassifolia*, Coll. et Hemsl.
13. *Ceropegia nana*, Coll. et Hemsl.
14. *Brachystelma edulis*, Coll. et Hemsl.
16. *Strobilanthes connatus*, Coll. et Hemsl.
17. *Phacellaria caulescens*, Coll. et Hemsl.
18. *Sauropus concinnus*, Coll. et Hemsl.
19. *Bulbophyllum comosum*, Coll. et Hemsl.
20. *Cirrhopetalum Collettianum*, Hemsl.
21. *Polygonatum Kingianum*, Coll. et Hemsl.
22. *Lilium Bakerianum*, Coll. et Hemsl.

Of these *Rosa gigantea* is the largest wild rose (flowers 4 inches diameter) yet found; *Lonicera Hildebrandiana* is the largest honeysuckle (flowers 6½ inches long) yet found; the two orchids are extraordinary species, though located in old genera. *Neocollettia* (Hemsley, *genus novum*) is a 1-ovulate plant placed by Mr. Hemsley next *Phylacium*, but is probably as Mr. Hemsley suggests) one of the tribe *Phaseoleæ* (near *Rhynchosia*).

This collection enables us to estimate the wealth of the newly annexed territory; General Collett has added some observations on agriculture and economic botany. The Khasi pine is plentiful, and (as in several of the adjacent regions) valuable oaks are plentiful, 9 species having been collected by Collett. The area altogether included in General Collett's paper extends from 19° 30′ to 21° 30′ lat., and from 95° to 97° 30′ East long.; and contains probably not less than 4000 species of which Collett's collection gives us 725. Mr. Hemsley, in his part of the introduction, observes that the species are to the genera as 725 to 460, *i.e.* about as 1·6 to 1, and that these proportions closely approach those obtaining in many insular floras. But similar proportions usually occur when any area is imperfectly collected over. Thus in the very similar list of Muneypoor and Naga Hill plants (given in Journ. Linn. Soc., vol. xxv.) there are 924 Phænogams in 503 genera—*i.e.* a proportion of about 1·8 species to a genus. In this case the total flora would amount perhaps to 5000 species.

Mr. Hemsley concludes:—"The most interesting point, perhaps, connected with this collection has been left to the last. It is the large number of temperate types it contains from comparatively low elevations. Sir Joseph Hooker ("Himalayan Journ.," vol. ii. [ed. i.] p. 281) observed the same thing in the investigation of the Khasi Hills." This is a very curious point. Mr. Hemsley suggests that in the Shan Hills the comparatively small rainfall may have had much to do with it. But, near Cherra Poonjee, where Sir Joseph Hooker observed the fact, the annual rainfall varies from 400 to 650 inches. In both the Khasi and the Shan Hills the plateaus were probably once largely covered by jungle which has been (except patches) destroyed, while the district is kept in open grass (or small shrubs) by setting the grass on fire at the commencement of each cold season. In this way a large number of the temperate genera cited by Mr. Hemsley (Anemone, Delphinium, Silene, Stellaria, Hypericum, &c.) obtain a suitable habitat, which is denied them in the dense forest of the Eastern Himalaya at the same elevation (4000-7000 feet). But this is no adequate explanation. *Pinus longifolia*, which ascends to 7500 feet in the North-Western Himalaya, is rare above 3000 feet in Sikkim, and grows very fairly in the Bengal plain at Dacca. The Khasi pine, which grows mainly in the Khasi Hills at about 5000 feet altitude, descends nearly to sea-level in more tropical areas. And there are many such cases. The paper is put through the press by Mr. Hemsley with his usual literary finish. He might be asked why he prints *Physostelma carnosa* and *Brachystelma edulis*. He might reply that, according to "Propria quæ maribus," the names of all plants are female. Granting that, then why does Mr. Hemsley, who insists on uniformity from other botanic writers, write *Hypericum pachyphyllum?*

The present paper is produced by General Collett and the Linnean Society at their own private costs and charges. It would be a mistake to infer, therefore, that it is inferior in botanic merit to Aitchison's "Botany of the Afghan Delimitation Commission" or to Ridley's "Botany of Fernando Noronha"; and it has the additional value to Government that it deals with a territory (before unexplored) on its annexation to the English Crown. The thanks of [all systematic, geographic, and economic botanists will be gratefully accorded to General Collett for his very valuable contribution to knowledge.

THE METHOD OF POLITICAL ECONOMY.

The Scope and Method of Political Economy. By John Neville Keynes, M.A. (London: Macmillan and Co., 1891.)

MR. KEYNES is known to the philosophical world as the author of what is in some respects the best treatise on a subject which has occupied the acutest intellects for above two thousand years—to wit, formal logic. Cultivated by so many skilful hands, that little branch of science might seem to have produced all the fruit of which it was capable. Yet it has been at least trimmed and pruned by Mr. Keynes not inelegantly. Nay, more; climbing up to that part where growth is still going on, he has gathered new fruits, or at leas brought down to earth those which had been before very difficult of attainment. We allude to the arduous and thorny problems of symbolic logic, which Mr. Keynes, in the work referred to, has translated into the language of ordinary life and common-sense.

Mr. Keynes's second claim to distinction is curiously similar to his first. His present subject has not, indeed, the venerable antiquity of formal logic. Yet the material logic of political economy has also occupied treatises which are already classical. Mill, the Aristotle of the subject, opened and almost exhausted it.

> "Quo nihil majus generatur ipso,
> Nec viget quidquam simile aut secundum;"

even if we concede to Mr. Keynes that Mill required to be corrected by himself: that the "Unsettled Questions" lag behind the "Political Economy." The general principles propounded by Mill appear to have been accepted by an influential majority of his successors; not excepting many names which are usually associated with the exclusively historical school. The remarks of Cohn, Roscher, and Wagner, which Mr. Keynes cites, are substantially in accord with Mill's. We say, substantially; for the phrase and emphasis have varied with the individuality of each writer, and the particular variety of heresy which he has had occasion to controvert.

Reviewing a long controversy, Mr. Keynes draws up, as it were, a confession of faith, so comprehensive and tolerant that, as it seems to us, only fanatics can find difficulty in subscribing to it.

The cardinal article is, of course, that which defines the relation between abstract reasoning and specific experience. Mr. Keynes holds the balance impartially between the *a priorists* and the historical school. He reasserts in modern words Mill's doctrine that "either acquirement without the other leaves one lame and impotent." In Prof. Cohn's words, cited by Mr. Keynes, "all induction is blind, so long as the deduction of causal connections is left out of account; and all deduction is barren, so long as it does not start from observation."

On the one hand, Mr. Keynes insists that all deductive reasoning rests on "hypotheses"; which do not indeed rest upon nothing, yet are seldom sufficient to support a practical conclusion. The person who confines himself to abstract reasoning must be content, as Mill says, to "have no opinion, or to hold it with extreme modesty, on the applications which should be made of his doctrines to existing circumstances." Mr. Keynes has no leaning towards the dogmatists who deduce *laisser faire* or any other practical rule from abstract notions. He deals another blow to, he speeds upon their road to extinction, those whom Dr. Sidgwick has described as "a scanty and dwindling handful of doctrinaires whom the progress of economic science has left stranded on the crude generalizations of an earlier period."

On the other hand, Mr. Keynes does not exaggerate the importance of experience and observation. He points out the uses of history in illustrating, criticizing and establishing economic theory. But at the same time he exposes the utter inadequacy of a merely inductive method to deal with the complex phenomena of industry and commerce. He quotes approvingly Bagehot: "If you attempt to solve such problems without some apparatus of method, you are as sure to fail as if you try to take a modern military fortress—a Metz or a Belfort—by common assault." Addressing extreme representatives of the exclusively historical school, Mr. Keynes condemns them out of their own mouth. Owing to that shifting character of economic conditions upon which they are always insisting, the study of the past becomes less applicable to the problems of the present day.

One difficulty in forming a judgment about the pretensions of the historical school is to know what they mean to assert beyond what every sensible person admits. "It is far from being easy," says Mr. Keynes, "to gain a clear idea of the form to be assumed by economics when its 'transformation' has been effected." His gentle reproof may be contrasted with the slashing sarcasm of a recent writer who applies to the historical school what has been said of the French, "that they don't know what they want, and will never be satisfied till they get it." Mr. Keynes, it must be admitted, is less incisive and epigrammatic than some preceding writers upon method. He is less entertaining to those who already agree with him; but perhaps he is more likely to convert those who differ from him.

The parallel which we have attempted to draw between the present and the earlier work of the author would not be complete if we did not point out that he has done more than merely consolidate the *dicta* of the earlier authorities. He has not only gone over the beaten road, mending it in places; but also, diverging into a comparatively fresh field, he has struck out a new path, or rather converted what was but a path into a highway. We allude to his remarkable chapter on symbolical and diagrammatic methods in political economy. Following upon Prof. Marshall's great work, in which these methods are so potently employed, Mr. Keynes's careful statement of their uses is likely to obtain general acceptance. Most of the previous writers who had taken much the same general view as to the functions of deductive reasoning had not considered that particular species of deduction which is effected through the channel of mathematical conceptions. Some eminent theorists were perhaps silent on this head from motives of discretion, knowing the hardness of readers' hearts. With others the cause may have been that which Dr. Johnson assigned for one of the mistakes in his dictionary, "Ignorance, madam, pure ignorance." Jevons, indeed, is a conspicuous exception. But his very zeal marred his advocacy. His personal connection with the cause impaired his authority. A plain man could hardly feel certain but that the new calculus was not a plaything like the "logical machine." Accordingly, when in the course of an impartial summing up of the claims of different schools, Mr. Keynes is far from condemning the mathematical method as trivial, his judicial utterances are likely to have a considerable effect. Very convincingly he dwells upon the appropriateness of mathematical symbols to represent the mutual dependence of variables and other leading conceptions of political economy. The peculiar genius of the economical calculus is thus seized:—

"Functions, while remaining numerically unknown, may possess known properties; and on the assumption that certain general relations between quantities hold good, it may be possible mathematically to deduce further relations that could otherwise hardly have been determined."

Altogether, it is a matter for rejoicing that the task of connecting and supplementing all the authorities on all the methods has devolved upon one so widely read, so impartial and exact. On a subject which it is undesirable to be always reopening, it may be hoped that Mr. Keynes's work will prove final. It may be expected that his second logical treatise will enjoy the same popularity as his first; for it deserves the same rare encomium—that, if a reader is under the necessity of confining himself to a single book upon the subject, the single book had best be that of Mr. Keynes. F. Y. E.

OUR BOOK SHELF.

Mixed Metals, or Metallic Alloys. By A. H. Hiorns (London: Macmillan and Co., 1890.)

THIS is a useful little book, which will render good service to the craftsmen for whom it is evidently intended, and by whom such a work was much needed, for, with the exception of the translation of Guettier's "Guide Pratique des Alliages" and Brannt's "Metallic Alloys," there is no treatise on the subject, the information we possess being scattered through books and monographs which are difficult to obtain.

Mr. Hiorns begins with a reference to Gellert's "Metallurgic Chemistry," but he can hardly be familiar with even the English edition of Gellert's work published in 1776; he would have refrained from adopting the title of "Mixed Metals" for his book if he had had Gellert's clear indications as to the solvent action of metals on each other to guide him, supported as they are by Matthiessen's later experimental evidence, which led him to define alloys as "solidified solutions." It is true that in many cases, when masses of fluid alloys solidify, certain groups of constituents "fall out" of solution, but there is no known instance of a pure metal separating from the mass with which it was united, and remaining simply mixed. It is to be regretted that, for the sake of employing a term well known in the "metal trades," artisans should have an erroneous suggestion as to the nature of alloys conveyed by the very title of a hand-book.

In dealing with the effects of elements on metals, the indications are not quite as definite as could be wished. For instance, it is stated that "much arsenic is highly injurious" to copper, "making the metal hard and brittle"; but what should be considered *much* arsenic in a case of this kind? If certain metals were melted with gold, the ten-thousandth part of the added matter would impair the ductility of the gold, and would render it impossible for the jeweller to use it; but as regards the case in point—the action of arsenic on copper—a "trace" of arsenic would greatly diminish the value of the copper for electrical purposes, nevertheless the presence of as much as 1 per cent. would not be injurious if the copper had to be used for the fire-boxes of locomotives.

The author contributes the results of some important experiments of his own in connection with the manufacture and use of alloys of copper, nickel, and zinc, known as German silver. The sections which relate to alloys of iron with other metals are well done, as are those in which phosphor-bronze is dealt with. What is needed throughout the volume is fuller reference to authority, and graphic illustrations of the properties of alloys by means of curves. The author may, however, be said to have fully justified his claim to have offered practical men and students a book which will enable them to gain "a more intimate acquaintance with the nature and properties of metals in the alloyed state" than they have hitherto had for ready reference. W. C. ROBERTS-AUSTEN.

Grasses of the South-West: Plates and Descriptions of the Grasses of the Desert Region of Western Texas, New Mexico, and Southern California. Part I. By Dr. Geo. Vasey. Published by Authority of the Secretary of Agriculture. (Washington: Government Publishing Office, 1890.)

THIS work is issued by the United States Department of Agriculture, and is the twelfth Bulletin relating to botany which has been published by the Department. In this first part fifty uncoloured figures of the characteristic grasses of the south-west are given. The drawings are made by Mr. William Scholl, and the botanical determinations and descriptions are furnished by the veteran chief botanist of the Department, Dr. Geo. Vasey. The region of country immediately adjoining the northern boundary of Mexico, including the western part of Texas and the greater part of New Mexico, Arizona, and Southern California, is one of great heat and aridity. It is mainly a region of elevated plains, intersected by mountain ranges which occasionally run into high peaks, and is drained by comparatively few streams. In consequence of these climatic conditions the grasses become scanty, not in variety of species, but in individual quantity: some of them being short-lived, springing up rapidly after the summer rains, and soon dying away; others perennial, provided with deeply penetrating roots which enable them to bear the long droughts. Nowhere do the native grasses form a continuous herbage, as in our English meadows and pastures. The common grasses of the Northern and Eastern States are nowhere to be seen. This tract of country is getting more and more settled, and the most important agricultural problem before its inhabitants is how to increase the production of grasses and forage plants on the arid lands. It is very likely that this can best be done by bringing some of the native grasses into cultivation. The present work is issued mainly to give aid in this direction. A second part, containing fifty more plates, is in preparation; and this will be followed by a synopsis of all the grasses which grow wild in the district. Amongst the natives which are specially recommended for trial are *Panicum bulbosum*, *Stenotaphrum americanum*, *Hilaria mutica*, *Andropogon saccharoides*, *Bouteloua aristoides*, and *B. eriopoda*. There is a native species of millet, *Setaria caudata*.

The figures are very characteristic, and accompanied by botanical dissections. A large proportion of the species belong to Chlorideæ, a tribe which is scarcely represented in the European flora; and only two of them to Festuceæ, which contains the great mass of our European pasture grasses. On the agricultural bearings of the question it is likely that the Department might consult with advantage Dr. Schomburgk, Baron von Mueller, Mr. Bailey, and other botanists as to what has been attempted in Australia, which species have succeeded there as forage plants, and which have been tried and failed.

J. G. B.

Prodomus of the Zoology of Victoria. By Sir Frederick McCoy, M.A., &c. Decades 18, 19, and 20. (London: Trübner and Co., 1889.)

THESE three decades complete vol. ii. of this well-illustrated natural history of Victoria. Of the thirty coloured plates in these parts, four are devoted to Reptiles, seven to Fishes, three to Mollusca, nine to Polyzoa, two to Insects, four to Crustacea, and one to Echinoderms. Among the more noteworthy species figured may be mentioned—*Cyclodus occipitalis*, very rare in Victoria; the great red king crab (*Pseudocarcinus gigas*), from life; *Sepia apama*, which, though one of the commonest species of cuttlefish, does not appear to have been figured before; *Trachinops caudimaculatus*, McCoy, a little fish which created a great sensation by appearing in large numbers, about the middle of October 1884, off the piers at Williamstown, in Hobson's Bay, and being reported to the Commissioner of Customs as the young of the Californian salmon, introduced by Sir Samuel Wilson. The publication of such figures as are to be found in these decades will not only help to prevent such mistakes in the future, but will also be a direct means of calling attention to animals important from an economic point of view. Figures of *Pyrameis itea* and of *P. kershawi*, with their larval and pupal forms, are given; this latter species is very closely related to our own "painted lady," the three lower spots on the posterior wings in the Australian form are of a bright cobalt blue in their centre, instead of black. In the latter end of October and beginning of September 1888, this butterfly appeared in extraordinary numbers for two or three weeks, almost darkening the sky with their general flight towards the south-east, covering the gear and decks of ships many miles out at sea, and filling the air on land from the northern parts of the colony down south to Melbourne. They were accompanied by a day-flying moth (*Agrotis spina*).

Annals of a Fishing Village. Drawn from the Notes of "A Son of the Marshes." Edited by J. A. Owen. (Edinburgh and London: Blackwood and Sons, 1891.)

EVERYONE who has seen much of the marshlands is aware that to a lover of Nature they have a peculiar charm of their own, and that even now, when local individuality is everywhere being so rapidly effaced, there is something characteristic in the manners and customs of the marshmen. These special qualities are well brought out in the present volume, the substance of which, according to the editor, is "from the life," although real names are not given. "A Son of the Marshes," whose notes have been worked up by Mr. Owen, has had ample opportunities of becoming familiar with every phase of Marshland; and there are in the "Annals" many passages which show that he is a keen and accurate observer.

Solutions of the Examples in Elementary Algebra. By H. S. Hall, M.A., and S. R. Knight, B.A. (London: Macmillan and Co., 1891.)

THE authors of this book seem to have taken great trouble in securing accuracy: although we have worked out many of the examples taken at hazard, no errors have been brought to light. By making a judicious use of the examples, the student will find himself materially helped, especially if he is studying the subject without the aid of a teacher. We may also recommend this key to teachers, who will find much of their time saved by having it in their possession.

British Ferns, and where Found. By E. J. Lowe, F.R.S. (London: Swan Sonnenschein, 1891.)

THIS volume belongs to the "Young Collector Series," and presents an immense mass of carefully-arranged information on the subject with which it deals. The author has been a cultivator of British ferns since 1842, so that he is thoroughly and practically familiar with them, and knows exactly what are the kinds of facts for which a collector would be likely to look in a work of this sort. The book ends with a series of useful hints to fern cultivators.

LETTERS TO THE EDITOR.

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

An Assumed Instance of Compound Protective Resemblance in an African Butterfly.

Hamanumida dædalus, Fabr., generally quoted by its better known synonym *Aterica meleagris*, has been recorded as a good instance of protective resemblance.

Mr. Wallace ("Darwinism," p. 207) writes:—"A common African butterfly (*Aterica meleagris*) always settles on the ground with closed wings, which so resemble the soil of the district that it can with difficulty be seen, and the colour varies with the soil in different localities. Thus specimens from Senegambia were dull brown, the soil being reddish sand and iron-clay; those from Calabar and Cameroons were light brown with numerous small white spots, the soil of those countries being light brown clay with small quartz pebbles; while in other localities where the colours of the soil were more varied the colours of the butterfly varied also. Here we have variation in a single species which has become specialized in certain areas to harmonize with the colour of the soil."

Now in the Transvaal this butterfly never settles on the ground with closed wings, and the only example sent from Durban by Colonel Bowker to Mr. Trimen was described as "settled on a footpath with wings expanded" ("South African Butterflies," vol. i. p. 310). I have seen and captured a number of specimens in this country, and always found them with wings expanded and nearly always on greyish coloured rocks or slaty hued paths, with which the colour of the upper surface of their wings wonderfully assimilated. We have large tracts of bare ground of a reddish-brown colour with which the under surface of the wings would be in perfect unison, and for months I have watched to see a specimen thus situated and with its wings vertically closed, but without success.

If the reports as to its habits from Senegambia, Calabar and Cameroons are correct, and I believe for the last localities the authority was the late Mr. Rutherford (but I do not possess the necessary reference here), then we not only have a change of habit with difference of latitude, but also what I have ventured to style a "compound" condition of protective resemblance. For we thus see that while in Senegambia, Calabar and Cameroons, where according to report the butterfly always settles with wings closed, and which "so closely resemble the soil of the district that it can with difficulty be seen, and the colour varies with the soil in different localities," here in the Transvaal and Natal where it rests with expanded wings, its protection is almost equally insured by the assimilative colour of the upper wings to the rocks and paths on which it is usually found.

W. L. DISTANT.

Pretoria, Transvaal, January.

Cultivation of India-Rubber.

IN NATURE of January 15, in a note on p. 355, a statement is quoted, to the effect that some few attempts have been made to cultivate india-rubber, but as yet not very successfully. As, however, there are extensive flourishing plantations of *Ficus elastica* in Assam, a short account of their origin and present condition may prove interesting.

After some preliminary experiments on a small scale, the Government of Assam in 1873 determined to plant caoutchouc in the Charduar Forest at the foot of the Himalayas, north of Tezpur. Mr. Gustav Mann, the Conservator of Forests, gave me the necessary instructions to start the work in November of that year, and I remained in charge of the plantation till September 1875. The Charduar Forest has an essentially damp climate, the average rainfall at the caoutchouc plantation having been 94·65 inches during the years 1878–85, and during 1886–89, the annual rainfall was distributed as follows:—

Winter Rainfall.		1886–87.	1887–88.	1888–89.
November till March ...	Inches	4·87 ...	7·38 ...	4·78
Summer Rainfall.		1886.	1887.	1888.
April till October ...	,,	99·30 ...	71·55 ...	82·39
Total ...	,,	104·17 ...	78·93 ...	87·17

Data for the temperature of the Charduar Forest are not available, but the following average figures for ten years, for Sibsagar, which lies to the south-east of Tezpur, across the Brahmaputra River, will give sufficiently approximate results:—

Average annual temperature	73°·4 F.
Average monthly for January (lowest) ...	59°·0 F.
Average monthly for July (highest)	83°·7 F.

The absolute maximum and minimum temperatures for Sibsagar are not given in the meteorological tables from which the above figures are taken, but, quoting from memory, they are for Tezpur about 95° and 42° respectively.

The relative humidity for Sibsagar averages 83 per cent., being lowest in March, 79 per cent., and highest in January, September, and December, at 85 per cent. It is certainly not less than this in the Charduar Forest, where the moist hot atmosphere in the summer months resembles that of a forcing house. The Charduar Forest contains a vast number of woody species, both evergreen and deciduous, but chiefly the former, nearly pure woods of *Mesua ferrea* and *Altingia excelsa* prevail in the higher parts of the forest, and the undergrowth consists of dwarf palms, small bamboos, and evergreen shrubs, *Caffea bengalensis* being abundant in places, whilst cane palms are found in the damper parts of the forest, and festoon the trees in company with other huge climbers. A few enormous old rubber-trees are disseminated here and there throughout the forest. *Ficus elastica* has here been measured 129 feet high, with a girth around the principal aërial roots of 138 feet, whilst the girth of its crown was 611 feet.

As rubber-trees cannot stand shade, and the seedlings damp off unless fully exposed to light and well drained, the natural reproduction of *Ficus elastica* generally takes place in the forks of stag-headed or lightly foliaged trees high up in the crown, where seeds are left by birds; and from such a site the aërial roots in process of time descend to the ground, and develop into a vast hollow cylinder around the foster stem, which is speedily inclosed and completely killed by the vigorous crown of the epiphyte, which eventually replaces it in the forest. In its epiphytic growth, the aërial roots of *Ficus elastica* may take several years to reach the ground, but, once well rooted, nothing can probably surpass it in its native habitat for rapidity of growth and vigour.

As, owing to the above mode of growth, rubber-trees are so sparely scattered in the Assam forests, and it is therefore extremely difficult to protect them from being tapped in a wasteful manner, the plan of concentrating them in artificial plantations, as proposed to the Government by Mr. Mann, was carried out as follows:—

At first, attempts were made to propagate by cuttings, which struck readily, but it was soon discovered that rubber-seed germinates freely on well-drained beds covered with powdered charcoal or brick-dust, and that the seedlings, though at first small as cress, grew rapidly, and became about 2 feet high in twelve months, and were much hardier against drought than plants produced from cuttings. The base of the stem of the seedlings swells out like a carrot, and this fact, no doubt, enables them to tide through the dry season in safety, for, in spite of the humidity of the air, the nearly constant sunshine from November till March is trying to young plants.

In order to imitate Nature as much as possible, some strong seedling rubber-plants were placed in the forks of trees in 1874, and by 1885 only a few of them had reached the ground and were growing most vigorously.

As this method, though much more economical than planting on the ground, gave such slow results, and it was found easy to produce plants in any quantity from seed, large nurseries were formed, in which the plants are now retained until they are 10 feet high, as smaller plants were browsed down by deer when planted out in the forest. The planting lines are cleared to a breadth of 40 feet in strips, separated by alternating strips of untouched forest 60 feet wide.

It was found that the rubber-plants did not get sufficient light with lines less then 40 feet broad, whilst the strips of forest kept the soil and atmosphere moist, and afforded side shelter to the plants, forcing them to grow upwards, instead of branching out near the ground. As this method involves considerable expense in clearing the lines, and wastes the wood, which is frequently unsaleable, Colonel, now General Keatinge, the Chief Commissioner of Assam, in 1874, directed that plantations of *Ficus elastica* should also be made in grass-land near Tezpur. It has been, however, found that large rubber-trees in Tezpur, when tapped, yield scarcely any rubber, the difference between them and the rubber-trees of the Charduar Forest being probably due to the greater dampness of the atmosphere and soil in the latter locality, as compared with the Brahmaputra Valley.

An area only of 8 acres was therefore planted out near Tezpur, whilst the area of the Charduar plantation in 1889, was 1106 acres, and contained 16,054 plants, besides large nurseries with 84,000 seedlings.

Local Governments in India, which have to find funds for all sorts of administrative purposes, are naturally inclined to economize, and Sir Charles Eliot, when Chief Commissioner of Assam, about ten years ago, proposed to stop further work on the Charduar plantation, but this was vigorously opposed by Dr. Schlich, the Inspector-General of Forests, and at his advice, the Government of India directed the further extension of the plantation. Apparently, however, little progress was made between 1881 and 1888, when an additional area of 63 acres was planted up. Regarding the growth of the plants, the following figures, taken from Mr. Mann's report on the Assam forest administration for 1888–89, give the average height and girth, up to April 1889, of 50 trees in each year's planting:—

Year when planted.	Average				Growth since last year.			
	Height.		Girth.		Height.		Girth.	
	Feet.	Inches.	Feet.	Inches.	Feet.	Inches.	Feet.	Inches.
1874–75	61	11	11	5	6	1	0	9
1875–76	57	6	7	10	5	2	0	6
1876–77	55	10	7	5	3	7	0	6
1877–78	53	9	5	11	5	3	0	7
1878–79	46	2	4	6	4	0	0	5
1879–80	44	10	5	2	5	9	1	2
1880–81	38	7	4	2	6	7	0	8

Thus, we see that the present average annual growth in height and girth, taken from 350 plants, are respectively 5 feet 2 inches and 8 inches.

In the small Tezpur plantation, where there are now 794 plants, all of 1874, the average height and girth are 47 feet 3 inches and 10 feet 10 inches respectively, the average growth in one year being 4 feet 4 inches in height.

The up-keep of the plantation consists chiefly in clearing the lines round the plants, but four years after planting the undergrowth is well kept down by the shade of the rubber-trees.

Experimental tappings were made in 1883 and 1884 on 50 natural grown rubber-trees in the Charduar Forest, the total yield being 438 pounds in 1883, and 206 pounds in 1884, giving an average yearly yield of $6\frac{1}{2}$ pounds per tree. Further information regarding the yield of rubber from trees in the Assam forests would doubtless be procurable from the Assam Forest Office, as well as statistics of the cost of the plantations, which are not given in the papers at present before me. W. R. FISHER.

Cooper's Hill College, February 18.

Snow on the Branches of Trees.

FOLLOWING upon the remarkable ice-storm of which I wrote you last month (NATURE, February 5, p. 317), we have had a wonderful and beautiful display of the amount of snow which the branches of trees can bear. There had been the beginning of an ice-storm on Sunday last; and on Monday, the 9th instant, there followed a damp but light snow which fell rapidly in a calm atmosphere. The whole appearance of trees and air and sky was very beautiful. Some of the trees caught a large quantity of snow, fastened to the branches in a form resembling elliptical cylinders, of which the lower lines of the branches were elements. I made some measurements on the extremities of drooping branches of an elm-tree on our lower campus. One twig with a diameter of 0·21 inch sustained a mass of snow with diameters of 2·50 and 2·33 inches; a second, 0·15 inch in diameter, carried snow the diameters of which were 2·30 and 1·93 inches; so that the area of the cross-sections of this snow was not far from 120 and 153 times that of the twigs which supported it. Two other measurements were still more remarkable. In one the twig was one-tenth of an inch in diameter, and the mass of snow had diameters of 2·40 and 1·75 inches, making the area of the sections 420 times that of the wood; and in the other, a twig 0·11 inch in diameter, carried snow with diameters of 2·50 and 2·05 inches, so that the area of the sections of the snow was 424 times that of the wood. The snow was so loosely attached to the branches that it seemed impossible to make accurate measurements of the weight of the twigs and of the snow which was piled up on them; but the ratio of the weights was, of course, by no means equal to the ratio of the sections—which was practically that of the bulks—of the wood and the snow. SAMUEL HART.

Trinity College, Hartford, Conn., U.S.A., February 12.

Elementary Systematic Chemistry.

I DO not as a general rule approve of a reply to a review, and so far as regards the part of the notice which refers to the short Chemistry which I have lately brought out, I have merely to thank your reviewer for the hints he has given in the last paragraphs, and for the friendly tone of his criticism.

But his first remarks open up a wide field, which appears to me to form a legitimate subject for discussion apart from the merits or demerits of any particular text-book.

The discussion turns on the age at which it is intended to begin the *study* of chemistry. I am all in favour of "children" playing with matter in all its forms; getting to know the appearance and properties of things in general; just as, indeed, very young children learn many useful facts from handling toys, and from the objects which daily come under their notice. But I do not acknowledge that playing with chemical materials constitutes a *study* of chemistry. To pursue your reviewer's simile, a child plays with language; he learns to speak it, read it, and possibly write it reasonably well. But when he begins to study language, he must learn grammar. I am equally in favour of learning a foreign language by conversation and by promiscuous reading; but to *know* French and German, we must study the classification and derivation of their words, their connection with each other, and the means whereby they may be combined to form correct sentences.

Now my experience has been that the ordinary text-books of inorganic chemistry convey a large amount of heterogeneous information—the facts grouped in a certain order, it is true, but not in such order as to lead the beginner to generalize and classify. And indeed this is tacitly acknowledged by your reviewer in his remark, "The student who is already fairly acquainted with the subject will find the summary of properties, &c., of much use," implying that such summaries are not easily obtained from ordinary text-books. The beginner in chemistry acquires a vast amount of information on isolated facts; great demands are made on his memory, and many students have formerly hinted to me that they find the study hopeless; there is so much to be remembered, and so little connection between the facts. This short text-book has been written with a view of removing this obstacle. In it facts are classified, general methods are set forth, and the properties of compounds common to all members of a group are to be found together. In the preface, I have emphasized these views; but I did not intend to exclude the acquisition of general knowledge of matter, which may be acquired as thoroughly by this arrangement as by any other.

I am quite aware that a complete comprehension of the periodic law is beyond the young student; but a boy of fourteen or fifteen will learn to understand it better by this method than by any other, and at first he may accept the statement that experience (the experience of the writer, at least) has proved it to be the best way of presenting the subject. WILLIAM RAMSAY.

University College, Gower Street, W.C., February 20.

Frozen Fish.

IT is not uncommon for small fish to be frozen to ice in shallow water. In 1838 I put some of these frozen fish into tepid water, and they recovered. In 1852, in one part of the lake at Highfield House, there must have been hundreds frozen to the ice, but when it melted scarcely any dead fish were seen: they had either recovered or had been devoured by pike. In 1860 a number of gold-fish were hard frozen, but recovered in warm water.

When ice is transparent the fish seen beneath are apparently healthy; indeed, there always seem to be air-bubbles sufficient to sustain the life of fish.

I never saw pike, carp, tench, perch, or trout frozen to ice.

Shirenewton Hall, February 22. E. J. LOWE.

THE ZOOLOGICAL STATION OF NAPLES.

AT the recent meeting of the British Association at Leeds, much difficulty was experienced in obtaining the renewal of the vote for the occupation, by a British naturalist, of a table at the Zoological Station at Naples—a grant which has received the sanction of the Committee of Recommendations of the Association for many successive years. It was alleged, we believe, that the Zoological Station at Naples was used by those sent to it rather for educational purposes than as a place for original research, and objections were also raised, perhaps with greater force, to the policy of continuing to support an already thriving institution for an indefinite period. Had it not been for the munificence of an individual member of the Association, Captain Andrew Noble, C.B., F.R.S., who kindly offered to supply the debated sum of £100, the Association could not have continued, during the present year, to send naturalists to work at the Naples Station.

So far, however, from being mainly used for education, as was affirmed by some of its criticizers, Dr. Dohrn's station at Naples (for, as Dr. Dohrn is its founder, director, and proprietor, we may fairly call it by his name) is, it may be truly said, almost entirely devoted to original investigations. The investigators, no doubt, get a large amount of education out of their work, but the leading idea at Naples is *research*. All the minor works at the station are subordinated to this leading idea. As we have lately established in this country an institution with nearly similar aims and objects—we mean the Laboratory of the Marine Biological Association at Plymouth—it may be useful shortly to review the state to which the institution at Naples has arrived after a career of twenty years, and to show an ideal to which its British imitator may, we trust, hope to attain after a certain period.

The Zoological Station of Naples consists of two buildings, connected by a gallery, and placed on the Chiaja, in the beautiful public garden which occupies part of the strand of the world-renowned Bay of Naples. The lower portion of the larger building contains a long series of tanks arranged for public inspection, so as to give sightseers a sample of the fishes and other marine wonders of the Bay of Naples. This portion of the building is open to the public, at stated hours, at an admission fee of two francs, and produces a revenue of about £1000 a year to the institution. The large tanks which it contains are at the same time very useful as storehouses for the specimens required by the students. The whole of the upper stories of the larger building, and the whole of the smaller building are devoted entirely to scientific purposes. They contain the naturalists' working tables and tanks, the library, the studies and apartments of the Director and other officials, and the rooms used for the reception, preservation, and storage of specimens.

There is room in the buildings at Naples for about fifty naturalists' "tables," by which term is designated not merely the table itself, but the adjoining tank for specimens and every other sort of accommodation required for work in any branch of marine zoology. The tables actually rented continuously from year to year (at £100 each) are about twenty in number. Of these Prussia takes four, Baden one, Bavaria one, Saxony one, Hesse one, and Wurtemberg one, making altogether nine occupied by the various German Governments. Of nations foreign to Germany, Italy takes no less than seven, five of these being rented by the Ministry of Public Instruction, and two by that of Agriculture. France, in view of national prejudice, and having zoological stations of her own, could perhaps be scarcely expected to subscribe to what is essentially a German institution; but Switzerland, Hungary, and Holland each take a table, and the University of Cambridge occupies the only table rented in England, if, as now seems possible, that of the British Association will be given up. Besides these twenty "certain tables," others, varying in number from eight to sixteen, are let every year. These are taken by Russia, Belgium, Austria, Spain, and occasionally by some of the Italian provincial Governments. On the whole, this second "uncertain" series may be reckoned to number about ten on an average of years. Thus altogether thirty naturalists' tables are let and tenanted, and produce a revenue of about £3000 a year to the institution.

A certain number of these tables are occupied throughout the year, but in the height of summer the workers are reduced to a minimum, while in the early spring, perhaps, they attain their maximum number. At such an intermediate period as November 18 last, when the writer of this article had last the pleasure of visiting the establishment, eighteen naturalists were found to be in full work. The following list gives the names of these gentlemen, together with the names of the tables which they occupied and the objects of their various studies:—

Naturalists.	Residence.	Tables Occupied.	Objects of Study.
Dr. G. Jatta	Naples	Italy	Monograph of Cephalopods.
Dr. G. Cano	Sassari	,,	Crustaceans, system and embryology.
Dr. C. Crety	Rome	,,	Anatomy of Entozoa.
Dr. F. Monticelli	Naples	,,	Helminthozoa, system and anatomy.
Dr. G. Mazzarelli	,,	,,	Anatomy of Gastropods.
Dr. S. Pansini	Molfetta	,,	Bacteriology.
Dr. Salviati	Naples	,,	,,
Dr. M. Verworn	Jena	Prussia	Physiology of Protozoa and Cœlenterata.
Dr. M. Mendthal	Königsberg	,,	Anatomy of Nereidæ.
Dr. C. v. Wistinghausen ...	Berlin	,,	Embryology of Annelids.
Dr. A. Looss	Leipzig	Saxony	General study of the fauna.
Dr. J. Loeb	Strassburg	Strassburg	Physiological experiments on Cœlenterata and Worms.
Dr. M. Davidoff	Munich	Zoological Station	Monograph of Appendicularia.
Mr. W. Melly	Liverpool	British Association	Anatomy of Sponges.
Dr. J. Koningsberger ...	Utrecht	Holland	Embryology of Nemerteans and Nudibranchs.
Sr. Rioja y Martin	Madrid	Spain	General study of fauna.
Lieutenant Borja	,,	,,	Conservation of marine animals.
Lieutenant Anglada	,,	,,	,, ,, ,,

But these were by no means the only naturalists at work in the Zoological Station of Naples in November last. Besides the eighteen regular occupants of the "tables," the following members of the Station carried on scientific work whenever leisure from their ordinary duties permitted them to do so:—

Members of the Staff of the Zoological Station.	Subjects of Work.
Prof. A. Dohrn (Director)	Comparative embryology of Vertebrates.
Prof. H. Eisig	Anatomy and embryology of Annelids.
Prof. P. Mayer (Editor of Publications)	Morphology of Vertebrates.
Dr. W. Giesbrecht	Monograph of the Copepoda.
Dr. P. Schiemenz (Librarian)	Mollusks: monograph of the Pteropods.
Dr. F. Raffaele	General fishery questions. Development of the skeleton in Vertebrates.
Dr. W. Kruse	Bacteriology.
Dr. E. Herter	Physiology, chemistry.
Dr. Schöbel	Branchial apparatus of Selachians, microscopic drawing.

The whole number of naturalists that have occupied "tables" and worked at the Zoological Station of Naples since its opening, some twenty years ago, is 575. Of these, 228 have been Germans, 127 Italians, 52 English, 48 Russians, 32 Dutch, 26 Austro-Hungarians, 23 Swiss, 18 Spaniards, 14 Belgians, and 4 Americans, while the remaining 12 were of various other nationalities. Much of the good work that has thus been produced has been scattered abroad over the world in articles contributed to different scientific periodicals. But a portion of it, sufficiently solid to show its general character, has been published in a noble series of memoirs on various departments of the flora and fauna of the Bay of Naples, which now extends to sixteen elaborate and abundantly illustrated quarto memoirs. These are:—

(1) "Ctenophoræ," by Dr. C. Chun, 1880, with 18 plates.
(2) "Fierasfer," by Dr. C. Emery, 1880, with 9 plates.
(3) "Pantopoda," by Dr. A. Dohrn, 1881, with 17 plates.
(4) "Die Corallinenalgen," by Graf zu Solms-Laubach, 1881, with 3 plates.
(5) "I Chætognathi," by Dr. B. Grassi, 1883, with 13 plates.
(6) "Die Caprelliden," by P. Mayer, 1882, with 10 plates.
(7) "Cystoseiræ," by R. Valiante, 1883, with 15 plates.
(8) "Bangiaceæ," by Dr. G. Berthold, 1882, with 1 plate.
(9) "Le Attinie," by A. Andres, Vol. I., 1884, with 13 plates.
(10) "Doliolum," by Dr. B. Uljanin, 1884, with 12 plates.
(11) "Polycladidea," by Dr. A. Lang, 1884, 2 Parts, with 35 plates.
(12) "Die Cryptonemiaceen," by Dr. G. Berthold, 1884, with 8 plates.
(13) "Die Koloniebildenden Radiolarien," by Dr. K. Brandt, 1886, with 8 plates.
(14) "Polygordius," by Prof. J. Fraipont, 1887, with 16 plates.
(15) "Die Gorgoniden," by G. v. Koch, 1887, with 10 plates.
(16) "Die Capitelliden," by Dr. H. Eisig, 1888, 2 Parts, with 37 plates.

Besides these memoirs, eight successive volumes of a yearly journal entitled *Mittheilungen aus d. zoologischen Station zu Neapel*, containing smaller contributions to science, have been published during the past twelve years, and, since 1879, a *Zoologische Jahresbericht*, containing a summary of the advances made in the different branches of zoological knowledge during each year, has been regularly issued. In these three undertakings we have ample testimony to the great amount of work carried on at Naples by Dr. Dohrn and his coadjutors, and to the excellent results which they have arrived at.

Having described the nature of the business transacted at the Zoological Station at Naples, let us now consider the cost at which it is carried on, and the means whereby the necessary funds are obtained. Taking the expenditure of the last three years as a basis, we find, from figures kindly supplied to us by Dr. Dohrn, that about £2400 are required for the general expenses of management—that is, for stocking the tanks, preserving specimens, keeping up the laboratories, machinery and pumps, providing additions to the library, and paying taxes and other outgoings. A similar sum of about £2400 is spent on the salaries of the officials, the higher officers (twelve in number) receiving from £220 to £72 per annum, and the lower grades (34 in all) ranging from £72 to £15, the last-mentioned sum being the wages paid to boys.

These are the two most serious items on the outgoing side, and make together £4800, besides which about £1300 are required for interest on the debt and sinking-fund, £200 for accumulation towards a pension-fund, which was commenced two years ago, and £100 for the publications, which cost about £1400 a year, and only produce a return of about £1300. Thus the total yearly expenditure of the Zoological Station at Naples, as at present carried on, may be reckoned at about £6400. To meet these annual requirements an income which has averaged about £4800 during the past three years is available. As already stated, the receipts from the admission of visitors amount to about £1000, while the thirty tables, let at £100 a year for each table, produce a revenue of £3000. Besides these principal items, the sale of specimens preserved at the Station produces about £700, and that of waste materials of various sorts another £100. Thus the whole income derived from the institution itself reaches only about £4800, and the Station would be carried on at a considerable annual loss were it not for the magnificent subsidy of £2000 a year granted to its support by the German Empire, which just covers the deficiency. This is a good example of the liberal way in which science is encouraged and supported in the "Fatherland," and is the more noteworthy because the object of its well-bestowed bounty in this instance is localized on foreign soil, and, though established and carried on by a German citizen, is by no means restricted for German subjects. We may appropriately contrast this with the conduct of the Government of our own country, which, in the case of the corresponding institution at Plymouth, situated in England, and founded and carried on mainly if not entirely for the benefit of British subjects, could only be persuaded to grant a subsidy of £500 a year for a limited period of five years. P. L. S.

ATTRACTIVE CHARACTERS IN FUNGI.

ON the recent introduction of this subject into the columns of NATURE it was understood, if not so expressed, that the inquiry was to be practically limited to the Hymenomycetal fungi, with the view of restricting it within a definite compass, and preventing too discursive a discussion. The limit was a very natural one, and included the best known and most appropriate objects for exhibiting the presumed attractiveness. Allusions have been made to another remarkable group, the *Phalloidei*, but facts applicable to this group would scarcely serve as illustrations of the *Agaricini*. Moreover, it must be admitted that with the *Phalloidei* the difficulties in the way of arriving at a conclusion are small. Strong fœtid odour and bright coloration are features almost universal, the object of which may fairly be accepted as attractive, to the end that the minute spores may be distributed, and the continuity of the species preserved. On this point nothing has been adduced beyond what is contained in Mr. Fulton's communication in the *Annals of Botany* for May 1889, on "The Dispersion of the Spores of Fungi by the Agency of Insects."

As regards the *Hymenomycetes*—that is to say, fungi of the mushroom type, with naked spores—the question appeared to resolve itself into this : Are such characters as colour, odour, &c., attractive, and if so to what members of the animal kingdom, and for what purpose? Incidentally, and apart from this, the side issue has been raised whether other characters, such as viscidity, inconspicuous coloration, &c., are not in some sense protective, for it has not been urged, nor do we think there was any ground for urging, that such latter characters were attractive, except perhaps the allusion to *Agaricus radicatus* by Mr. Worthington Smith, which does not seem to be at all conclusive.

Although not expressly stated, there seems to be an undercurrent of feeling amongst some correspondents that colour and odour are attractive to insects for the purpose either of fertilization or the dispersion of spores. This may be so, but there is no evidence, in the facts elicited, to support it—nothing to show that the attractive species are more in need of extraneous aid than unattractive. And, as to the subject of fertilization, the mystery is still unsolved, whether or no any special act of fertilization takes place, and if so, whether each individual spore is fertilized, or whether there is a fertilization of the young plant in the embryonic condition, or in its earliest stages, as some have contended, rendering all its spores fertile. This subject has been discussed over and over again during the past half-century, and has not been left, as one correspondent seems to think, disregarded. Dr. Karsten, in 1860, and M. Oersted, in 1865, held that upon the threads of the mycelium the male and female elements combined in the production of the rudimentary cap which developed into a fertile individual. On the other hand, Bulliard, Corda, Hoffmann, and others, both before and after this, contended for the fertilization of the individual spores by the cystidia. Mr. Worthington Smith supported this view, based upon experiments with *Coprinus radiatus*, and declares himself of the same opinion still. It is impossible to enter upon the details here, but this carefully written memoir by Mr. Smith merits attentive and unprejudiced perusal. The cystidia are borne upon the gills of the *Agaricini*, side by side with the basidia supporting the spores. Insect agency is not essential for direct fertilization, but, for cross-fertilization, some such aid would be necessary, assuming the theory of fertilization by the cystidia to be established. Here, again, another suggestion must be taken into account, for Mr. Smith contends that usually the cystidia fall out from the gills, and are scattered upon the ground beneath, and the fertilization of the falling spores takes place upon the ground, and not during the time that both spores and cystidia are attached to the gills. If this be the case, it explains why no foramen has been detected in the spore membrane, except the hilum of attachment, and suggests that through the hilum communication is established between the cystidia and the spore contents. On the other hand, fertilization usually takes place, in most organisms, at an early stage of the ovum, and not at its apparent maturity, and full coloration. It is not improbable, if fertilization takes place after the spores and cystidia have fallen to the ground, that the visits of insects, &c., to the gills may assist in releasing both organs and causing their precipitation, and, consequently, promoting fertilization. This hypothesis being true, a viscid stem would be of service to retain many of the spores and cystidia attached until fertilization is accomplished, so also would a woolly or hairy stem. As a rule, we imagine that the brightest coloured species (*Russula*, for example) have neither a viscid or woolly, but a dry and smooth stem, whereas a proverbially dull-coloured sub-genus, such as *Inocybe*, includes a great number of species with a rough scaly stem. We cannot pretend to discuss here the strength or weakness of this theory of fertilization, only to suggest, on the assumption of its being accepted, the probable advantages of insect visitations, and consequently of attractive characters favouring such visitations.

Closer habits of observation, and a larger number of observers, is the only hope for acquiring a more perfect knowledge of this subject, and this may be stimulated by some suggestions offered in the course of this discussion, indicating the direction in which observation is calculated to produce favourable results. However plausible it may appear to hint that bright colours in Agarics are attractive, we fail to recognize any evidence that such is the case. Do insects visit *Agaricus muscarius* more persistently than they do *Agaricus pantherinus*, or *Russula rosacea* more than *Russula consobrina?*

The persistency with which reference is made to the supposed passage of fungus spores through some animal host, in order to produce fertility, provokes as persistent a denial that there are facts to support such an hypothesis, and compels us to insist that such a supposition is untenable, and is not accepted nowadays by mycologists, however much it may have been tolerated in the past. Apart from the question of the attractive colours of fungi, we are reminded of instances in which colour, in the Hymenomycetal fungi, is evidently protective, although these are not numerous. *Cantharellus carbonarius*, as its name suggests, grows upon charcoal, or charred ground where charcoal has been burnt, and its smoky black cap so nearly resembles the soil that it may easily be overlooked. There are also two small species of *Collybia*, usually found growing together on burnt ground. *Agaricus atratus* and *Agaricus ambustus*, with dingy blackish-brown caps, which render them very inconspicuous. One of the most common of fungi on charred ground is *Agaricus* (*Flammula*) *carbonarius*, with a brown cap, so viscid that it is nearly always disguised by a coating of fragments of burnt soil and charcoal which adhere to it. The little *Agaricus* (*Pleurotus*) *acerosus* grows on the side of wet wheel-ruts in woods, and has such a dingy grey cap that it must be sought very carefully to be seen. Whenever we have found *Agaricus* (*Psalliota*) *hæmorrhoidarius*, it has been partly buried in clayey soil, and the whole fungus and soil so nearly of the same colour that even a practised fungus-hunter could easily pass without observing it. *Agaricus* (*Tricholoma*) *vaccinus* growing amongst pine-leaves would be mistaken for a fir cone, and *Agaricus* (*Tricholoma*) *imbricatus* is remarkably inconspicuous amongst dead pine-leaves and old fir cones ; and every mycologist knows how very difficult it is to see the little *Hydnum auriscalpium* amongst old fir cones. *Agaricus* (*Tricholoma*) *sordidus*, with its dingy brown pileus, is almost indistinguishable on old dunghills. *Agaricus* (*Collybia*) *fusipes*, which grows at the base of rotten stumps, is wholly of a dark chestnut brown colour, and, when wet, is not readily seen, unless specially hunted after. *Agaricus* (*Collybia*) *vertirugis* can scarcely be distinguished from the dead bracken on which it grows. Some of the pretty little species of *Mycena* are very difficult to find, because they resemble in colour the dead leaves and twigs amongst which they flourish. The small forms of the bright tawny *Agaricus* (*Galera*) *hypnorum*, with their conical caps, resemble the calyptra of the moss they grow among. Many of the species of *Cortinarius*, although possessing bright colours, are so in harmony with the bright tints of the freshly-fallen autumnal leaves, amongst which they grow, that they are hardly distinguishable. The colour of *Paxillus panuoides* is just that of the sawdust it inhabits. These are only a few instances to which our memory reverts at the moment, but there are many other examples which might be cited, if these were not sufficient, to show that, although some fungi exhibit a very bright and conspicuous coloration, there are others which harmonize with their surroundings to such an extent as to be practically inconspicuous.

There is another class of phenomena which might be alluded to in passing, and this consists of what could almost be termed imitative resemblances, between species otherwise remarkably distinct from each other. We do not allude to fancied resemblances, but deceptive resemblances, so close as to deceive even fungologists, until they apply the test of a scientific examination. Most of these are alluded to by Mr. Plowright in his paper on "Mimicry in Fungi." The renowned orange amanita (*Agaricus* (*Amanita*) *cæsareus*), which is so much praised as an esculent on the Continent, but is not an indigenous species, resembles closely the poisonous *Agaricus* (*Amanita*) *muscarius*, not only in colour and size, but also in the volva at the base of the stem, and the large pendulous ring. The edible *Ag.* (*Amanita*) *rubescens*, one of the safest and best of our white-spored species, has a counterpart in *Ag.* (*Amanita*) *pantherinus*, which has the reputation of being poisonous, and so closely like the edible species as to be liable to be confounded by the inexperienced. Then, again, the typical mushroom *Agaricus campestris* has its resemblance in the unwholesome *Agaricus melaspermus*, and another species, *Agaricus* (*Hebeloma*) *fastibilis*, which Mr. Smith reports came up in great numbers upon a mushroom bed, on one occasion, and might have caused a disastrous result had not the fact been detected by an adept. A no less remarkable similarity is that between *Lactarius deliciosus*, an excellent esculent, and the deleterious *Lactarius torminosus*: the latter, we know from experience, is sometimes not to be distinguished from the former when growing, and not until gathered and examined. We have gathered two or three times a very mild pleasant species of *Russula* which is perfectly innocuous, which in size, and its deep red colour, cannot be distinguished from the acrid and dangerous *Russula rubra*, and yet we can detect no difference between them, except in taste. The false chantarelle (*Cantharellus aurantiacus*) has a bad reputation, and yet it simulates the edible chantarelle (*Cantharellus cibarius*) sufficiently to caution novices against confounding them. Whether its ill name has good foundation or not, *Lactarius aurantiacus* so nearly resembles large specimens of *Lactarius mitissimus*, which is mild and good eating, that mycologists themselves have often confounded them. Then, again, there are other instances in which innocuous species closely resemble each other, as *Agaricus* (*Clitocybe*) *dealbatus* and *Agaricus* (*Clitopilus*) *orcella*, but the former has white spores and the latter pink, and both are edible. On the other hand, *Agaricus* (*Clitocybe*) *Sadleri* is the counterpart of *Agaricus* (*Hypholoma*) *capnoides*, and neither of them is fit to eat. These comparisons might be extended considerably, even to species systematically far remote from each other, but the above will suffice to show that good species have their counterparts, or imitators, in bad ones, and that both good and bad may have analogous resemblances in other distinct species.

We have purposely restricted ourselves in these observations to the Hymenomycetal fungi, but if Prof. Saccardo is correct that there is still to be found a *Clavaria ophioglossoides* with all the external features of *Cordyceps ophioglossoides*, and also a *Clavaria nigrita* which is the counterpart of *Geoglossum nigritum*, then we have two remarkable instances of species with naked spores simulating species in far-removed genera with a widely different structure and fructification, bearing large sporidia inclosed in asci. But in dealing with these groups we are in constant danger of mistaking conidial forms of ascigerous species for autonomous fungi, and we cannot help such a suspicion in these instances.

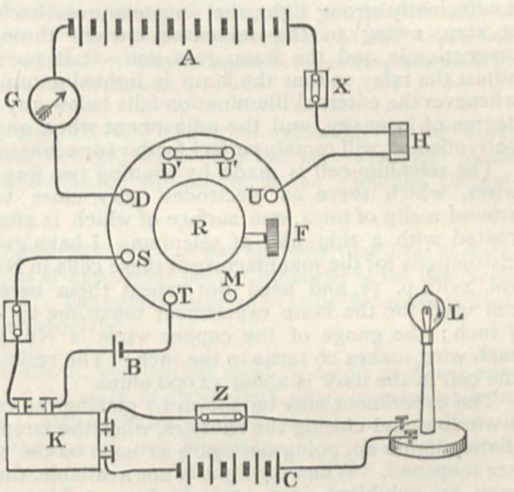
The whole subject is one of considerable interest, but surrounded by difficulties. Facts accumulate slowly because intelligent observers are few amongst the lower orders of Cryptogamia; still every decade of years exhibits some advance, although there is insufficient material for safe generalization at present. It is well to keep in view what has been written on the subject, and to that end we subjoin references, which may be consulted by those who are interested sufficiently to take the trouble. "Mimicry in Fungi," by W. G. Smith, in *Gardeners' Chronicle*, November 16, 1872, and February 10, 1877; also by M. C. Cooke, in *Grevillea*, vol. ix., June 1881, p. 151; and C. B. Plowright, in *Grevillea*, vol. x., September 1881, p. 1, and March 1882, p. 89.

M. C. COOKE.

AN AUTOMATIC LAMP-LIGHTER.

IN illustration of a paper on selenium, read at a recent meeting of the Physical Society (NATURE, vol. xliii. p. 262), I exhibited an electric lamp which was connected with a selenium-cell and a relay in such a manner that the lamp was automatically turned on in the dark and extinguished by the action of light. The details of the arrangement were, however, not described, and I propose to give here a few particulars for the assistance of those who may wish to repeat the experiment.

A scheme of the connections is shown in the annexed diagram. It will be seen that there are three circuits.



The first includes a battery A, of 24 small Leclanché cells, the selenium-cell H, and the magnet coils of the relay R. A Post Office tangent galvanometer G, capable of measuring milliamperes, is a convenient but not indispensable adjunct. In the second circuit is a Leclanché cell B, one pole of which is connected through the terminal T with the tongue of the relay R, and the other through the magnet-coils of the electro-magnetic switch K, and the terminal S, with one of the platinum stops of the relay. The third circuit contains the lamp-battery C, the incandescent lamp L, and the tongue and stop of the electro-magnetic switch K. The three simple switches, X, Y, Z, are useful for breaking any of the circuits.

The selenium-cell H has a resistance in the dark of about 50,000 ohms, which is diminished to one-half, or less, by the action of diffused daylight, or by the light of an ordinary gas jet at a distance of 1 foot. The relay R is a "standard relay," as used in the Postal Telegraph service. Its tongue, connected with the terminal T, oscillates between two adjustable platinum stops, which are connected respectively with S and M. (For brevity we will call these the S stop and the M stop.) It contains four magnet-coils which, as the instrument is sent out by the manufacturers, may be connected either all in parallel or two in series and two in parallel. For the present purpose it is desirable that the coils should be joined up all in series, thus greatly increasing the sensitiveness of the instrument to small currents at an immaterial sacrifice of rapidity of action. This can only be done by altering the permanent connections underneath the stand of the relay. The terminals D' and U' are joined to each other by a brass strap. Care must be taken to join the terminal D to the zinc pole of the battery. The electromagnetic switch K is simply an ordinary electric bell relay: it is used in order to avoid passing a strong current through the delicate relay R. The lamp L is an 8-volt lamp of 5-candle power. The battery C consists of 5 bichromate or Grove cells; secondary cells, if available, would of course be much better.

The connections being made as above, it only remains to adjust the relay. The platinum contacts must be clean and smooth; those in my instrument are occasionally cleaned with a watchmaker's "dead smooth" file, and then rubbed with a bright knitting-needle. The two stops are screwed up until there is only just room for the tongue to move between them. The milled head F, is first turned clock-wise, so as to make the tongue press against the M stop, and then (the selenium cell being in the dark, or only feebly illuminated) it is slowly and cautiously turned counter-clockwise, until the tongue passes over to the S stop, which causes the lamp to be switched on. If now the selenium cell is exposed to a sufficiently strong light, the tongue moves back to the M stop, owing to the increased current through the magnet-coils, and the lamp goes out. It is possible to adjust the relay so that the lamp is lighted automatically whenever the external illumination falls below any desired degree of intensity, and the adjustment when once properly effected, will remain perfect for days or weeks together.

The selenium-cell is made by winding two fine copper wires, which serve as electrodes, very close together around a slip of mica, one surface of which is afterwards coated with a thin film of selenium. I have given full instructions for the manufacture of these cells in NATURE, vol. xxiii. p. 58, and need not repeat them here. The cell used for the lamp experiment measures 2¼ inch by ¾ inch; the gauge of the copper wires is No. 36, and each wire makes 20 turns to the inch. The resistance of the cell in the dark is about 52,000 ohms.

The experiment may be shown by placing the cell near a window, and closing the shutters, when the lamp immediately lights up, going out again as soon as the shutters are reopened. When daylight is not available, the effect may be exhibited in a scarcely less striking way by alternately screening and exposing a gas burner placed at a distance of a foot or two from the selenium, or by turning the gas up and down. The following test illustrates the sensitiveness of the arrangement. The relay was adjusted so that the lamp circuit was just closed when a standard candle was burning at a distance of 7½ inches from the selenium-cell. The candle was moved slowly towards the cell, until the distance between them was reduced to 6½ inches, when the increased illumination caused the lamp circuit to be broken. The candle was then moved back, and when the distance was once more 7½ inches, the circuit was again closed. By moving the candle backwards and forwards over a range of about 1 inch, the circuit could be alternately closed and broken as often as desired. The extreme difference in the strength of the currents passing through the selenium under these changes of illumination was shown by the galvanometer to be rather less than 0·1 milliampere.

Though the apparatus does not at present claim to be anything more than a pretty scientific toy, it is possible that it may turn out to be of some practical utility. To demonstrate its capabilities, I one day left the selenium-cell near the window, with the batteries joined up. At about 4 p.m., just when reading was becoming impossible through failing daylight, the lamp (which I had in fact forgotten all about) was automatically turned on.

SHELFORD BIDWELL.

REMARKABLE ANCIENT SCULPTURES FROM NORTH-WEST AMERICA.[1]

MR. JAMES TERRY has just published descriptions and photographs of some of the most remarkable works of prehistoric man yet discovered on the American continent. The title of his paper is sufficiently startling, but it is fully borne out by the beautiful full-size and half-size photographic prints with which it is illustrated. They represent three rude, yet bold, characteristic, and even life-like sculptures of simian heads, executed in basalt. One of these belongs to the author, one to Mr. T. Condon, and the third to Prof. O. C. Marsh, who referred to it, in his address "On Vertebrate Life in America," in the following terms:—"On the Columbia River I have found evidence of the former existence of inhabitants much superior to the Indians at present there, and of which no tradition remains. Among many stone carvings which I saw, there were a number of heads which so strongly resembled those of apes that the likeness at once suggests itself. Whence came these sculptures and by whom were they made?" Unfortunately we have no detailed information as to the conditions under which these specimens were found, except that "they would be classed as 'surface finds,' from the fact that the shifting sand-dunes, which were largely utilized for burial purposes, are continually bringing them to the surface and exposing them." This gives no indication of their antiquity, but is quite compatible with any age which their other characteristics may suggest.

The size of the heads varies from eight to ten inches in total height, and from five and three-quarters to six and a half inches in width. The three are so different from each other that they appear to represent three distinct animals; and, so far as I can judge, they all differ considerably from the heads of any known anthropoid apes. In particular, the nostrils are much farther from the eyes and much nearer to the mouth than in any of the apes. In this respect they are more human; yet the general form of the head and face, the low and strongly-ridged forehead, and the ridges on the head and cheeks seem to point to a very low type of anthropoid. In a letter to Mr. Terry, Mr. Condon suggests "that they were copied from the figure-head of some Malay proa that may have been wrecked on the coast;" but such a supposition is quite inadmissible, since nothing at all resembling these heads is ever carved on Malay proas, and there is no reason to believe that if such a carving did come into the possession of the natives they would ever think of copying it in stone; while these sculptures were found two hundred miles from the coast on the east side of the Cascade Mountains.

Taking into consideration the enormous antiquity of the stone mortars and human remains found in the auriferous gravels of California buried under ancient lava streams and associated with a flora and fauna altogether different from that of any part of America at the present time, Mr. Terry's own conclusion appears the more probable. It is, "either that the animals which these carvings represent once existed in the Columbia valley, or that, in the remote past, a migration of natives from some region containing these monkeys reached this valley, and left one of the vivid impressions of their former surroundings in these imperishable sculptures." The latter alternative appears to me, for many reasons, to be highly improbable; and though the former will seem to many persons to be still more improbable, I am inclined provisionally to accept it.

ALFRED R. WALLACE.

[1] "Sculptured Anthropoid Ape Heads found in or near the Valley of the John Day River, a tributary of the Columbia River, Oregon." By James Terry. (New York, 1891.)

NOTES.

THE celebration of the jubilee of the Chemical Society was in every way most successful. At the meeting at Burlington House, on Tuesday afternoon, admirable addresses were delivered, and the *conversazione* at the Goldsmiths' Hall in the evening was attended by about 800 guests, including many eminent men of science. The Fellows and their friends dined together on Wednesday. We shall have more to say about the celebration next week.

THE following have been appointed to preside over the Sections at the Cardiff meeting of the British Association in August next:—A—Mathematics and Physics, Prof. O. J. Lodge, F.R.S.; B—Chemistry, Prof. Roberts-Austen, C.B., F.R.S.; C—Geology, Prof. Rupert Jones, F.R.S.; D—Biology, Mr. Francis Darwin, F.R.S.; E—Geography, Mr. E. G. Ravenstein, F.R.G.S.; F—Economics, Rev. Dr. W. Cunningham; G—Mechanical Science, Mr. T. Forster Brown, M.Inst.C.E.; H—Anthropology, Prof. Max Müller.

THE first *soirée* of the Royal Society this year is to be held on Wednesday, May 6. The date of the *conversazione*, to which ladies are invited, is not yet fixed.

M. JEAN SERVAIS STAS is to have a jubilee next May. The Royal Academy of Belgium purposes to strike a gold medal on the occasion of his fiftieth anniversary as a "membre titulaire de la Classe des Sciences," and to present it to M. Stas at a general meeting of the Academy on May 5. Corresponding Societies will also probably send congratulatory addresses.

ON Monday afternoon a numerous and influential meeting was held at the Mansion House in support of the University College and King's College Extension Funds. The chair was taken by the Lord Mayor. The Bishop of London moved a resolution to the effect that it is essential to the welfare and dignity of London that its institutions for University teaching should be maintained at the highest standard and in the utmost efficiency. In another resolution, moved by Lord Reay, the meeting was reminded that the two Colleges had deserved well of London and merited liberal support. Mr. W. H. Preece, F.R.S., supporting this resolution, spoke of science in its relations to trade and industry. It was only a few days ago that, in common with the Lord Mayor, he was present at the inauguration of a system of lighting the City of London which would surpass what was done in any other city of the world. It was of the highest importance that London should not be behindhand as compared with our provincial friends or our foreign competitors. London, however, was at some disadvantage compared with the other great cities—it was so vast that the local spirit was practically inoperative, and it possessed no Whitworths, or Masons, Firths, or Owens, to leave all their wealth to education. Germany and Switzerland had made lavish outlays, and the United States were founding institutions which were the wonder of the age. In all the Universities of the United States large numbers were being taught in the practical classes, and it was our bounden duty that in this war of competition between the different nations of the world we should be able to hold our own. The third resolution, moved by Dr. Erichsen, was as follows:—"That a committee be formed, under the presidency of the Right Hon. the Lord Mayor, to receive subscriptions in support of the extension funds of the two Colleges, consisting of the committee of the University College Extension Fund, under the chairmanship of Lord Reay, and of such governors and other members of the council of King's College, under the chairmanship of the Bishop of London, as the Bishop may appoint."

PROF. ARMAND SABATIER, the well-known zoologist of Montpellier, is at present collecting money for the purpose of completing the zoological marine station of Cette. This laboratory will certainly be one of the most useful in France, the fauna there being very abundant and varied. It would be difficult to conceive of a station more favourably situated. Fresh waters are plentiful, brackish waters very abundant, in the *étangs* of the vicinity; in the harbour many forms are found which do not thrive or are seldom met with on the shore; and there is open water close by.

A SHORT Bill relating to technical instruction has been introduced into the House of Commons by Sir Henry Roscoe. He proposes that a local authority shall be enabled to make such provision in aid of the technical or manual instruction for the time being supplied in a school or institution outside its district, as may, in its opinion, be necessary for the requirements of the district in cases where similar provision cannot be so advantageously made by aiding a school or institution within its district. In the same way a local authority may provide, or assist in providing, scholarships for, or pay or assist in paying the fees of, students ordinarily resident in its district, at schools or institutions within or outside that district. In distributing the provision made in aid of technical or manual instruction, the local authority is empowered to consider the relative needs of the schools or institutions aided, as well as the nature and amount of efficient technical or manual instruction supplied by those schools or institutions.

MR. JAMES MUIR, Professor of Agriculture in the Royal Agricultural College, Cirencester, has been appointed to the new Professorship of Agriculture in the Yorkshire College, Leeds.

DR. ALEXANDER BUCHAN has for some time been at work on the effect of high winds on the barometer at the Ben Nevis Observatory. The result is believed to settle this much-debated question conclusively.

MR. MOSSMAN, who has just spent six weeks on Ben Nevis, investigated the cases of glazed frost which occurred while he was there. The results he obtained are said to promise well for the extension of our knowledge of cyclones and anti-cyclones.

SOME months ago Mr. James Britten, the editor of the *Journal of Botany*, and Principal Assistant in the Botanical Department, British Museum, issued a circular notifying that the "Biographical Index of British and Irish Botanists," compiled by himself and Mr. G. S. Boulger, which has appeared in sections in the last three volumes of the *Journal of Botany*, would be reprinted in an amended and augmented form, provided that a sufficient number of subscribers could be found to cover the cost of reproduction. We regret to learn that this project is likely to fall through in consequence of the very small number that have responded to the appeal for a very small subscription. The work is so obviously valuable and interesting to all concerned in botany and horticulture, that we think it has only to be known to be in great demand.

AT the last meeting of the Russian Geographical Society, on February 18, Th. Tchernysheff made a communication about the expedition which has been engaged during the last two years in the exploration of the *tundras* of North-east Russia, and especially the Timansk Mountains. The expedition had an excellent scientific staff, including, besides the geologist, M. Tchernysheff, Prof. Backlund for determining latitudes and longitudes, a mining engineer, and a botanist. About 25,000 square miles of this almost quite unknown territory, were carefully mapped, and the geological and orographical data gathered by the expedition proved especially valuable.

Mr. William Davies, F.G.S., died on February 13, at the age of seventy-seven. For forty years he was connected with the Geological Department of the British Museum, from which he retired as senior assistant two or three years ago.

M. C. Reinwald, the *doyen* of the publishers in Paris, died suddenly a few days ago. He was the publisher of a number of scientific works, including translations of those of Darwin and Haeckel.

We are sorry to hear from St. Petersburg of the death of K. I. Maximowicz, member of the Russian Academy of Sciences, the author of well-known botanical works. He had lately been engaged in the description of the floras of Tibet, Central Asia, and Mongolia, as represented by the rich collections of Prjevalsky and Potanin. The Russian Geographical Society has lost N. L. Puschin, well known in Russia for his hydrographical works, and especially for a work upon the hydrography of the Caspian Sea. We have also to record the death of Prof. Alexeyeff, of Kieff, one of the most active and able of Russian chemists.

The donations reported at the meeting of the Royal Botanic Society on Saturday last included one from Messrs. Dakin of an extensive and interesting collection of samples of the more curious forms of tea, many of which are never seen in use in Europe or known in commerce. To these kinds of tea, extraordinary virtues are attached in China and the East, and some command fabulous prices. Several varieties of growing tea-plants from the Society's greenhouses of economic plants were on the table in illustration.

On Thursday next, March 5, Prof. C. Meymott Tidy will begin a course of three lectures at the Royal Institution on "Modern Chemistry in Relation to Sanitation."

Archæologists have, of course, been profoundly interested by the recent discovery of a vault filled with mummies and funereal coffers at Deir Elbahiri, near the plain of Thebes. The Cairo correspondent of the *Times*, telegraphing on February 24, gives the following as the latest details :—The site of the discovery is east of the Temple of Queen Fatasou, in a small spot previously undisturbed, amidst the excavations made by the late Mariette Bey and Brugsch Pasha. A well-shaft of 15 metres leads to a doorway blocked with large stones, opening on a gallery 73 metres long, whence a staircase descending 5½ metres conducts one to a lower gallery 12 metres in length, both lying north and south. The lower gallery gives access to two mortuary chambers, four and two metres square respectively. At the top of the staircase is a transverse gallery, 54 metres long, lying east and west, the object of which is unknown. The total underground area is about 153 metres, excavated in the limestone rock to over 65 feet below the surface. The same disorder reigned amongst the contents of the tombs as was found when the famous Royal mummies were discovered nine years ago. Sarcophagi were piled upon sarcophagi, and alongside were boxes, baskets of flowers, statuettes, funereal offerings, and boxes crammed with papyri. There is every indication that the place, though originally constructed as a vast tomb, was chosen for hurried concealment in time of tumult. Some of the exteriors of the mummy-cases are unusually richly decorated with religious subjects, carefully depicted ; others of large size enclose mummies in a broken condition, and were apparently procured hastily, as the spaces for the occupants' names are left unwritten upon. The contents of the papyri are as yet unknown, but hopes are entertained that the writings are of permanent historical interest and have been thus hidden to avoid destruction. The mummies are priests and priestesses of Ammon, Anubis, Seti, Mentou, and Queen Aahotep, numbering 163, the latest belonging to the 21st dynasty. Seventy-five papyri were found in boxes in the form of statuettes of Osiris. Each mummy is also expected to contain more or less valuable manuscripts. The collection is *en route* in barges by the Nile, and will probably reach Cairo in a few days.

The *Université de Montpellier*, a paper recently started in the city of Montpellier, publishes an interesting series of articles by Prof. C. Flahault, on the organization of higher education in Sweden and Denmark.

Dr. G. v. Lagerheim, the Professor of Botany at Quito, has been entrusted with an investigation of the Cryptogamic Flora, of Ecuador, at the expense of the Government. In the course of the next eighteen months he hopes to have completed his monographs of the Uredineæ and of the Freshwater Algæ of Ecuador.

In the neighbourhood of Ascholtshausen, in Bavaria (according to the *Moniteur Industriel*), a species of coffee is successfully cultivated on sandy soil. It is sown in spring, and begins to flower in July (the flowers sky-blue) ; the fruit ripens in August, and is pale yellow, like Bourbon Island coffee. The taste of this coffee is said to be very pleasant, though slightly more bitter than foreign coffee. Several families in the district named grow all their own coffee.

As a small, isolated territory, the Andaman Islands, which have been under scientific observation since 1858, afford excellent scope for studying the growth of new plants, intentionally, accidentally, or naturally introduced. Dr. Prain, of Sibpur, has studied the subject, and gives some particulars in a long paper contributed to the Journal of the Asiatic Society of Bengal. Mr. Kurz made a list of the Andaman flora in 1866, recording 520 indigenous species, and the number has since been raised by persistent search to 600. The general points of Dr. Prain's discoveries are, that in 1866 fifteen intentionally introduced plants and "sixty-one weeds of cultivation" had become established as an integral portion of the Andaman flora, and that by 1890 twenty-three more of the first and fifty-six more of the second had been added. He also observes that four of the naturalized plants noted in 1866 have disappeared. By "weeds of cultivation" is meant weeds whose seeds have been carried thither unintentionally. With very few exceptions they are the commonest of Indian road-side and rice-field weeds. A common Indian butterfly has made its appearance since the plant on which its larva feeds became naturalized.

An instrument, called the *hæmatokrit*, has been lately invented by Herr von Hedin ; it is for determining the volume of corpuscles present in blood, and is based on centrifugal action. A volume of blood and one of Möller's liquid (which prevents coagulation) are mixed together, and the mixture is brought into small thick-walled glass tubes, graduated in 50 parts. The tubes rest on a brass holder which is fixed on the axis of a rotation-apparatus. After some 8000 rotations, in 5 to 7 minutes, the process is complete. The separation between the corpuscles and the salt-plasma is more distinct, in that a narrow band of leucocytes appears between them. The instrument is useful in comparing the blood of different individuals. With a little practice, the total error is not more than one volume per cent.

Señor R. A. Santillan has published a meteorological bibliography for Mexico (Mexico, 1890) which—although comparatively little has been published in that country—will be very useful for reference. Until the middle of this century very few persons paid attention to that science ; the first trustworthy observations were made by Alzate in 1769, and from that time none appear to have been taken until those by Dr. Burkart, in 1826. But since the foundation of the Central Observatory, in 1877, many stations have been established in all parts of the country. The publication in question includes the titles of 228 eparate works and articles in Transactions, &c., arranged under (1) authors, (2) anonymous works and reports by institutions, and (3) articles relating to Mexican meteorology in foreign periodicals. There is also a list of works on earthquake phenomena, and a classified index of subjects for easier reference.

THE Burmah Administration Report for the past year says that the total approximate area topographically surveyed in Burmah last year was 31,680 square miles, of which nearly 9620 square miles were surveyed by the Anglo-Siamese Boundary party. The total cost of these surveys was £16,880. A cadastral survey party worked in Kyaukse from November 1889 till July 1890, and surveyed 550 square miles, at a cost of over £18,500. Surveys of State lands were undertaken in several districts in Upper Burmah by small detachments of local surveyors. These parties surveyed nearly 81,000 acres in six districts.

SODIUM amide, NH_2Na, forms the subject of a communication by M. Joannis to the current number of the *Comptes rendus*, This interesting compound was supposed to have been obtained by Gay Lussac and Thénard in the form of an olive-green readily fusible substance, by heating metallic sodium in ammonia gas. The product of this reaction, however, can scarcely have consisted of pure sodamide, for M. Joannis has now obtained the isolated compound in well-defined colourless crystals, and analyzed it. He first prepared the curious substance sodammonium, first obtained by Weyl, who liquefied ammonia by heating the compound of ammonia with silver chloride at one end of a sealed tube and allowed the liquid to collect at the other cooled end of the tube in contact with metallic sodium. It has been stated that the deep blue liquid thus formed is merely a solution of sodium in liquid ammonia. However this may be, M. Joannis finds that sodammonium decomposes spontaneously at the ordinary temperature into hydrogen and sodamide. NH_2Na. The decomposition occurs rather more quickly in sunshine than in the dark, but under any circumstances is very slow, only about a third of a cubic centimetre of hydrogen being evolved per gram of sodammonium in twenty-four hours. As the decomposition slowly progresses, however, small transparent colourless crystals make their appearance, whose average diameter is about one millimetre. Upon analysis, they yield numbers agreeing with the formula NH_2Na. When thrown into water a most lively action occurs, just as if the crystals had consisted of globules of red-hot metal, violent hissing occurring without the evolution of any gas except water vapour. The solution is found to contain only soda and ammonia. Sodamide may be prepared in much larger quantities and in very much less time by allowing saturated water solutions of sodammonium and sodium chloride to react upon each other at the temperature of melting ice. Under these conditions hydrogen is liberated to the extent of one equivalent for every equivalent of sodammonium. The solution remains blue until the sodium chloride is in excess, when it becomes colourless. The white solid product of this reaction is then washed with liquefied ammonia (NH_3) to remove the sodium chloride; the last traces of chlorine are found to be eliminated after several such washings. The residual substance is sodamide. This remarkable action of sodium chloride is due to the formation of an unstable intermediate compound, NH_2Na_2Cl, which is obtained, mixed with sodium chloride, when metallic sodium is treated with excess of sodium chloride in presence of a quantity of liquefied ammonia insufficient to dissolve the whole of the sodium chloride. On treating the compound with further quantities of liquefied ammonia it is decomposed into sodium chloride which dissolves, and sodamide which is left in a pure state. This compound, NH_2Na_2Cl, behaves quite differently with water to sodamide; it dissolves quietly without the least hissing, with formation of a solution of ammonia, soda, and common salt.

THE additions to the Zoological Society's Gardens during the past week include a Macaque Monkey (*Macacus cynomolgus* ♀) from India, presented by Mr. Henry Williams; a Green Monkey (*Cercopithecus callitrichus* ♂) from West Africa, presented by Mr. A. Mann; a Grey Ichneumon (*Herpestes griseus* ♀) from India, presented by Mr. J. Seymour Bartlett; a Jack Snipe (*Gallinago gallinula* ♂), a Common Buzzard (*Buteo vulgaris*), British, presented by Mr. W. H. St. Quintin; a Little Grebe (*Tachybaptes fluviatilis*), British, presented by Miss E. Bartlett; two Burbot (*Lota vulgaris*) from the Trent, presented by Mr. T. F. Burrows; a Scaup (*Fuligula marila* ♂), a Curlew (*Numenius arquata*), European, purchased.

OUR ASTRONOMICAL COLUMN.

THE SOLAR SPECTRUM AT MEDIUM AND LOW ALTITUDES.—Dr. Ludwig Becker, of the Royal Observatory, Edinburgh, has made a series of interesting observations of the solar spectrum at medium and low altitudes (Trans. Roy. Soc. Edin., vol. xxxii. Part 3, 1890). The region observed was between the wave-lengths 6024 and 4861. The method usually adopted for determining the wave-lengths of lines in the solar spectrum is by means of the reading of the vernier attached to the observing telescope. Dr. Becker has determined them by clamping the telescope, and recording the exact positions of a movable diffraction grating when the lines are successively brought to the fixed cross-wire in the field of view. Using one of Rowland's gratings, the angular interval between the two positions of the grating which bring the components of the E_1 line to the same direction was one second of arc in the second-order spectrum. This small angular movement has been multiplied 16,800 times by gearing several pairs of wheels and pinions together, and attaching the grating to the fastest wheel of the train. To make an observation, the observer turns the slowest wheel. The motion is transmitted by means of other wheels and endless screws, until it slowly rotates the grating and causes the lines of the spectrum to move across the fixed field of view. When the line under observation coincides with the intersection of the wires, the observer depresses one or more needles according to its degree of blackness, and the pricks thus made are recorded on a fillet of paper which is moved by another specially devised piece of apparatus. As to the linear distances between two lines on the paper, it is noted that the D lines are 19¾ inches apart, whilst the whole region of observation, λ 6024 to λ 4861, requires a strip 314 feet long. With respect to the work done, it need only be said that the memoir contains a catalogue of 3637 lines of the solar spectrum, including 928 telluric lines, between the above-mentioned limits. If 28 lines be excepted, the whole telluric spectrum is found by these observations to consist of three bands ranging from λ 6020 to λ 5666, λ 5538 to λ 5386, and λ 5111 to λ 4981, and containing respectively 678, 106, and 116 lines. Dr. Becker's investigations, combined with the results obtained by other observers, lead him to believe that the water-vapour lines of the first of the above-named bands are split into two distinct groups by a band of faint lines, which are probably due to oxygen. These two groups have been called the rain-band and the δ-band. They were known to Brewster, and his drawing of telluric absorption bands gives also the other two bands under the designation ζ and ι, besides some other bands which do not appear to be due to atmospheric absorption.

The water-vapour band (ι) between *b* and F is described by Ångström as very strong in summer. It is the same which Mr. Maxwell Hall has utilized as a rain-indicator at Jamaica.

Dr. Becker's memoir is a most important one, and all the methods of observation and reduction of observations are fully explained. The probable error in the determination of wave-length from the fillet of paper is said to be about $\pm$ 0·02 $\mu\mu$, but, of course, differs slightly with the intensity of the line observed. The catalogue of lines contains oscillation frequencies, as well as wave-lengths, and many details of value. The maps have been well reproduced by photo-lithography, and show the intensities of blackness of the solar and telluric lines as they would appear at medium altitudes of the sun for an average amount of water-vapour, and the intensities of the telluric lines only when the apparent altitude of the sun is 1° or 2°. It is unnecessary to comment upon this addition to our knowledge of the telluric spectrum. The author must be glad that his laborious observations have led to such tangible results.

A METHOD OF MEASURING ATMOSPHERIC DISPERSION.—At the Paris Academy on February 16, M. Prosper Henry described a novel method for determining atmospheric dispersion and its variation with the wave-length of the light observed. A *reseau*, formed of Bristol board perforated very regularly with holes about 1 millimetre apart, was placed in front of the object-glass of a telescope as a diaphragm. When a luminous point, not affected by atmospheric refraction, is observed through this arrangement, a double series of spectra are seen besides the central image of the point. M. Henry shows that by knowing the zenith distance of a star, and the size of the meshes of the *reseau*, the value of atmospheric dispersion (D) may be found by determining the angular distance of any particular part of the spectrum from the central luminous point. A large number of stars have been observed at Paris Observatory, and from them D has been found to be 0″·723 for eye observations, whilst the value 0″·729 has been deduced from photographs. The most probable value may therefore be taken as 0″·726. If the wave-length of the maximum light intensity of the spectrum be taken as 575 μμ, and the average amount of atmospheric refraction (A) for an object having a zenith distance of 45° be 58″·22, it is found that

$$A = 56''\cdot55 + \frac{0''\cdot726}{\lambda^{\frac{2}{3}}}.$$

This formula gives the following values for light of different wave-lengths:—

Wave-length. μμ	Average atmospheric refraction. ″
700	57·79
600	58·11
575 (maximum light intensity)	58·22
500	58·66
430 (maximum chemical intensity)	59·13
400	59·42

It will be seen that the most intense chemical rays give a value of A 0″·91 higher than that furnished by light of maximum luminosity.

The comparison of the different dispersive effects of the atmosphere on light of different wave-lengths indicates that, in the latitude of Paris, the green portion of the solar spectrum ought to be visible about a second after the disappearance of the yellow. This explains the phenomena noted by the late M. Thollon and other observers of the telluric spectrum. It is found that, in the majority of cases, the last light visible at sunset is in the blue part of the spectrum; this green or blue light is a limit of the visible spectrum when the sun is on the horizon, the more refrangible rays being absorbed by the atmosphere.

WOLF'S "RELATIVE NUMBERS" FOR 1890.—*Comptes rendus* for February 16 contain the "relative numbers" obtained by Wolf from a reduction, by the usual method, of the solar observations made at various Observatories in 1890. The following table shows the mean values (*r*) obtained for each month in the year, the mean variations (*v*) in magnetic declination observed at Milan, and the increments (Δ*r*, Δ*v*) that these quantities have received since the corresponding epochs of 1889:—

	Solar Observations.		Magnetic Observations.	
	r	Δ*r*	*v*	Δ*v*
Jan.	5·3	+ 4·5	3·02	+1·27
Feb.	0·6	− 7·9	4·81	+0·82
March	5·1	− 1·9	7·49	+1·32
April	1·6	− 2·7	8·68	−0·17
May	4·8	+ 2·4	7·70	−0·49
June	1·3	− 5·1	8·84	−0·02
July	11·6	+ 1·9	8·57	+0·32
Aug.	8·5	−12·1	8·00	−0·99
Sept.	17·2	+ 0·7	7·10	+0·26
Oct.	11·2	+ 9·1	8·72	+2·62
Nov.	9·6	+ 9·4	3·10	+0·55
Dec.	7·8	+ 1·1	2·54	+0·58
Means	7·1	+ 0·8	6·55	+0·51

NEW ASTEROIDS.—M. Charlois discovered (303) on February 11, Prof. Millosevitch (304) on the following day, and Dr. Palisa (305) on February 14.

THE BRITISH MOSSES.[1]

II.

LEAVES.—When we examine the leaves of mosses and compare them with the more familiar forms presented to us by the phanerogams, we find ourselves in a new world, and the interest with which we view them is increased when we remember that, according to the view usually accepted, they are, so to speak, a unique phenomenon: they are not the descendants of any earlier leaves nor the ancestors of any later ones; they appear thus once, as it were, in the history of the vegetable kingdom, and advance no further. They possess something of the charm which an ἅπαξ λεγόμενον exercises over the mind of a philologist.

We may first note what they are not. They are never opposite, never whorled, never on leaf-stalks, never truly veined, never lobed or compound, never furnished with epidermis or stomata.

When we turn to consider affirmatively what moss leaves are, we find them in some cases characterized by an extreme simplicity of form. They are single plates of similar cells without midribs, without veins, and without border; again, they stand in immediate connection with the atmosphere, absorbing moisture from it when moist, and shrinking and shrivelling when the air is dry. In some cases they are characterized by a marked difference in the form of the cells in the different parts of the leaf, and again in other cases by the unequal distribution of chlorophyll; in other cases we come across strange forms, the like of which we hardly know in the phanerogams: such are the thick border and double rows of teeth in some of the genus Mnium; the parallel plates in Polytrichum; and, stranger still, the third flange of the leaf in Fissidens, the true homology of which has proved a *crux* to bryologists.

In some cases the leaf is produced into a long thread or beak devoid of chlorophyll, and often with indented or toothed edges. This structure is found chiefly in mosses living on stones and rocks and in dry situations, such as Grimmia and Racomitrium, and the presence of these long white threads or beaks gives a grey tint to the whole moss; and in places where the moss is predominant (as, for instance, some parts of Dartmoor and North Wales, where Racomitrium abounds) a grey tint to the whole landscape. These long hairs and prominences, especially when armed with lateral teeth, no doubt retain the moisture which is necessary not only for the vegetative life of the moss, but also for the process of reproduction by archegonia and antheridia; hence it probably is that this form of leaf prevails in mosses living in dry situations, just as the thick leaves of succulent plants are found in similar situations.

The Roots or Rhizoids of the mosses are distinguished by the minuteness of their growing ends, by their pliancy, and by the presence on their exteriors of a balsamic or glutinous deposit. To these points of structure they owe their capacity to insinuate themselves into the minutest crevices of rock, to get, for instance, amongst the particles of the oolites, and also to fix themselves in the shifting sands of the sea-coast, and by so fixing themselves to give fixity in return to the sand, and so tend to produce the sand-dunes in many parts of the coast. At some parts of the Northumbrian coast the *Racomitrium canescens* may be found buried deep in the sand, from which it can scarcely be detached, and in like manner the sand-dunes of Holland and the west of France have in many places been fixed by mosses. The forests of firs on the North Sea and the Bay of Biscay thus owe their origin to humble mosses.

Sphagnaceæ.—Vast tracts of land in this country and throughout Northern Europe and America are covered with plants of this group, and large tracts which are now fertile agricultural land, where they have entirely ceased to grow, have in former times been occupied by them. The bogs of Ireland, which are mainly constituted of turf moss, were computed in 1819 by the Bog Commissioners to occupy 2,830,000 acres. No moss has probably ever, at least in the present state of the globe, played so large a part as the Sphagnum or peat moss.

Structure.—It is to the peculiar structure of the peat moss that this great part on the theatre of the globe is to be attributed.

Leaves.—In the young leaves the component cells are all alike; then by a differential growth we are presented with square cells surrounded by four narrow and oblong ones; then

[1] The substance (with omissions and additions) of a Discourse by the Right Hon. Lord Justice Fry, delivered at the Royal Institution, January 23, 1891. Continued from p. 382.

chlorophyll forms in these narrow cells, but is absent from the square cells; from these the contents disappear, and water or water-like fluid occupies the whole cell; subsequently annular and spiral threads develop on the walls of the square cells. The intimate structure of the leaf thus enables it to absorb great quantities of water.

But again, the shape of the leaves is in many species adapted to the retention of water. By a retardation of the lateral as compared with the mesial growth, the leaf assumes a boat shape. Often the edges of the leaves are turned over; the leaf thus affords means of holding water. Again, the lateral branches grow in groups from the stem, and some of these branches are generally pendent, and in close proximity to the stem, so that an immense capillary attraction is exerted by them.

Again, the *stem* itself is surrounded or rather is more than half occupied by large water-holding cells, and pitchers of a very peculiar form.

Again, the mode of growth of the plant, abandoning its moorings on the soil and throwing out roots into the water, and growing successively year after year, enables it not only to attain great growth, but also, when the occasion demands, to keep pace with the rise of the water in which it may be growing, "the individual thus becoming," it has been said, "in a manner immortal, and supplying a perpetual fund of decomposing vegetable matter." [1]

Physical Results from Structure.—The result of these peculiarities is that the entire plant of any species of Sphagnum is a perfect sponge. When dry it is capable (as may easily be found by experiment) of rapidly absorbing moisture, and carrying it upwards through the plant; and when growing in vast beds it acts thus on a great scale. Everyone who knows Scotland must know how on many a steep mountain-side, or on the bottom and sides of a gorge, these beds will hold up a great body of water against the force of gravity; and again, the Irish bogs are described as often ascending from the edges towards the interior, sometimes by a gradual, and sometimes by a sudden ascent, so that at times the bog is so high that it reaches the height of the church steeples of the adjoining country, without any rising ground intervening.

These peculiarities in the structure of Sphagnum have produced considerable physical effects.

(1) Everyone knows the different effects of rain falling on a land of bare rock or sand, like the Sinaitic desert, and on a porous soil; in the one case it produces a freshet or a flood, that leaves no trace behind; in the other it is held for a while in suspense, and only gradually passes into the streams. The glaciers and the Sphagnum beds of the mountains of Europe alike act as compensation reservoirs—receive large quantities of moisture as it falls, and retain it till the drier season comes, when it gradually passes away in part; but for these reservoirs, many of the rivers would exhibit a far greater shrinkage in summer and autumn than is now the case.

But (2) the Sphagnum beds have become peat, and have gradually filled up the ancient lakes and morasses, and turned water into dry land. It is true that peat appears under some circumstances to be formed by other vegetables than Sphagnum, and in all cases it has probably some other plants or roots growing amongst it. Mr. Darwin tells us that in Terra del Fuego and the Chonos Archipelago, peat is formed by two phanerogamous plants, of which one at least seems endowed with an immortality something like that of the Sphagnum; and the peat of the fens of Lincolnshire is formed mainly of *Hypnum fluitans*. But Sphagnum appears to be the main constituent of peat in Ireland, Scotland, and, so far as my researches have gone, in England; the peculiar spiral threads of the cells of the Sphagnum leaf being easily detected in the peat so long as it retains traces of its organic origin.

Ancient Forests.—The peat mosses, and the sea-shores of our islands and of the adjoining mainland, reveal, as it is very well known, traces of ancient forests. Many parts of England, nearly all the mainland of Scotland, the Hebrides, the Orkneys, and the Shetlands, Ireland, and Denmark, the shores of both sides of the English Channel, Normandy, Brittany, the Channel Islands, and Holland, and the shores of Norway, all bear evidence to the presence of these primæval forests; and what is more, to the successive existence of forests, each in succession living above the buried remains of the earlier ones.

[1] Macculock, "Western Islands," p. 130.

The following table will show the order of succession in the different species of trees in some of the places where this has been observed, the braces representing the co-existence of the trees:—

Island of Lewes.	England.	Scotland.	Denmark.	Danes Moor, near Macclesfield.
1. Oak.	1 { Oak.	1 { Oak.	1. Scotch fir	1. Scotch fir.
2. Elder.	Scotch fir	Scotch fir	2. Oak.	2. Larch.
3. Birch.	2 { Birch.	2. Birch.	3. Birch.	3. Oak.
4. Scotch fir.	Hazel.	3. Hazel.		4. Birch.
	3. Alder.	4. Alder.		5. Hazel.
		5. Willow.		6. Alder.
		6. Ash.		7. Willow.
		7. Juniper.		

What is the cause of the disappearance of these ancient forests one after the other? To this question various answers have been proposed.

The Romans, it has been suggested, in their inroads, cut ways through the forests and laid waste the land. But, wide as was the spread of the wings of the Roman eagle, the phenomenon in question is of far wider extension. They never conquered Denmark, or Norway, or Ireland, or the islands of Scotland: in Scotland, and even in England, their operations could never have covered the whole country; and as regards some of our peat mosses, we know that they must have existed long before the Roman invasion; for at least on the borders of Sedgmoor we have traces of their using peat for fuel as it is used there at the present day.

Still humbler agents have been invoked, in the supposition that the beaver and other rodents were the authors of the destruction of the forests. So far as I can judge, the cause suggested seems inadequate to the effect.

Again, changes in climate have been suggested. But, although there may be some evidence from the succession of the trees of a gradual amelioration in the climate, we know of no evidence of changes of so sudden and violent a character as would destroy the existing forests over large areas. Moreover, with few exceptions, the trees of the destroyed forests are such as are now found wild, or will grow easily in the spots where they lie buried.

The overthrow by storms has, again, been suggested as the cause of this wholesale destruction; and the fact that in some of the peat bogs of the west of Scotland the trees that have fallen lie to the north or north-east, and in some of those in Holland to the south-east, in the direction of the prevailing winds in those countries respectively, affords some reason to believe that wind has given the *coup de grâce* to the dying trees, and determined the direction of their fall. But it is much more likely that this was the work of the wind, than that successive forests should have been swept from the face of vast tracts of Europe by the agency of wind alone. Moreover, in some cases the trunks as well as the bases and roots of the trees are found standing or buried in the bogs.

Allowing that some or all of these agencies may have had their part in the destruction of the forests, I believe that the growth of Sphagnum has been the greatest factor in the work of destruction. "To the chilling effect of the wet bog mosses in their upward growth must be attributed," says Mr. James Geikie, "the overthrow of by far the greater portion of the buried timber in our peat bogs" (Trans. Roy. Soc. Edin., xxiv. 380).

In a letter written by Lord Cromarty, in 1710, on peat mosses, and published in the twenty-seventh volume of the Philosophical Transactions, we get a curious account of the swallowing up of a forest by a peat bog. In 1651 the Earl saw, in the parish of Lochburn (or, as Walker says, at Loch Broom, in West Ross), a plain with fir-trees standing on it, all without bark, and dead. Of the cause of their death he says nothing. Fifteen years after, he found the whole place a peat moss or "fog," the trees swallowed up, and the moss so deep that in attempting to walk on it he sank in it up to his armpits.

But, it will be said, assuming that this may be the case with one growth of forest, how about the successive destruction of successive forests? The answer is, I believe, to be found in the curious change which peat undergoes, and which converts it from a substance highly absorbent of water into one impervious to it.

The section exposed by a peat-cutting in, I believe, almost all cases exhibits two kinds of peat, the one known variously as red peat—or red bog, or fibrous bog, or in Somersetshire as white turf—which lies at the top, and the other, is a black peat, which lies at the bottom. The red peat retains visible traces of the Sphagnum of which it is mainly composed, and is highly absorbent of moisture; whilst the black peat has lost all, or nearly all, traces of the minute structure of the cells, and is not only unabsorbent of moisture, but is impervious to it. In fact, it constitutes an insoluble substance which is said to be scarcely subject to decay, so that it is used in Holland for the foundations of houses, and is found unchanged after ages, and when the buildings have fallen into decay. It is even said to have remained unchanged after three months' boiling in a steam-engine boiler. The broad difference between these two kinds of peat may easily be ascertained by anyone who will subject the two kinds to the action of water.

If we now take a section of a peat bog, with a succession of forests one above another, the history of the formation will be, I believe, much as follows:—

(1) We must get a water-tight bottom—sometimes this is a stiff clay, sometimes a pan, *i.e.* a stratum of sand or gravel made into a solid plate by the infiltration of insoluble iron oxides, themselves often due to decaying vegetable matter. The necessity of this water-tight bottom is well shown by the fact that in places in the Irish bogs where a limestone subsoil occurs the bog becomes shallow and dry.

(2) If on this clay bottom or sandy or gravel soil a forest arises, it may flourish for a considerable period, until the natural drainage of the area is stopped, whether by the choking up of the course of the effluent stream, or from the aggregation of vegetable matter, or from the fall in the course of nature of the trunks of the trees themselves. Everyone who will consider how much care our rivers require in order to make them flow with regularity to the sea—who thinks, for instance, of the works in the Thames valley, or in the upper valleys of the Rhine—will see how often and how easily, in a country in the condition of nature, stagnant waters will arise. In the morass thus formed the Sphagnum has grown, years after years, and if it has not destroyed the old trees it has prevented the growth of young ones. The stools of the trees buried in the antiseptic waters of the Sphagnum pools have been preserved, whilst the fallen trunks have, except when preserved by the like circumstance, rotted, and added their remains to the peat which the Sphagnum has been producing. It has been observed in several places in Scotland, that the under side of fallen trees which would be protected from decay by the tannin of the Sphagnum is preserved, whilst the upper side has decayed or rotted away. Year by year the process of decay on the lower parts of the Sphagnum goes on until the water grows shallower and at last disappears, leaving the original morass choked and filled up by the Sphagnum and the plants which it has nourished. On the top of this soil have grown first the heathy and bog shrubs which first succeed the Sphagnum, and in time, as the soil has grown more solid, forest trees. This is our second forest. This first peat deposit, or the lower part of it at all events, having been turned into the black peat impervious to water, plays the same part in the next stage that the clay or pan did in the earlier stage. Again, the drainage of this second level gets stopped, and the forest bottom is loaded with stagnant water, the home of the Sphagnum; together, the water and the Sphagnum kill the forest trees, which share the fate of their predecessors. The same history is gone through again—the Sphagnum filling up the morass and turning the water into dry land until it supports the third forest, and so on to the end.

Decay of the Moss.—Then comes, however, in many cases a time when this process is arrested; the artificial drainage of the soil, or the physical position of the area, prevent the re-formation of a morass, and the Sphagnum dies away. So in many parts, if not universally, in Sedgmoor, in Somerset, it is almost impossible to gather a bit of Sphagnum, and the peat is well known to the peat diggers not to be reproduced. Here the regulated drainage of the level maintains the surface in the condition of meadows or agricultural land. But in many cases, especially on mountain sides or tops, when the Sphagnum has died, and the peat undergone its last change into black earth, a process of decay sets in under the influence of air and water. The water lies in holes or "hags," or flows in sluggish streams, wearing away the dead peat; and the surface of the soil is broken and uneven, small patches of green surface with a rough growth of sedge or grass being surrounded by wider spaces of black earth. Such is, or was some years ago, the condition of the peat on the top of Kinder Scout in Derbyshire; on the parts of Dartmoor around Cranmere Port; and such also it is described to be on many of the Lowland hills of Scotland.

Sedgmoor.—In some cases the peat mosses have been originally arms of the sea, and the peat has only grown after the exclusion of the salt water. Such appears to be the history of Sedgmoor, the great plain of Central Somerset. Northward it is bounded by the Mendips; eastward lies Glastonbury with its Tor or hill; westward the Bristol Channel. The plain is intersected by the low line of the Pouldon Hills, once a long level-backed island in the estuary and afterwards in the morass: and the way in which the villages lie and the moor is apportioned between them suggests that the Pouldon Hills and some other spots which slightly rise above the level of the moss were the original seats of population. Originally this whole area appears to have been open to the Bristol Channel, of which it formed a bay or recess. The Burtle beds are a marine deposit well seen at the slight elevation on which the village of Burtle stands, which have been traced in various places along the borders of the moor and indicate the old line of beach. A curious confirmation of this geological fact is afforded by the presence—the one on Shapwick Heath, and the other near Glastonbury—of two plants (the *Rumex maritimus* and the *Vicia lutea*) which are shore plants, but which have until recently maintained their places as remains of the ancient marine flora, showing the retreat of the sea. The *Vicia lutea* has, I believe, recently succumbed in this interesting locality to the British collector. The description of Glastonbury as the Isle of Avalon, and the account of the bringing of the body of King Arthur from Tintagel to its resting-place at Glastonbury, are confirmations from tradition of the same fact.

Then a change came over the district, apparently by the formation of a barrier of sand or mud along what is now the shore of the Bristol Channel, and in that way the sea-water was shut out, and a depressed region left with a mud surface; on this the Sphagnum grew, and gradually filled it up, but leaving down to historic times spaces of fresh water from which the Abbots of Glastonbury formed their great fishing lake at Meare, by the side of which they erected the beautiful manor house and fish house which still remain. When the Romans occupied this part of England, they not only used the Burtle beds for plastic clay, but used the peat in their kilns, and the remains of the road which they constructed across the moor are now found some 6 feet below the present surface. In like manner, the Glastonbury monks formed a pathway across the moor from their own abbey to Burtle, where they appear to have had a chapel which they served. It consists of alder trunks laid crosswise so as to form a kind of corduroy road. Its remains near Westhay are said to be about 12 feet below the surface. Now, as I have already said, the system of drainage is so complete that the peat, when once cut, is not reproduced (though the lower soil is said to have a remarkable power of expansion and rises often to the old level), and the Sphagnum is to be found rarely if at all on many parts of the moor.

To the intimate structury of the turf moss are thus to be attributed great results in the history of the world. To look at our own island alone, but for it the primæval forests that once covered the land might still be standing; but for it large tracts of land would still be lake and mere; but for it every freshet in a highland river would be a flood; without it we should have had no mosses on the confines of England and Scotland, and where would have been the border warfare and the border minstrelsy? where the moss hags in which the hunted Covenanters sought for shelter and freedom of worship? Or, to come southward, by force of its growth the broad meadows of Somerset have been built up, and the dark waters on which the mysterious barge bore the dead Arthur from Tintagel to Avalon have been turned into the green pastures of Glastonbury and Meare and the battle-field of Sedgmoor.

FROM TONGKING TO CANTON.

THE paper read at the meeting of the Royal Geographical Society on Monday was on a journey from Haiphong in Tongking to Canton, overland, by Mr. A. R. Agassiz in the early part of 1890. He went by steamer from Haiphong to Phu-lang-thuong, thence to Langson and across the frontier into the Chinese province of Quang-si.

The country between Phu-lang-thuong and Langson is briefly described as follows:—First stage, to Kep: country perfectly flat and well cultivated. Second stage, to Bac-le: hilly, with numerous groves of bamboo and tropical trees. Third stage, to Than-moi: very hilly, some of the hills being well timbered. Last stage: cross mountain range, passing Thien-ho, situated at the highest point reached by the road, which is probably not less than 3000 feet above the sea-level. Langson stands in the centre of a small plain at the foot of these mountains; the French portion of the town and the citadel on the left bank of the Sung-chi-chiang river, and the native town on the right bank.

As to the Sung-chi-chiang river, its source is not exactly known, but Mr. Agassiz was assured by the officer in charge of the convoy with which he travelled that it enters Tongking from the province of Kuang-Tung. It then turns sharply to the north, passes Langson, and then flows on in the same direction to a place called That-khe, below which it is navigable for small boats. From here it takes an easterly course, and re-enters China (province of Quang-si) at Ping-erh-kuang. At Lung-chow, thirty miles farther, it unites with a river called the Kao-ping-ho, which rises in Yunnan, and crosses the north-east corner of Tongking, passing the French garrison town of Cao-bang.

At Chin-nan-kuan, after passing through a massive stone archway, Mr. Agassiz entered Chinese territory. There is a village here, but the town of Chin-nan is about two miles distant. Further on is Lung-chow, a walled city, said to contain 20,000 inhabitants. Many of the houses are of the bamboo-and-mud style of architecture; but the Yamens, and the residences of the better class of the people, are built of brick.

The only article produced in the district, that is not wholly consumed locally, is sugar, which is said to be cultivated with much success. Mr. Agassiz walked through many of the cane-fields, but could not see any cane that in point of size would compare with cane he has seen in the north of Queensland. The fields would have looked better for being trashed.

Nearly every planter possesses his own crushing machine, constructed in the following primitive way: two stout hard wood posts are placed firmly in the ground about 10 feet apart, and secured between them, at a height of 1 foot from the earth, is a plank 2 inches thick by 10 broad. On this plank, standing on their ends, and almost touching each other, with their lower axles fitted into holes bored in the plank, are two hard wood rollers, of 2 feet diameter. These rollers are connected at their upper edges by cogs, so that one cannot revolve without the other. Above them, with holes for their upper axles to fit into, is another plank, secured to the upright posts at its ends. The upper axle of one roller is longer than the other and protrudes a foot above the upper plank, with a hole bored through it, into which is fitted one end of a 15-feet pole. An ox, made fast to the other end of the pole, keeps the machinery in motion by walking round and round it, while a man, sitting on the ground, feeds the machine by placing the ends of the canes between the rollers, crushing five or six at a time. A trough beneath the machine catches the juice.

After remaining in Lung-chow for a fortnight, Mr. Agassiz started by boat for Canton on March 11, 1890.

Below Lung-chow the river is called the Tso-chiang or Left river; and is formed by the junction of the Sung-chi-chiang and Kao-ping-ho; none of which rivers are marked on any English maps of China.

Tai-ping, the only town of any size on this river, is situated on the left bank, three days' journey below Lung-chow.

On the 18th, four days after passing Tai-ping, Mr. Agassiz came to the junction of the Tso-chiang and the Yü-chiang, below which place, to its mouth near Macao, the river is called the Hsi-chiang, or West river.

The Yü-chiang, navigable up to the town of Pe-se, has long been one of the highways to the province of Yun-nan; but during the past year the opening of the Red River in Tongking has taken away much of its trade. Nan-ning, the most important town in Western Quang-si, is favourably situated about six hours' journey below the junction of the two rivers.

As to the general aspect of the country through which Mr. Agassiz travelled, its chief feature, and certainly a most striking characteristic, is the peculiar formation of certain hills, which, as Mr. J. G. Scott has said in his book "France and Tongking," are formed of a kind of prismatic limestone, and rise sheer out of the rice-fields to a height, in some cases, of 1000 feet. The first of these hills that Mr. Agassiz saw was a range on the southern side of the military post of Bac-le, in Tongking, after passing which he saw no more ranges, but numerous isolated hills. The mountains he crossed before entering Langson, which form the natural, although not the geographical, frontier of Tongking, are not of this formation. In the vicinity of Lung-chow, they are very plentiful, and in most cases have a peculiar turretted appearance. The river Tso-chiang passes frequently close under their perpendicular sides, and at times, when Mr. Agassiz was descending that river by boat, it required but a small effort to imagine one of these hills to be the ruin of a huge mediæval castle. Below Nan-ning, he saw no more of them, but at rare intervals.

Nan-ning is a large town, in fact, in point of population, it stands third on the list of the towns of this province.

Below Nan-ning, in some places ridges of rock stretched almost across the river, and the water, being thus partially dammed up would rush round the edge of a ridge, or through a breach in one, at a frightful rate.

At the junction of the Hung-shui-chiang and the Hsi-chiang, is situated the town of Hsun-chow.

With Hsun-Chow a traveller is likely to be disappointed, as its position induces one to expect to find a place of considerable commercial importance, which it is not. The city, surrounded by a wall, probably contains about 40,000 inhabitants; and as it is the chief town of one of the departments into which the province of Quang-si is divided, is a place of some official importance; but it has not the busy aspect of Nan-ning.

Below Hsun-chow the river is a splendid expanse of water, which might be rendered navigable to steamers by a slight expenditure of engineering skill.

In two days, after leaving Hsun-chow, Mr. Agassiz reached Wu-chow, the commercial capital of the province. This place is Canton on a reduced scale. Its houses, built, some of them, close to the water's edge; its boats, with an enormous floating population—for people here are born, live, and die in their boats; and the dress, and the general aspect of the people as they busily pass along its crowded streets, all recalled vividly to Mr. Agassiz the features with which he had formerly been familiar in the latter city.

The River Tan-chiang, on which is situated the town of Kwei-lin, the official capital of the province, here enters the Hsi-chiang, making Wu-chow a turning-point round which boats must pass when journeying between the chief towns of the two Kuangs, as the provinces of Kuang-Tung and Kuang-Hsi are frequently called. The Tan-chiang is, like so many of the rivers of China, variously named on different maps; on some it is called the Fu-ho.

Below Wu-chow the country is hilly, and the river deep to the Shao-hing gorges, through which it passes, with hills rising on either side to a height of 700 or 800 feet.

A short distance below the gorges the waters of the Hsi-chiang are augmented by the Pei-chiang, or North River; which is a very considerable stream, rising in the mountainous country on the borders of the Kuang-Tung and Kiang-Si provinces. Below this junction the Hsi-chiang begins to split up, and finds its way to the sea through many mouths. The great branch enters the ocean near the Portuguese colony of Macao, and rightly bears the name of the parent river whose first-born it is. Another branch, only second in size to the one already mentioned, is the Canton river, which enters the sea close to the historical Bogue Forts. Opposite to Canton this river divides into two branches, which lower down unite, forming the Island of Honam. The larger of these branches, called the Back Reach, was the one most used for the purposes of steam navigation; but since the time of the late Franco-Chinese troubles it has been closed by a barrier, which makes it impossible for ocean steamers to reach Canton, as the other branch, called the Front Reach, is too shallow for any but light-draught river steamers to ascend. Ocean steamers have consequently, for the past five years, been obliged to discharge their cargoes at Whampoa, twelve miles below Canton. The name "Canton

River" is by some map-makers already erroneously applied to the whole of the Hsi-chiang river. It would be as correct to call the River Ganges the "Hoogli."

THE ST. PETERSBURG ACADEMY OF SCIENCE.

WE have before us the yearly Report of the St. Petersburg Academy of Science, drawn up by its new secretary, Prof. A. A. Strauch; it is full of interest, as it gives a careful analysis of the scientific work done by the Academy. After having mentioned the losses sustained by the Academy, and the new members elected, Prof. Strauch passes in review the scientific institutions connected with the Academy. The Pulkova Observatory is now under the directorship of the Moscow Professor, Th. Bredichin, well-known for his researches into the structure of comets; the Physical Observatory, under H. Wilde, has added to its former weather warnings a system of warnings of snowstorms, which are sent to the Russian railways. A new laboratory for researches into the physiology and anatomy of plants has been opened; while the remarkable ethnographical and anthropological collections of the Academy (which contain the collections brought in by Krusenstern, Lütke, Junker, Miklukho-Maclay, Polyakoff, and so on), have been lodged in a separate museum, now opened to the public. Rich collections, especially zoological, from Caucasia, Turkestan, and Mongolia, were received during the past year. Among the recent acquisitions of the library, Mr. Friedland's collection of Hebrew printed works, old and new, some of which are very rare, is especially valuable.

As to the scientific work done during the last year, the following are especially worthy of notice.

In mathematics, Prof. Ishmenetsky, continuing his researches into the functions of Bernoulli, has shown the use which may be made of them to explain the geometrical meaning of Euler's formula for the approximate calculation of surfaces limited by curves; Prof. Markoff's work on the transformations of slowly convergent series into rapidly converging ones, and M. Bortkevitch's researches into the average duration of life in Russia, are also valuable contributions.

In astronomy, Prof. Backlund, besides geodetical work in the north of Russia, continued his calculations of the ephemerides of Encke's comet, which will reappear this year.

In physics, O. D. Chwolson's work upon the conductivity of metals at various temperatures is mentioned.

In meteorology, we find, besides a review of the already known publications of the Central Physical Observatory, special reference to H. Wilde's memoirs on a new (very practical) instrument of his own invention for measuring magnetical inclination, as also on his anemograph, registering pluviometer, and atmograph.

In chemistry, Prof. N. Beketoff continued his work upon the physical and chemical properties of cæsium and its oxides.

In geology, Dr. Rogon published an interesting work upon the Ganoid fishes of the Upper Silurian deposits of Oesel, as also on the Jurassic fishes of Ust-Balei in East Siberia. The six species discovered in these last deposits are intermediate forms between the Mesozoic Ganoids and the *Teleostei*. M. Tschersky's work is especially interesting: taking advantage of more than 2500 specimens (70 species) of fossil Mammalia discovered in Northern Siberia, he prepared a most elaborate monograph on Post-Pliocene Mammalia, which contains, first, a full account of what is already known about the Quaternary mammals in Siberia, a description of the Post-Pliocene formations of Siberia generally, and their mammalian fauna, with incidental remarks upon the fauna of the caves, and, finally, a very good systematic description of 25 Post-Pliocene mammals.

In botany, the work of Prof. Maximowicz on the flora of Tibet is prominent. This flora is of high antiquity, and consists, besides its own endogenous species, of immigrants from both the Himalayas and the mountains of Mongolia. Many of those immigrants have already evolved into distinct species. Later immigrants came from China, and, later on, the Tibet flora was completed by our familiar northern plants. The orographical division of Tibet into a plateau in the west, and Alpine tracts in the East holds good for the flora as well. As to the flora of Mongolia, it is an impoverished continuation of the flora of South Siberia. Prof. Famintsyn continued his researches into the symbiosis of Algæ with Infusoria. The green grains often seen in several Infusoria proved to be Algæ having a nucleus, chromatophores, and covered with a jelly-like envelope; their structure is identical with that of monocellular Algæ, and they multiply within Infusoria by partition. But they are incapable of an independent life, and die out soon after the death of the Infusorium they have lived in. Further research is now being carried on to ascertain in what conditions they might live independently.

In zoology, the chief work of the Academy consisted in the publication of the zoological results of Prjevalsky's expeditions. Two fascicules have now been issued containing the description of the Rodents, by E. A. Bichner, and the description of the families of *Silviidæ*, *Timeliidæ*, and *Accentoridæ*, by Th. Pleske. The chief interest of the latter fascicule is in the new genus of birds, *Lophobasileus*, which appears to be a connecting-link between the *Sylviæ* and the *Regulus*. S. M. Hertzenstein described some new fishes from the Russian Pacific coast, and E. A. Bichner made a preliminary review of a small but very interesting zoological collection brought in by MM. Potanin and Berezovsky from the Chinese province of Kansu, and now lodged at Irkutsk. Th. Pleske issued the fourth fascicule of his "Ornithographia Rossica," which contains the description of ten Russian species of *Acrocephalus*.

In anatomy and physiology, Prof. Owsiannikow continued his researches into the striation of some nerves, and Dr. Tarenetski described forty-four Aino skulls from the island of Saghalien. The author is inclined to admit that they belong to a race quite different from the Mongolian.

In ethnography the Report mentions the following works:—Dr. Bilenstein has terminated an important work upon the geographical distribution of the Letts, now and in the thirteenth century, in Courland and Livonia. In view of the capital interest of this work, it will be published by the Academy separately, with an atlas of maps. Prof. W. Radloff has published a *facsimile* of a most important document, the "Kudatku-bilik," which is the oldest representative of the Uigur language, and has, for Turkish dialects, almost the same importance as Ostromir's Gospel has for the Slavonian languages. To complete the historical and linguistic materials which will be associated with this publication, M. Radloff consulted the Eastern manuscripts of the British Museum, and is now preparing a general work upon the subject. In connection with the above, Prof. Eitling, of Strasburg, prepared for the Academy a table of Uigur, Mongol, and Mantschu alphabets, which shows that they originated from the Syrian alphabet. The likeness between Syrian and Uigur letters also permits us to guess the sounds which separate letters had in the Uigur language. Prof. Wasilieff's notes on his journey to West Siberia are also worthy of note. The learned Professor is now preparing a work on the geography of Tibet, as well as the second volume of his great work on Buddhism. Finally, M. Katanoff (of Sagai origin) visited, last year, Northern China and Turkestan, and collected a good many interesting materials relative to the Tartars, and especially the now rapidly disappearing Soyotes. His collection of tales, songs, Shaman prayers, &c., is remarkably interesting, the more so, as all has been written down in the Soyote language (with Radloff's Turkish alphabet), and transcribed for print, on the spot, among the Sagais, who speak the Soyote language correctly.

P. K.

A METHOD OF DETERMINING SPECIFIC GRAVITY.

THE specific gravity of a single Foraminifer, such as a Globigerina, of the scales from a butterfly's wing, or of a drop of its blood, might seem a difficult task to ascertain, as indeed by the ordinary gravimetrical methods it would be plainly impossible. Yet nothing can be easier, given the following method. And to conduce to brevity we shall describe its application in a particular case, say to the spicules of the common shore sponge (*Halichondria panicea*). A quantity of one of the well-known heavy fluids, such as cadmium-boro-tungstate, or potassium-mercury-iodide solution, or methylene iodide, is diluted down to a density of about 2·25 (which is known to be above that of the spicules), and introduced into a small glass tube, about one-quarter of an inch in diameter, and with two opposite flattened faces. This is cemented by one of its flat faces to an ordinary microscope slide, the axis of the tube being set at right angles to the length of the slide.[1] The tube being about half-filled with heavy fluid, water (or in the case of methylene iodide,

[1] See Proc. Roy. Dublin Soc., vol. iv. p. 374, 1885, and Journ. R. Micr. Soc., vol. v. p. 679.

benzole) is poured in, and this not too carefully, since partial admixture will serve to expedite the process. The vessel is now left to stand for a few hours or over-night. In the morning the change in the specific gravity of the column of fluid will be found to increase *uniformly* on passing from the top downwards. To make certain of this three small indexes of different specific gravities, say 2·15, 2·03, and 1·98, are thrown in: naturally they sink till they each reach that level in the column where the specific gravity is identical with their own—"their own level," as we may briefly term it. The distances between them may be determined by bringing them successively into the focus of the microscope, and then reading off the position of the edge of the microscope slide by means of two parallel scales attached to the stage of the instrument.

If it be found that these distances are exactly proportional to the known differences of specific gravity, then the increase in density of the column must be uniform. It will save arithmetic if the distances and densities be referred to two rectangular axes, and a curve constructed; evidently when the change in density is uniform, the curve will be a straight line.

The sponge spicules are next introduced (in practice they are added at the same time as the indexes), and, like the indexes, sink to their own level. The position of this is read off as in the case of the indexes, and being referred to the axis of distances in the diagram, the specific gravity will be found on the corresponding axis of density. In this way it is easy to determine the specific gravity of individual spicules, and with a certainty that does not always attach to specific gravity determinations on large bodies by ordinary methods. The specific gravity of the spicules as a result of actual experiment is found to be 2·036, the great bulk of them floating at a level indicating this, but individual examples may sink to 2·09, while others do not fall below the level of 2·02.

It is only rarely that one needs to employ a microscope in this method; usually a test tube serves admirably to hold the heavy fluid, and a graduated glass mirror affords the speediest means of reading off the distances of the levels. So easy, accurate, and sure, has experience shown this method to be, that I now use it whenever practicable in preference to any other: unfortunately its range is limited to specific gravities below 3·45.

The indexes may be small fragments of minerals, or chemically pure substances of known density, such, for example, as yellow phosphorus (1·85), sulphur crystallized from carbon disulphide (2·07), and the like; or little floats may be made by manipulating short lengths of capillary glass tube. The ends of the bit of tube are successively sealed, the last to be fused generally blowing out into a little bubble during the process, and thus giving a form to the float which causes it to assume the vertical position when suspended in the heavy fluid. The quantity of solid glass in the float as compared with hollow, is determined chiefly during the sealing of the first end, since this merely fuses together without blowing out. Having constructed a good supply, some dozens, of these floats, they are thrown into a diffusion column along with three mineral indexes of carefully determined density: by reference to these, the specific gravity of each float can be found, and it can then be fished out from the fluid with a dipping tube, and preserved in a labelled box for future use.

The density of fluids can be ascertained in the same way as that of solids; but if the fluid be watery, an oily fluid such as methylene iodide, with benzole to dilute it, must be used for the diffusion column; while if it be oily, the diffusion column must be an aqueous solution, it may be of cadmium-boro-tungstate, or some other heavy salt.

There is, finally, one other case in which density can be determined by this method, while all others fail: given a gelatinous precipitate, like some of the silica hydrates, in which one has a sponge of loosely combined hydrate with additional water mechanically present filling the meshes, to find the specific gravity of the hydrate. This is not possible by ordinary methods, for one cannot be sure that no combined water is lost in the process of drying, which must precede the application of gravimetrical processes. But if a small clot of the gelatinous substance be introduced into a diffusion column, the mechanically mixed water will slowly diffuse out, and its place be taken by heavy fluid till the hydrate has reached its own level, where it will rest, its meshes then being filled, no longer simply by water, but by solution of the same specific gravity as its own. I am at present investigating the composition of the silica hydrates by a process based on this method. W. J. SOLLAS.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—The General Board of Studies propose to appoint Mr. J. J. Lister, M.A., of St. John's College, Assistant to the Superintendent of the Museum of Zoology and Comparative Anatomy (Mr. J. W. Clark) for a period of three years. He will give special attention to the preparation of a new Catalogue of the Museum.

The Mechanical Workshops Inquiry Syndicate make proposals which virtually amount to the establishing of an Engineering School and Laboratory under Prof. Ewing, by recommending an annual expenditure of some £700 for demonstrations and apparatus. Another Syndicate report in favour of reserving a considerable area of ground between the Chemical and the Physical Laboratories for buildings in which the Engineering School may be accommodated. But the erection of these buildings and their equipment with suitable plant depend on a handsome response being made to the appeal for funds from outside the University which Prof. Ewing has in contemplation. It is to be hoped that his energy and fervour in the cause of engineering education in Cambridge may be adequately rewarded by generous benefactions to the Engineering School.

The Sites Syndicate propose that the remainder of the ground available in the New Museums area should be assigned (1) to the necessary extension of the Cavendish Physical Laboratory; (2) to the Botanical Department for new class-rooms, &c.; (3) to the Departments of Medicine, Surgery, &c.; (4) to the Sedgwick Memorial Museum of Geology; and (5) to the temporary accommodation of the Classical and Modern Language Lecturers. The Syndicate have been unable to assign special rooms to the Lecturer in Geography.

SCIENTIFIC SERIALS.

American Journal of Science, February.—A solution of the aurora problem, by Prof. Frank H. Bigelow. The question considered is the location in space of the visible aurora arch and streamers, referred to the surface of the earth, as seen by an observer. The observations required to test the theory which is developed consist in measuring the angle of inclination of a streamer to the vertical plane passing through the station, together with the azimuth of the ray. A simple piece of apparatus, suitable for such measurements, is described. The problem is of importance, because it bears upon the physical connection between the sun and the earth, as communicated through the medium of the ether.—Columbite and tantalite from the Black Hills of South Dakota, by W. F. Headden. A full description is given of the constitution of these minerals.—Note on the geology of the Florida phosphate deposits, by N. H. Darton.—Record of a deep well at Lake Worth, Southern Florida, by the same author. The well penetrated the great sand mantle at Lake Worth, and extended down into the Vicksburg limestone to a depth of 1212 feet. The section obtained from the borings is an important one, inasmuch as it throws some light on the general stratigraphy of a portion of Florida of which little was hitherto known.—On the chemical composition of aurichalcite, by S. L. Penfield.—The compressibility of hot water and its solvent action on glass, by Carl Barus. As a general deduction from the experiments, the author infers that in many instances a definite dissociation temperature of the solid must first be surpassed before solution will set in.—An attempt to harmonize some apparently conflicting views of Lake Superior stratigraphy, by S. R. Van Hise.—Powellite calcium molybdate, a new mineral species, by W. H. Melville.—Brückner's "Klimaschwankungen," by Frank Waldo. This is an extended review of Dr. Edward Brückner's important work on oscillations of climate, published last year.—The gigantic Ceratopsidæ, or horned Dinosaurs of North America, by O. C. Marsh (with ten plates); read at the Leeds meeting of the British Association for the Advancement of Science, 1890.

Bulletin de l'Académie Impériale des Sciences de St. Pétersbourg, new series, vol. i. No. 4.—On the products of condensation of benzaldehyde and the phenols, by A. Rusanoff (in German).—List of the (thirteen) *Scotylus* species in the Museum of the Academy, by P. Shevyreff Two species (*S. ventrosus* and *S. unispinosus*) are new.—On some observations made by Winnecke at Pulkova with the meridian circle in 1861-63, by O. Backlund (in German).—

New anemograph and anemoscope, by H. Wild (in German). The former has been at work at St. Petersburg since 1887, and gives satisfactory results; the second, which is a simplification of the former, has been in use at St. Petersburg and Pavlovsk for more than ten years, and also works quite satisfactorily.—On the law of reciprocity of quadratic residues, note by Ed. Lucas (in French).—On the structure of nerve-filaments, by Ph. Owsjannikoff.—Apocryphal Acts of Apostles in Coptic language, by O. Lemm (in German).

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, February 5.—"On a Membrane lining the Fossa Patellaris of the Corpus Vitreum." By Prof. T. P. Anderson Stuart.

The existence of a membrane here had been the subject of discussion *pro* and *con.* till 1886-87, when the matter was considered by some to have been finally set at rest by Schwalbe, who decided against it in very clear and explicit terms. According to his description the vitreus jelly itself lies against the lens capsule and forms the posterior boundary of the canal of Petit—if such it could be called, for the canal, he says, is merely to be compared with the other clefts in the vitreus. Any membrane that had been seen he declares to be an artificial product, the result of the action of reagents. The author finds, however, that in the perfectly fresh, unaltered eye, after the removal of the lens in its capsule, there may be raised off the surface of the jelly a membrane which, when stained and mounted, does not show any structure. When the membrane from the four-year-old ox eye was isolated and tied over the mouth of a test-tube ½ inch wide, it sustained a column of water 40 inches high. A smaller column than this may be sustained for days together. When isolated, it may be dried to form a delicate membrane. It is thinner in the centre where it lies against the lens capsule, thicker peripherally where it forms the posterior wall of the canal of Petit, which is thus a true canal. Thus, when the entire vitreus is squeezed, the centre of the anterior face bulges more than the periphery. The line of demarcation of the two parts is fairly sharp. The sun's rays concentrated upon it show fluorescence as marked as in the case of the hyaloid, and at a puncture the sharp fluorescent edge is strikingly different from the jelly showing through the hole. Treated with picrocarmine by the Gross method (to be described in the next number of the *Journal of Anatomy and Physiology*), the membrane is red, the jelly is yellow, and now its wrinkles are seen just as in the case of the hyaloid. In successful meridional sections the membrane is seen *in situ.* For ophthalmological practice, a knowledge of the existence of the membrane is most important, and the observations of ophthalmologists strongly support the author's observations.

"On the Connection between the Suspensory Ligament of the Crystalline Lens and the Lens Capsule." By Prof. T. P. Anderson Stuart.

The common teaching is that there is a direct continuity of substance between the suspensory ligament and the capsule of the lens, but an observation by the author of the paper seems to indicate that the ligament is only cemented to the capsule. On opening eye-balls in an advanced state of decomposition—putrid—he found the lens in its capsule perfectly free, and no indication of any rupture of tissue along the line of attachment of the suspensory ligament. This ligament was found perfectly intact projecting from the collapsed vitreus body as a sort of frilled ring with a free edge. These points are best seen after the Gross staining of the structures, as described by the author in the next number of the *Journal of Anatomy and Physiology.* The observation bears upon the still unsettled question of the development of the lens capsule, and upon cases of detachment of the ligament from the capsule sometimes met in ophthalmological practice; also on cases of atrophy and solution of the suspensory ligament, and cases of luxation of the lens.

"A Simple Mode of Demonstrating how the Form of the Thorax is partly determined by Gravitation." By Prof. T. P. Anderson Stuart.

Remembering how constant and how potent is the action of gravitation, and arguing that the segments of the thorax were so many rings of more or less elastic matter, the author concluded that, if similar rings of any other elastic material were suspended in the same way, the form of the thoracic segments should be reproduced, provided there intervened no other condition strong enough to counteract the action of gravitation. The author has found crinoline steel most convenient, though bands of paper do very well. The form of the thoracic segment of the quadruped, of the human fœtus, and of the human adult, are reproduced in succession if the ring be held between finger and thumb, and turned, from lying in the vertical, till it lies in the horizontal plane. The complete reproduction of the different features of the adult human thorax at its most characteristic level is most striking. This is when the steel, as usually sold, is about 6 feet long and ½ inch wide. As the ring is made smaller, the forms of the higher segments appear in succession. The points which are thus reproduced are so numerous and simultaneous that the author cannot believe them to be mere coincidences, and he therefore concludes that gravitation has had a greater influence in determining the typical form of the thorax than would be generally admitted. This is supported by the shapes assumed by the steel rings when the mode of suspension is varied from the normal, as in deformities of the vertebræ: here the particular form in the individual—the thoracic deformity—is more or less accurately reproduced.

Physical Society, February 13.—Annual General Meeting.—Prof. A. W. Reinold, F.R.S., Past-President, in the chair.—The reports of the Council and Treasurer were read and approved. From the former it appears that there has been a satisfactory increase in the number of members, and in the average attendance at the meetings. During the year a translation of Prof. Van der Waals's memoir on the continuity of the liquid and gaseous states of matter has been issued to members, and it is hoped that the translation of Volta's works, now in hand, will be published before the next general meeting. The Council regret the loss, by death, of Mr. W. H. Snell and Mr. W. Lant Carpenter, and obituary notices of these late members accompany the report. The Treasurer's statement shows that the financial condition of the Society is very satisfactory, and that the sales of the Society's publications have increased considerably.—A vote of thanks, proposed by Mr. Whipple and seconded by Dr. Gladstone, was unanimously accorded to the Lords of the Committee of Council on Education for the use of the room and apparatus. Dr. Atkinson proposed a vote of thanks to the auditors, Prof. Fuller and Dr. Fison, which was seconded by Dr. Thompson, and passed unanimously. The proposer, in referring to the satisfactory nature of the accounts, recommended that the publications of the Society should be brought before physicists and other students of physical science, and Dr. Thompson heartily concurred in this recommendation. A third unanimous vote was accorded to the President and Officers for their services during the past year, the proposer and seconder being Dr. Waller and Prof. Minchin.—The following gentlemen were declared duly elected to form the new Council: President: Prof. W. E. Ayrton, F.R.S.; Vice-Presidents: Dr. E. Atkinson, Walter Baily, Prof. O. J. Lodge, F.R.S., Prof. S. P. Thompson; Secretaries: Prof. J. Perry, F.R.S., T. H. Blakesley; Treasurer: Prof. A. W. Rücker, F.R.S.; Demonstrator: C. V. Boys, F.R.S.; other members of Council:—Shelford Bidwell, F.R.S., W. H. Coffin, Major-General E. R. Festing, R.E., F.R.S., Prof. G. F. Fitzgerald, F.R.S., Prof. J. V. Jones, Rev. F. J. Smith, Prof. W. Stroud, H. Tomlinson, F.R.S., G. M. Whipple, James Wimshurst.—The meeting was then resolved into an ordinary science meeting, and a paper on the change in the absorption spectrum of cobalt glass produced by heat, by Sir John Conroy, Bart., was read by Mr. Blakesley. The absorption spectrum of cobalt glass, when cold, consists of three dark bands in the red, yellow, and green, with a considerable amount of absorption between the first two. When a piece is heated to nearly red heat, the absorption between the first two dark bands diminishes, and the band in the red moves towards the least refrangible end of the spectrum, whilst those in the yellow and green retain their position, but become less distinct. During the heating of the glass the intensity of its colour diminishes, and as the glass cools its original colour and absorption spectrum returns. Diagrams and numbers showing the character and positions of the bands in hot and cold glass accompany the paper, together with the numbers obtained by Dr. W. J. Russell (Proc. Roy. Soc., xxxii. p. 258) for cold cobalt glass. In conclusion, the author says that these observations, and those of Feussner on solutions, show that the absorption spectra of some substances vary with temperature. In solutions, this may be due to formation of different hydrates or to partial dissociation, but in a solid like cobalt glass an actual change in its chemical constitution at a temperature considerably below its fusing point does not seem probable. Dr. Gladstone said it was generally known that heat affects the colouring power of substances, and that in solutions absorption is greater the higher the temperature. Different solvents sometimes produce effects analogous to heat, for cobalt salt dissolved in water and in alcohol gives pink and blue solutions respectively, and rise of temperature makes the aqueous solution more blue. He concurred with the author as to the causes of the phenomena in liquids, and that the same explanation would not apply to glass. Prof. S. P. Thompson thought Sir John Conroy's results agreed with the experiments which Mr. Ackroyd showed before the Society some years ago, when he demonstrated that the colours reflected by opaque bodies, such as porcelain, &c., when heated, tend towards red.—Prof. Minchin showed some experiments in illustration of his paper on photo-electricity read at the previous meeting. In one of these, a seleno-aluminium battery, illuminated by the light of a taper, deflected an electrometer needle, thereby actuating a relay and ringing a bell. He afterwards exhibited one of his "impulsion cells" in action, and showed the change from the insensitive to the sensitive state produced by a Hertz oscillator at a distance. In the discussion, Mr. Tunzelmann said Kalischer and von Uljanin had worked at the same subject, the former being the first to make experiments on a photo-E.M.F. in selenium. His cells were made by winding brass wires on glass tubes and coating them with selenium, which was subsequently annealed. These cells lost their power after some time, and would not respond to feeble lights. By using two wires of different metals he obtained better results. Fritts, in 1883, used brass and gold plates coated with selenium, and Uljanin employed platinum plates deposited so thin as to be transparent. The latter experimenter found that the E.M.F. was proportional to the square root of the intensity of the light. He also observed that the orange-yellow of the prismatic spectrum produced the greatest effect, whereas the yellow-green and green rays of the diffraction spectrum gave the maximum E.M.F. Comparing these results with Langley's observations on the energy of the spectrum, it would appear that the E.M.F. bears no relation to the maximum energy falling on the surfaces. Speaking of the cause of the phenomena, he said the electrolytic idea of von Uljanin seemed inapplicable to Prof. Minchin's results, and he inquired whether a mixture of selenium and aluminium would undergo a gradual change by exposure to light. Dr. Gladstone said such a change, if it occurred, would be very slow, for nearly all difficult chemical reactions take time to complete. The fading of colours was adduced as an instance of slow chemical change produced by light. Dr. Waller thought the subject might throw light on the changes occurring in the retina, and asked if it was possible to separate thermo-electric and photo-chemical effects. Dr. Burton said he had suggested that the action of light on the retina was a photo-chemical one some time ago. But hitherto it had been difficult to obtain substances sensitive to any but the blue and violet rays, whereas the eye was most sensitive to green and yellow light. In the photo-electric batteries, however, the E.M.F. may generate a current and therefore energy, and the important question seemed to be, Where does this energy come from? Is it a chemical change precipitated by the action of light, or does a direct conversion of light into electric energy occur? Prof. Minchin, in his reply, said he thought his cells really transformed the incident energy. They were usually kept on open circuit, and there appeared to be no deterioration with time, the only change being a sluggishness in developing the maximum E.M.F.

Zoological Society, February 3.—Prof. Flower, F.R.S., President, in the chair.—The Secretary read a report on the additions that had been made to the Society's Menagerie during the month of January 1891; and called special attention to a Yellow-crowned Penguin (*Eudyptes antipodum*) from Stewart Island, New Zealand, presented by Sir Henry Peek, Bart., new to the collection.—A letter was read from Dr. Emin Pasha, dated "Bussisi, October 6, 1890," announcing the despatch to the Society of a collection of birds which he had made on his way up from the coast.—The Secretary exhibited, on behalf of Mr. J. W. Willis Bund, a specimen of the Collared Petrel (*Œstrelata torquata*), which had been shot off the Welsh coast in Cardigan Bay in December 1889, and was new to the British Avifauna.—A communication was read from Dr. R. W. Shufeldt, containing remarks on the question of saurognathism of the Woodpeckers and other osteological notes upon that group.—Count T. Salvadori pointed out the characters of two new species of Parrots of the genus *Platycercus*, which he proposed to call *P. xanthogenys* and *P. erythropeplus*, both believed to be from Australia.—Mr. P. L. Sclater, F.R.S., gave an account of a collection of birds, from Tarapacà, Northern Chili, which had been made for Mr. H. Berkeley James by Mr. A. A. Lane. Fifty-three species were recorded as represented in the series, amongst which was a new Finch, proposed to be called *Phrygilus coracinus*.—Mr. F. E. Beddard gave an account of the pouch of the male Thylacine, from a specimen recently living in the Society's Menagerie. Mr. Beddard also described the brain of this animal, and pointed out its differences from the brains of other Marsupials.

CAMBRIDGE.

Philosophical Society, February 9.—Prof. Darwin, President, in the chair.—The following communications were made:—On rectipetality, by Mr. F. Darwin and Miss D. Pertz.—On the occurrence of *Bipalium kewense* in a new locality, by Mr. A. E. Shipley. The specimens exhibited came from an orchid house in the garden of Mr. Lawrence Birch, at Wiley, near Bath. They were apparently introduced in a miscellaneous lot of orchids whose origin was unknown. The species was first described by Prof. Moseley in 1878, from specimens obtained in the Kew hot-houses. Since then, individuals have been found at Haslemere, Welbeck Abbey, Clapham Park, and finally at Bath; they occur nearly always in hot-houses and a few at a time. So far the species does not seem to be becoming acclimatized. Abroad it has been recorded in the Botanic Gardens of Berlin, Frankfort, Cape Town, and Sydney, in the latter place in considerable numbers. The animals are very soft and extensible; they require a moist atmosphere, and die quickly in uncongenial surroundings. They are hermaphrodite, and reproduce both sexually and by transverse fission. They seem to be entirely carnivorous, devouring earthworms and small snails, &c. There is no reason to believe that they are ever harmful to plants. The mucus which is secreted from the skin, chiefly in the anterior region of the body, leaves a slimy trail along the track of the animal, which moves by means of ventrally placed cilia. The skin contains two kinds of urticating organs, (i.) simple rod-like bodies, the rhabdites; and (ii.) somewhat similar bodies one end of which is drawn out into a long thread.—The medusæ of *Millepora* and their relation to the medusiform gonophores of the *Hydromedusæ*, by Mr. S. J. Hickson. In *Millepora plicata* no medusiform structures of any kind were observed. The spermaria are simple sporosacs on the sides of the dactylozooids. The eggs are extremely minute, and show frequently amœboid processes: they are found irregularly distributed in the cœnosarcal canals of the growing edges of the colony. In *Millepora murrayi* from Torres Straits, large well-marked medusæ, bearing the spermaria, were observed lying in ampullæ of the cœnosteum. Even when free from the cœnosarcal canals and ready to escape they show no tentacles, sensory bodies, radial or circular canals, velum or mouth. They are formed by a simple metamorphosis of a zooid of the colony. The eggs of this species, like those of *M. plicata*, are extremely small and amœboid in shape. They are not borne by special gonophores. In the *Stylasteridæ*, the eggs are large, contain a large quantity of yolk, and are borne by definite cup-like structures produced by foldings of the cœnosarcal canals. In *Allopora* the spermarium is inclosed by a simple two-layered sac composed of ectoderm and endoderm. The endoderm at the base is produced into the centre of the spermarium as a simple spadix. In *Distichopora* the male gonophores are similar to those of *Allopora*, but there is no centrally placed endodermal spadix. In both genera a two-layered tube (seminal duct) is produced at the periphery of the gonophore when the spermatozoa are ripe. Neither the gonophores of *Allopora* and *Distichopora* nor the medusæ of *Millepora murrayi* show any traces in development of being degenerate structures like the adelocodonic gonophores of the other *Hydromedusæ*.—The development of the oviduct in the frog, by E. W. MacBride. The previous work on this subject was sketched; the only important paper being one by Hoffmann in the *Zeitschrift für wissenschaftliche Zoologie*, 1886. The development of the abdominal funnel of the oviduct was then described: this arises as a groove in the peritoneum, ventral to the only remaining nephrostome of the pronephros, this latter being the persistent first and not the third of the tadpole's head-kidney, as stated by Hoffmann. This groove is subsequently carried round the root of the lung to the ventral surface, and this extension persists in the adult, though the length of the orifice is increased. It does not atrophy as suggested by Marshall. The main body of the duct grows back as a solid rod of cells in close connection with and apparently derived from a strip of columnar peritoneal epithelium on the outer border of the kidney. Hoffmann is incorrect in stating that the most anterior part of this rod is split off from the Wolffian duct. At the time when this solid rudiment first appears the Wolffian duct in front of the persistent part of the mesonephros has completely disappeared. The general conclusion reached is the complete independence of the oviduct, in its development, from the Wolffian duct.

PARIS.

Academy of Sciences, February 16.—M. Duchartre in the chair.—On the objections raised to the interpretation of Herr Wiener's experiments, by M. A. Cornu. Further evidence is adduced in support of the conclusion drawn from some experiments made by Herr Wiener (*Comptes rendus*, January 26 and February 9), viz. that in a beam of polarized light the vibrations take place in a direction perpendicular to the plane of vibration, as is indicated by Fresnel's theory.—History of the Ibañez-Brunner apparatus, by M. Rod. Wolf. It is shown that the idea of utilizing optical, instead of real contacts, for the determination of a base line in geodetic observations was acted upon by Tralles and Hassler in 1797.—On solar statistics for 1890, by the same author. (See Our Astronomical Column.)—The Mont Dol elephants, by M. Sirodot. The author describes Quaternary strata exceedingly rich in the *débris* of elephants, he having found as many as 758 teeth within an area of 1400 square metres. Those of *Elephas primigenius* predominate, but with such variations that a great number of the specimens would have been classed as *Elephas antiquus*, or as *Elephas indicus* if they had not been found isolated in particular strata.—Observations of the asteroid discovered by M. Charlois on February 11, made at Paris Observatory, by Mdlle. D. Klumpke. Observations for position were made on February 13 and 14.—On a method for measuring the atmospheric dispersion of light of different wave-lengths, by M. Prosper Henry. (See Our Astronomical Column.)—On the resistance of various gases to the movement of a pendulum, by Commandant Defforges. It has been previously shown that

$$\frac{\Delta T}{T} = Pd + R\sqrt{d},$$

where T = time of oscillation of a pendulum, P = the hydrostatic impulse during motion, d = the density of the surrounding air, and R = its resistance. Six series of experiments in carbon dioxide, three in oxygen, and three in hydrogen, show that the coefficients P and R are the same with the same pendulum for all three gases and also for air. They depend on the form of the pendulum, but not on the nature of the surrounding gas.—Remarks relative to M. Poincaré's note on Herr Wiener's experiment, by M. A. Potier.—Variability of the number of vibrations of musical notes according to their functions, by M. Mültzer.—On the conductivity of organic acids and their salts, by M. Ostwald.—Reply to M. Ostwald's preceding note, by M. Daniel Berthelot.—On some compounds of pyridine, by M. Raoul Varet.—On amide of sodium, and on a chloride of disodammonium, by M. Joannis.—Researches on *l'huile pour rouge*, by M. Scheurer-Kestner. This compound has been previously described. Some of its combinations are now given.—On the action of excessive cold on animals, by M. G. Colin. The rabbit appears to be able to live through considerable cold. Adult specimens have lived in ordinary hutches suspended from a branch of a tree or standing on a heap of snow, and their temperature has only been lowered about 1° in five or six days, when the outside temperature varied from −10° to −15° C. Other specimens have lived in perfect health for two months in cubical hutches completely open on one side, when the temperature ranged from −10° to −25°. Sheep and pigs are also able to live through severe weather, but the dog and horse are killed by it.—Observations on the development of some Ascidiæ, by M. A. Pizon.

AMSTERDAM.

Royal Academy of Sciences, January 31.—Prof. van der Waals in the chair.—Dr. Hoogewerff and Dr. van Dorp dealt with the reaction of hypochlorites and hypobromites on phtalimide and phtalamide. When molecular quantities of phtalimide and hypobromite or a hypochlorite are brought together in an alkaline solution, anthranilic acid is obtained in a quantity nearly approaching that given by theory. Under the same circumstances Griess's benzoylencerea is formed from the amide.—Mr. H. A. Lorentz discussed the application of Maxwell's principles to electrical phenomena in moved bodies, the ether being supposed to remain at rest. By the aid of certain assumptions the author establishes the equations of motion for a system of electrified particles. The results may be applied to all phenomena which it is permitted to explain by the hypothesis of such particles. It is found that, by imparting to a dielectric a velocity v in the same direction in which it is traversed by light-waves, the velocity of these latter relatively to the ether is increased by $\left(1 - \frac{1}{n^2}\right)v$, n being the index of refraction. The co-efficient $1 - \frac{1}{n^2}$ is the same which was introduced by Fresnel into the theory of aberration.

STOCKHOLM.

Royal Academy of Sciences, February 11.—On the execution of the measuring of meridian degrees on Spitzbergen, by Prof. Rosén.—A new work, "Biologische Untersuchungen," Neue Folge, I., by Prof. G. Retzius, exhibited by himself.—An examination of the new tables of definite integrals of Bieren de Haan, by Dr. C. F. Lindman.—Anatomical studies of the Scandinavian Cestodea, by Dr. E. Lönnberg.—On the structure of *Ogmogaster plicata*, Creplin, by Hr. Jägerskiöld.—Bromeliaceæ Herbarii Regnelliani, described by Dr. C. A. M. Lindman.—Determination of the maximum elasticity of the vapour of water at low temperatures, by Dr. J. Juhlin.—Comparison between the methods of Ångström and of Neuman for determination of the caloric conductivity of different bodies; i. theoretical foundation, by Dr. Hagström.—Notes on the superficial strata of Scania, by Prof. B. Lundgren.—On *Anthella Wrighti*, n.gen. et n.sp., a singular Actinia, by Hr. O. Carlgren.

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