THURSDAY, APRIL 2, 1903.

THE NEW ENCYCLOPÆDIA.

Encyclopaedia Britannica. Vol. xxx. New Volumes. Vol. vi. K—Mor. (London : The *Times* Office, 1902.)

AS with its predecessors, the articles of scientific interest in this volume are very numerous and varied. The brief but effective biographies of Kelvin, Langley, Lister and Mendeléeff suggest the width of horizon that belongs to the work, as regarded from the scientific standpoint. The subjects and authors have been chosen with the same discrimination which established the reputation of the original ninth edition; every important article displays the careful workmanship of a special expert. In this particular volume, perhaps by alphabetic accident, all shades of gradation of scientific treatment are exhibited, from established metaphysics by Prof. Case, through a short article by Boltzmann on models with a tendency towards metaphysical considerations, to the technical treatment of such subjects as lighthouses, by Mr. W. T. Douglass; machine guns, by Major Barlow; military kites, by Major Baden-Powell; lead, by Mr. H. O. Hofman; mercury, by Mr. S. B. Christy; and mining, by Prof. C. le Neve Foster. Of the facilities which the publishers have afforded for taking advantage of most recent information, the inclusion of a brief account of the eruptions of 1902 under Martinique is sufficient evidence.

The authorship of the articles, in accordance with the traditions of the "Encyclopædia," is made conspicuous by the system of veiled anonymity which consists in putting initials at the end of the article, and thereby setting the reader a little sum in guess work with the assistance of a list of authors of the chief articles at the beginning, and a key to the system of initials at the end. The delicate challenge which this ingenious system offers is one which no self-respecting reader can resist.

We may turn first to the articles which illustrate recent progress in the department of physics and physical chemistry. An article on light, by Dr. C. G. Knott, supplements articles in the original volumes, and deals with photometry and refraction, as well as magnetic rotation, a subject which is subsequently treated in a special article on magneto-optics appearing over the suggestive initials of J. J. T. A brief but very luminous article on lubrication and its relation to viscosity and Tower's experiments is from the pen of Prof. Osborne Reynolds. Metallography and metallurgy, by the late Sir W. C. Roberts-Austen, give an indication of the wide field of research that is opening out in that direction, while Prof. Dewar gives an account of another subject of absorbing interest under the paradoxical heading of liquid gases, in which the general subject of low temperature research is treated from the point of view of most ample scientific experience. Mr. Marconi's name does not appear in the type of the heading of an article, but a concise and effective article by Prof. Fleming on "measuring instruments—electric" makes one feel that perhaps the omission of the subject only arises from the fact that it may be more effectively treated under a later letter of the alphabet. The immense developments of electromagnetics, nominally of magnetism, since Prof. Chrystal's article was written have afforded Dr. Shelford Bidwell an opportunity of which he has availed himself with conspicuous success.

A special welcome should be given to Prof. Henrici's article on mathematical instruments. It is a subject which, in a way, is everybody's business, and perhaps on that account is not generally treated in mathematical or physical text-books. It is one of the advantages of an encyclopædia that information upon such a subject can be put satisfactorily before a reader in a short article by an acknowledged expert.

Turning to the subjects included under cosmical and terrestrial physics, we may notice in passing an article on maps, by Mr. Ravenstein, which includes some interesting historical particulars, and one on limnology, by Dr. H. R. Mill. Prof. Simon Newcomb deals briefly with the work of Profs. Hill and E. W. Brown in an article on the moon. But the two chief articles in this division of the sciences are that on terrestrial magnetism, by Dr. Chree, and that on meteorology, by Prof. Cleveland Abbé. Dr. Chree gives a careful and concise account of recent work on terrestrial magnetism, including the systematic classification and representation of the variations shown by self-recording instruments, and the generalisations arrived at regarding them. He deals also with recent magnetic surveys and the identification of localities of special disturbance, and finally he treats of the evaluation of the Gaussian constants and other representations of the general magnetic conditions of the earth.

The article on meteorology, by Prof. C. Abbé, is specially interesting, as it starts *de novo*, without reference to the original article in the ninth edition, and in thirty-two pages gives a general conspectus of the subject. We may be permitted to consider this article somewhat more in detail later on.

The biological articles include Mollusca, by Mr. Pelseneer; Mammalia, by Mr. Lydekker; Malacostrata, by Mr. Stebbing; and a short unsigned article on malaria, a subject to which one naturally turns with interest in view of recent developments. The present position of the science of medicine is entrusted to the competent hands of Prof. Clifford Allbutt.

Returning to Prof. Cleveland Abbé's article on meteorology, its main headings are (1) fundamental physical data; (2) apparatus and methods; (3) climatology; (4) physical and theoretical meteorology, with an unnumbered addendum on meteorological organisations. The work is what may be expected from a learned and experienced worker in meteorology, although the task of making a rapid survey of the whole range of a very wide subject in a comparatively short article is evidently a difficult one; the difficulty lies partly in the selection of the class of readers to whom the remarks may be supposed to be addressed. In this case the article will certainly be read by meteorologists with great interest and with the wish to go into further details which any brief survey ought to stimulate. To cite an instance of what may be re-

garded as rather exaggerated compression, we may quote a sentence that disposes of the performance of the Campbell-Stokes sunshine recorder, in common use in this country :—

"A sheet of pasteboard or a block of wood at the rear receives the record, and the extent of the charring gives a crude measure of the percentage of full or strong sunshine."

Without further details one cannot help feeling that if the crudeness were entirely in the record, it would never have attached to it the name of the great philosopher about whose work the word "fastidious" seems, if anything, more appropriate than "crude." Again, the system of photographic recording adopted in this country for the barometer and thermometer is dismissed in an equally curt manner as not being "quite adequate to present needs"; it is difficult to see how the "needs" have changed since 1867, when the aspirations of meteorologists were described in words which might be adopted without change to-day.

A similar brevity runs through the whole article. Take, for example, an account of cirrus clouds :—

"They may be formed by mixture or even sometimes by mere contact and the conduction of their own heat to neighbouring cold air. More frequently they must be due to cooling of moist streaks in the atmosphere by expansion and radiation."

If one only really knew whether this is true or not, what should we not know about meteorology? It may be remarked, by the way, that in dealing with the thermal expansion of gases, there is a superfluity of zeros which would alter the whole face of nature if they could not be satisfactorily accounted for by the usual vagaries of the printer.

The article may be described without much exaggeration as a view of the present state of meteorology as seen from Washington. It is a great advantage to have a compendious view of so wide a subject from that most active centre, and from so competent a pen as Prof. Abbé's. No one need complain because the treatment is necessarily somewhat eclectic.

The section on climatology is devoted mainly to rainfall and the generalisations based on rainfall data from all parts of the world. The section on physical and theoretical meteorology is an especially valuable summary, including the most modern developments of the application of dynamical, thermodynamical and electrical theory. The final section, on meteorological organisations, leads, as all such considerations must lead, to the expression of the need for meteorological laboratories in important universities, following in this respect the analogy of the sister science of astronomy.

The reader with scientific tastes is not recommended to follow the reviewer in a rapid survey of the subjects of scientific interest in this volume. If he does so, he can hardly fail to be reminded of those public occasions on which it is felt necessary to give to as many distinguished persons as possible an opportunity, however short, of saying a few words. When the ingenuous reader feels a little at a loss to know why a particular title is selected as the subject of an article in an encyclopædia, the initials at the end may be relied upon to suggest a sufficient reason.

The tendency to represent authors is, perhaps, more conspicuous in this volume than in the ninth edition. An inquisitive person might even find himself wondering whether the term Britannica does not require some adjustment.

THE GEOLOGY OF CENTRAL BORNEO.

Geological Explorations in Central Borneo (1893-94). By Dr. G. A. F. Molengraaff. English Revised Edition, with an Appendix on Fossil Radiolaria of Central Borneo by Dr. G. J. Hinde. Pp. xx+530 + 56; with 89 illustrations in the text, 56 plates, 3 maps, and a folio atlas of 22 geological maps. (Leyden: E. J. Brill; Amsterdam: H. Gerlings; Sold in London by Kegan Paul, Trench, Trübner and Co., Ltd., 1902.) Price 2*l.* 12*s.* 6*d.* net.

THE Dutch edition of this work appeared in 1899, and Dr. Hinde's appendix, then issued in English, is now transferred, with its separate pagination, to the translation of the complete work. The Borneo Expedition, of which Dr. Molengraaff was the geological member, was organised by Mr. S. W. Tromp, Resident of West Borneo, in connection with the Society for the Promotion of the Scientific Exploration of the Dutch Colonies. The observations were made some ten years ago, and the author has not included references to the work of others, published since the completion of the Dutch edition. We are in possession, however, of the summary of the geology of Borneo drawn up by Dr. E. Suess in 1901 ("Das Antlitz der Erde," 3ter. Band, pp. 308-319), and many readers have already turned to that summary for an exposition of the work of Molengraaff. Dr. Posewitz, about 1890, brought together, after three years' residence in the island, the facts then known about the geology and mineralogy of Borneo ("Borneo"; translated by Hatch, 1892), and his geological sketch-map was intended to show how large a part of the country had already been examined in a preliminary kind of way. Dr. Molengraaff, in his atlas, provides only one geological map, dealing with the parts of Central and South Borneo known to him; an enlarged map of a portion of this area follows, and the other maps prudently record the observations actually made on the banks of the rivers, which provide practically the only routes for travellers in the country. Some generalised sections and panoramic landscapes follow, the latter proving that wide views are obtainable when observers climb above the forest-zone. The fine illustrations and plates in the volume of text reveal, moreover, many features of crag and mountain that will be new to those who think of Borneo as clothed with vegetation, amid which the rivers wander in equatorial shade.

The province of West Borneo, with which the author mainly deals, is practically the basin of the Kapoewas (the River Kapuas of Posewitz). By following it eastward, across a wooded region, where the projections of antique Borneo rise like islands above the vast alluvium, the traveller reaches Sintang, 2600 km. in a straight line from the coast. Here Dr. Molengraaff's

serious work began. He starts at once (p. 19) with the interesting observation that the coarse auriferous gravels near Sintang show that the carrying power of the rivers was formerly greater; and the explanation is found in the greater height of the ranges of the interior in late Cainozoic times. The author returns to these deposits in his valuable geological summary (pp. 453-9), where he states his conclusion that Borneo has undergone continuous degradation, through atmospheric action, in the Quaternary era. The products of decay have encroached on what was in earlier times a shallow sea, broadening the land, and connecting island after island with the central mass by new deposits of alluvium. At the same time, the alluvium has accumulated on the decaying ranges, burying their lower slopes in material which they themselves supplied. In opposition to the elevation-theory of Posewitz, Molengraaff sees in the growth of the river-deposits the real cause of the post-Pliocene extension of Borneo.

From Sĕmitau, higher up the Kapoewas, the author diverged through the thick forest, up a side-stream to Mount Kĕnĕpai. This is a steep mass 1136 m. above the sea, carved out of granite injected by andesite, the granite (p. 432) being of post-Jurassic age. Still more interesting igneous features are seen in the next range visited, on the Mandai River, where huge horizontal beds of volcanic tuff give rise to "table-mountains" bounded by vertical rock-walls. Molengraaff (p. 65) names this range the Müller Mountains, after the murdered explorer Georg Müller, who is believed to have penetrated the area. The volcanic action that here poured out rhyolite and andesite and abundant tuffs along an east-and-west line in Central Borneo was probably post-Cretaceous (p. 441), and may have continued throughout Cainozoic times. The range is now known to extend over at least 280 km., and has doubtless (p. 445) an important relation to the post-Cretaceous movements of the land. Have we here, indeed, unexpectedly revealed by Molengraaff, one of those volcanic chains that accompany the Eurasian "Alpine" system of folding? The author shows how the Müller Mountains have been piled on sunken land (p. 445), which has been lowered by east-and-west faults from the south flank of the Upper Kapoewas range. This old range, the slates of which are possibly of Palæozoic age, was at one time covered by Jurassic rocks, the age of the latter being determined by Dr. Hinde's observations on the radiolaria. These rocks, now preserved by the downward faulting in the lake-district north of Sĕmitau (pp. 123 and 414), are grouped by Molengraaff as the "Danau formation." The faulting has affected the "Eogene" sandstone strata, which once spread across the folded Cretaceous and Danau systems, and terminated somewhere on the flanks of the Upper Kapoewas chain. The plain of the Upper Kapoewas River was thus determined by the downthrow of the Danau beds in Middle Cainozoic times, whereby the chain of mountains to the north was more than ever emphasised. While intrusions of granite had already (p. 449) accompanied the post-Jurassic and pre-Eocene movements, the volcanic line of the Müller Mountains made its appearance along one of the Middle Cainozoic faults. In the eyes of Suess ("Antlitz," Bd. iii., pp. 312, 315, and Tafel xi.), the Upper Kapoewas range forms part of a great bow extending southward from the Philippines, and the volcanoes have arisen on the faulted outer side.

The association of radiolarian cherts with diabase and diabase-tuff, as described so often by the author, seems almost inevitable, although the beds in Borneo are of Jurassic or early Cretaceous age. Mr. J. J. H. Teall has discussed this phenomenon; and it seems independent of geological age. One is reminded of Anglesey, where Mr. Greenly (*Quart. Journ. Geol. Soc.*, 1902, p. 433) has been led to consider the cherts as of organic origin, on account of their association with "pillowy diabase"—so firmly has the connection of these two types of rock, however improbable at first sight, become established in recent years as an article of geological belief.

We must merely mention the interesting ascent of Mount Kĕlam, a strangely smooth boss of pre-Cretaceous microgranitic rock, the surface of which (p. 138) peels off like the layers of an onion, as in the instances studied by Branner in Brazil. It soon becomes clear to the reader that Central Borneo is rich in a variety of mountain-forms. While Dr. Molengraaff's landscapes will interest the geographer and the artist, other illustrations are of ethnographical value. The chapter on river-curves (p. 473) introduces a new term, "pintas," the Dyak name for a natural short-cut formed across the loop of a meandering stream. Unfortunately it has no convenient European plural, or it might be of much service in geography.

Dr. Hinde's important appendix is already known to palæontologists. The English in the translated part of the volume is, as a whole, clear and carefully printed. The two misprints in the title of plate lii. should, however, have been avoided, but are more than balanced by the action of the English binders, who have curtailed the author's name on the exterior of both the volumes. Dr. Molengraaff has added so much to our knowledge of a difficult country, especially in regard to its tectonic history, that we trust that political disturbances have not removed him permanently from another field of observation, where his work was only just begun. Grenville A. J. Cole.

PROCEEDINGS OF THE GERMAN ZOOLOGICAL SOCIETY.

Verhandlungen der deutschen zoologischen Gesellschaft, xii. Versammlung, Giessen, 1902. Pp. iv + 221. (Leipzig: Engelmann, 1902.)

THE German Zoological Society consists of about 240 experts, who meet in variable numbers for two or three days annually in some happily chosen hospitable spot, where they hold high discourse. There were only about sixty members present at last summer's (twelfth) meeting in Giessen, but the Society, if not large in numbers, is strong in quality. It is not pecuniarily rich, for it has backed out of more than an honorary responsibility with regard to one of its offspring—an expensive child—"Das Tierreich," which the Berlin Academy of Science will henceforth solely foster, but it is rich in enthusiasm, as we infer

from the proposal to segregate into entomological, ornithological and other sections. Long may it live and thrive, and continue to publish its interesting proceedings, which we have just been enjoying. The volume, ably edited by Prof. Korschelt, contains a general introductory address by Prof. Chun; a welcome from Prof. Hansen, as rector of the University of Giessen; a short reminiscence, by Prof. Spengel, of the zoologists who have taught and wrought at Giessen, *e.g.* Leuckart, Schneider and Ludwig; and about sixteen papers, most of which impress us with their general interest, their lucidity and their brevity.

We may arrange the papers in groups:—(1) *Œcological.*—Prof. A. Brauer gives an account of the so-called "telescopic" eyes of some deep-sea fishes from the *Valdivia* collection. These eyes tend to be tubular, with wide pupil, reduced iris and very convex cornea. They show a dimorphic retina, the main part at the back of the eye being very different from the accessory part ("Nebenretina"), which is usually medio-dorsal, near the lens, and perhaps adapted for the perception of more distant objects. Brauer notes that the adaptations of the eye in these deep-sea fishes are all of the plus and minus order; the eye is a very conservative organ as regards essential architecture. Prof. J. Vosseler gives an account of the protective adaptations of North African Orthoptera, paying particular attention to the odoriferous vesicle beneath the pronotum of *Œdaleus nigrofasciatus* and *Œ. senegalensis*, and to the blood-spraying apparatus between coxa and trochanter on the legs of the Hetrodid *Eugaster guyoni*. Dr. L. Reh discusses the importance of zoological study in regard to plant-protection. In a profoundly interesting paper, E. Wasmann describes the various adaptations (mimetic, symphilous, &c.) of the Staphylinid guests of Doryline ants, the striking convergence between some Neotropical and some Ethiopian myrmecophils, the particular case of *Mimeciton* to which he awards, as he well may, "the palm of mimicry," and the very suggestive occurrence of what he calls *exaggerated mimicry*. In another paper, the same author shows that the habit of rearing larvæ of Lomechusids (especially of *Lomechusa strumosa*) is responsible for bringing about that strange phenomenon of inhibited female development (the thorax of a female combined with the abdomen and size of a worker) called *pseudogyny*.

(2) *Morphological.*—Prof. C. Chun has traced the development of the chromatophore of the octopus Bolitæna from a small mononucleate cell, through stages with 2, 4, 8, 16, 32 nuclei. There is a large peculiar nucleus in the centre of the pigmented mass; the other smaller nuclei lie peripherally at the bases of the contractile processes. The accompanying figures are very striking. Prof. F. Vosseler finds that an intestinal villus may have a slit-like apical *aperture*, and sometimes a more lateral one in addition. The stroma of the apical region is sometimes cleanly retracted from the enveloping epithelium, so that a cap-shaped space is left with some *débris* and leucocytes. Prof. R. Hesse shows that the truly optic, rod-possessing cells of the Gasteropod retina may be with or without pigment; sometimes the optic cells are pigmented while the indifferent cells are pigmented; sometimes the converse occurs; and in the "Nebenretina" of Limax there is no pigment at all. Gräfin M. von Linden describes in the pupa of *Papilio podalirius* fine projecting hairs, connected through the chitinous sheath, with nerve terminations lying *outside* the epithelium of the body, which again are connected with sub-epithelial nerve strands.

Dr. B. Wandolleck figures the *two-jointed* styles of the female of *Lagria hirta*, thus answering Verhoeff's objection that styles cannot be truly appendicular because always unjointed. Prof. C. B. Klunzinger describes *Ptychodera erythraea*, Spengel, an interesting Enteropneust from the Red Sea, with very large genital flanges (Flügel). Dr. J. Meisenheimer notes the resemblances between the early development of *Ammothea echinata* and that of many Entomostraca, and also the resemblances between the "protonymphon" larva and the nauplius. He concludes that the relationship between Pantopoda and Crustacea is much closer than Dohrn would admit. Dr. F. Schmitt describes the gastrulation of double embryonic primordia in the blastoderm of the trout, and shows that the duplicity cannot be interpreted on the concrescence theory without accessory hypotheses.

(3) *Physiological.*—Dr. H. Jordan's experiments on Astacus confirm the conclusion that the mid-gut gland, besides secreting digestive juices, has a very important absorptive function. It is physiologically, as well as embryologically, just an evagination of the mid-gut.

(4) *Ætiological.*—Prof. W. J. Palacký revolts from the zoogeographical regions of Sclater and Wallace, and maintains that the useful task now is to take class by class, and to correlate present distribution with all that geology has to tell us of the past. Prof. H. Simroth has a remarkable paper in which he applies the "pendulation theory" to the problems of biogeography. In another paper Simroth excels himself in bold speculation, but we are quite unable to follow his elliptical argument, which, as might have been expected from the ingenious author of "Die Entstehung der Landtiere," is a glorification of the evolutionary advantages of *terra firma*. He seeks to show that everything worth having, *e.g.* a head and a vertebrated body, and striped muscles and sexual reproduction, must have been evolved on land. He seems to derive the Sponges from terricolous Acœla, and these form Infusorians, and so on until we land in Probacteria and the organic matter which preceded life. It reads like a recrudescence of "Naturphilosophie."

J. ARTHUR THOMSON.

ANCIENT AND MODERN ENGINEERING.

Ancient and Modern Engineering and the Isthmian Canal. By Prof. William H. Burr. Pp. xv+473. (New York: John Wiley and Sons; London: Chapman and Hall, Ltd., 1902.) Price 14*s.* 6*d.* net.

THIS is an English edition of a book published in America, and contains the outcome of six lectures delivered at the Cooper Union in New York, under the auspices of Columbia University. The first part deals

with ancient civil engineering works, and the remaining parts relate to bridge construction, waterworks for cities and towns, railroad engineering, and the Nicaragua and Panama routes for a ship canal. In the parts relating to modern engineering, the practice and examples described are those followed in America, therefore for English engineers Prof. Vernon Harcourt's book on "Civil Engineering as Applied in Construction," recently reviewed in NATURE, which includes the subjects dealt with in the book now under notice, would be found of more service.

The first part, relating to ancient civil engineering, contains a great deal of interesting information, but not of a specially original character. The author points out that the science and profession of engineering dates from very early times, and that many large works that would reflect credit on engineers of the present day were executed in the very dawn of history. The anciently populous country at the head of the Persian Gulf was irrigated and made prosperous by a complete system of canals and irrigation works carried out in the remote past, and traces of hydraulic works, including dams and regulating appliances, are to be found spread over a large territory in the vicinity of Babylon. From the remains still existing, it is calculated that some of these canals must have been from 25 to 30 feet in depth. It is recorded that Alexander the Great, when marching through the Assyrian country, found the River Tigris obstructed by masonry dams constructed for irrigation purposes. The present Suez Canal was preceded between 3000 and 4000 years ago by a channel cut to connect the Red Sea and the Nile. The extensive hydraulic works for regulating the supply of water from the Nile, some of which were carried out seventy centuries ago, involved engineering work of such magnitude as almost to put the great dam at Assuan recently constructed in the shade.

The immense blocks of stone used in the construction of the pyramids and temples and for obelisks show that a knowledge of mechanics must have been well developed in very early times. The remains of many of the ancient buildings afford evidence that both round and pointed arches were made use of. Later on the Romans excelled as engineers, whether as bridge builders, road makers, or in works required for sanitation. The Appian Way, constructed more than two thousand years ago, is only one example of the roads constructed by the Romans, both in Italy and in the lands they conquered, the remains of many of which are to be found at the present day. This road was 350 miles long, and formed a perfect highway between Rome and Brundusium. Water supply was another matter in which the Roman engineers excelled, some of the aqueducts along which the water was conveyed for the supply of their towns extending to a length of from 40 to 60 miles. The streets of Rome were provided with a complete system of sewers, and building laws were enacted for regulating the thickness of the walls and height of buildings, and the quality of the materials of which they were composed. The harbours at Ostia and those at Tyre and Sidon testify to the knowledge of the ancients in this department of engineering, and there are bridges still in existence the foundations of which were laid two thousand years ago.

With regard to the two Isthmian canals, the author sums up their respective capabilities as follows. He considers both routes feasible and practicable; that neither route has any commercial advantage over the other; the harbour features may be made adequate for either canal; the time that will be required for completion is about the same in either case; the control of the water supply will be simpler in the case of Panama; the relative seismic conditions in neither case are of sufficient gravity to cause anxiety; the question of cost is in favour of Panama.

OUR BOOK SHELF.

An Account of the Indian Triaxonia, collected by the Royal Indian Marine Survey Ship "Investigator." By Franz Eilhard Schulze. The German Original translated into English by R. von Lendenfeld. (Calcutta: By Order of the Trustees of the Indian Museum, 1902.)

THIS admirable report, the latest of the *Investigator* series, deals with 120 examples of Triaxonid Sponges dredged between the years 1885-1890, and it is in reality a revised edition of three memoirs contributed by Prof. Schulze during the years 1894-1900 to the *Abhandl.* Kais. Preuss. Akad., now put into form for translation into English, as modified in respect to important redeterminations arrived at in the study of the *Albatross* collection, and under the influence of contemporary research.

A main distinction is drawn between the Amphidiscophora and the Hexasterophora, the former embracing a description of the Hyalonematidæ (four genera, fifteen species described), the latter of the Euplectellidæ (five genera, eight species), Rossellidæ (three genera, three species), Farreidæ (one genus, one species), and Melittionidæ (one genus, three species). Then follow three tables, of which the first gives a list of the Indoceanic Triaxonia known independently of the *Investigator*, the second a list of the *Investigator* series, of which there were thirty-one species, eight of them from depths exceeding 1500 fathoms, the third a full classification of the known forms, with stations and localities, twenty-four genera and fifty-four species in all, including records of genera and species of the Asconematidæ, Euretidæ, Coscinoporidæ and Maeandrospongidæ of the *Challenger* and *Pola* expeditions.

There are twenty-three magnificent plates, and the forms most noteworthy are *Hyalonema masoni*, in which the Palythoa crust is replaced by Cirripedes; *Saccocalyx pedunculata*, now removed from the Asconematidæ to the Euplectellidæ; *Lophocalyx spinosa*, remarkable for the possession of "silica pearl" spicules; and *Lophophysema inflatum*, a much modified Hyalonematid obtained by the *Investigator* in the Andaman Sea at 498 fathoms, bearing an annular ridge, which sharply subdivides the body into an upper cylindrical portion and a lower conical one, characterised by the presence of large irregular cavities belonging to the inhalant system.

We congratulate Dr. Alcock and the Trustees of the Indian Museum upon this valuable addition to their reports, which rank high in the literature of marine zoology.

The Ventilation, Heating, and Management of Churches and Public Buildings. By J. W. Thomas. Pp. vi+140. (London: Longmans and Co., 1903.) Price 2*s.* 6*d.*

THIS book is addressed chiefly to the architects, managers and caretakers of buildings, and its opening chapter deals with the physical principles bearing on ventilation. An interesting account is given of the author's observations on alternating air currents and their effects. Some passages are, however, very obscure, as, for instance, when one reads of "the electrical conditions due to the sudden expansion of the air."

In discussing the effects of wind on ventilation, in the second chapter, the writer makes the cryptic statement that "the friction caused by the wind passing over buildings is so great that it is scarcely possible to demonstrate it accurately," and later on he speaks of the air in a room as being strained "to its utmost limit of tension." The next chapter is on the effects of moist air on ventilation, and here the author reaches a climax. In it we read of "rooms where persons are gathered who evolve sputae or other germs of infectious disease," and we are told that "when air is supersaturated with moisture it become heavier." It is a great pity that any writer should have so little sense of the responsibility of authorship as these extracts indicate.

The next chapter, dealing with air inlets and outlets, is disfigured by an obscure passage about carbonic acid being "held in suspension in a semi-dissolved condition" in air saturated with moisture. The actual state of the ventilation in typical buildings, and the methods to be employed in order to improve matters, are next treated. These portions will be found interesting and suggestive.

The remainder of the book is occupied by the discussion of different methods of ventilation, the ventilation of new buildings, and instructions for caretakers.

J. H. V.

Practical Exercises in Heat. By E. S. A. Robson, M.Sc. Pp. xii+187. (London: Macmillan and Co., Ltd., 1902.) Price 2*s.* 6*d.*

THIS useful little volume contains a description of one hundred and two experiments in heat, suitable for an ordinary laboratory course. It is divided into fourteen chapters, each of which comprises a set of classified and numbered experiments—an arrangement which should find favour with teachers of practical physics. At the end of each chapter is given a number of additional experimental exercises, mostly selected from examination papers of the London University. The descriptions are clear and concise, and the text is amply illustrated; the more elaborate experimental corrections are avoided, so as to allow the student to obtain a firm grasp of fundamental principles. The student who conscientiously works through this course should gain fairly accurate results, and, what is more important, a good general idea of the methods of experimental research. The first two chapters are devoted to measurements of temperature, and corrections of the mercury thermometer; these are followed by chapters on the expansion of solids and liquids. It may be noted, in passing, that, in experiment 22, p. 36, on the determination of the temperature at which water acquires its maximum density, the mercury placed in the bulb for the purpose of eliminating the expansion of the latter should have a volume equal to one-seventh of the internal volume of the bulb, not, as is stated, one-seventh of the volume of the glass composing the bulb. The expansion of gases, calorimetry, and change of state are treated in subsequent chapters. Chapters are devoted to electrical methods of measuring temperature, conduction, and radiation. The last chapter is occupied by experiments relating to elementary thermodynamics, including the ratio of the specific heats of air and the value of J. It may be remarked that, though a rough determination of J may be effected by allowing lead shot to fall a number of times down a cardboard tube, and observing the rise of temperature produced, yet if mercury is substituted for the shot, as suggested on p. 155, no appreciable rise of temperature will be obtained, owing to the small viscosity of the mercury. In later editions, it is to be hoped that an account of Prof. Callendar's recently devised method of determining J will be described, since this is the only satisfactory determination which has so far been brought within the reach of the student who can spend but a limited time over an experiment.

E. E.

"*The Amateur Photographer*" *Library.* Nos. 25 and 26. *Enlargements: their Production and Finish* (No. 25). By G. Rodwell Smith. Pp. xxiii + 130. Price 1*s.* *Bromide Printing* (No. 26). By Rev. F. C. Lambert, M.A. Pp. xxiii + 74. Price 1*s.* (London: Hazell, Watson and Viney, Ltd., 1902.)

THERE is no doubt that the photographer is well supplied with literature on his subject, and, as a rule, he is not loth to take advantage of this source of information, although he has to look about him for the book containing the particular kind of help he requires. There are, however, so many workers who do bromide contact printing and enlarge their negatives that these two small manuals on these special topics should prove of great service. The authors treat each manipulation separately, and explain them so that the amateur can easily follow the instructions. One excellent feature of both these books is that the illustrations, which are numerous, exhibit various types of under, correct and over-exposured prints or enlargements, prints from suitable and unsuitable negatives for enlarging, untouched and retouched prints, &c., which should aid the beginner in forming an early judgment on his own results. In addition to the actual routine of the manipulations required, many miscellaneous hints are given, such as obtaining a bromide print quickly from a wet negative, converting a bromide print into a line drawing, &c. Altogether, these manuals are well suited to acquaint amateurs with the nature and use of the materials employed in these processes.

Natural Law in Terrestrial Phenomena. By Wm. Digby, C.I.E., F.S.S., &c. Pp. xlv + 370. (London: W. Hutchinson & Co., 1902.) Price 6*s.*

THIS book deals with the theory, revived and amplified by Mr. Hugh Clements, which seeks the cause of all meteorological and of most volcanic phenomena in luni-solar attractions. The evidence which Mr. Digby adduces in support of Mr. Clements's theory is not convincing. In the early chapters, he shows how a number of gales and eruptions, more particularly the recent catastrophes in the West Indies, have occurred at times when the astronomical conditions were favourable to the production of high tides, but the important question of how often either of these two sets of phenomena may have occurred independently of the other is not discussed. The chapters on forecasting will probably attract most attention. Mr. Clements tells us that the earth, moon and sun occupy the same relative positions every 186 years, and that, therefore, identical weather conditions will prevail. Given trustworthy records extending over 186 years, forecasting becomes a mere matter of looking up records for corresponding days. Failing such records, we must compare days on which the astronomical conditions are as nearly alike as possible. In appendix iii., rules are given for allowing for the effect of small differences in the parallax, declination and times of transit of the sun and moon, on the height of the barometer, the

determining factor in the weather at any place. The unfailing agreement shown by these calculations arouses suspicion. On closer examination, we find that the signs of the corrections vary quite arbitrarily, while at least five different methods of correcting for declination occur in the text. Results based on such foundations cannot inspire much confidence, even though a fair agreement between predictions and Greenwich records is claimed. The more obvious method of exhibiting the similarity of meteorological conditions under similar astronomical conditions by comparing the corresponding isobaric charts does not appear to have occurred to Mr. Clements. We commend this method to the attention of those who have leisure to devote to a detailed examination of a mode of dealing with meteorology that recurs from time to time.

Bis an's Ende der Welt! Astronomische Causerien. Third Edition. Pp. 212. By Prof. F. J. Studnička. (Prague: Published by the Author, 1903.)

THIS book, which was dedicated to the celebration of Christian Doppler's hundredth birthday, has reached a third edition. It is written in the form of a conversation among men of various professions meeting socially together every day with the intention of conveying in popular language many astronomical ideas. "To the end of the Universe" is the subject of a dream which one of the members of this convivial party, Carpenter by name and astronomer by profession, had dreamt, and the narrative is his account of this dream to his companions, subject, of course, to many interruptions by one or other of them seeking more information or more detailed explanation.

The author has quite succeeded in his object, and the book will be found to contain an admirable exposition of some of the more general astronomical topics. Being printed in large and Roman type, it should find many readers in this country.

Die radioactiven Stoffe nach dem gegenwärtigen Stande der wissenschaftlichen Erkenntnis. By Karl Hofmann. Pp. 54. (Leipzig: Ambrosius Barth, 1903.) Price 1.60 marks.

THIS book contains a concise account of the discovery and subsequent investigation of the radio-active elements by Becquerel, the Curies, Rutherford and others. It is written mainly from a chemical standpoint, and many of the effects which have been accurately measured, especially by Rutherford, are referred to as though they had been merely observed and not measured. For example, Rutherford has shown that the radio-activity of thorium-X dies away with time according to the formula e^{-kt}, where t is the time and k a constant, but Hofmann merely mentions that the activity dies away. The book contains references to the original papers published before the latter half of 1902, and should prove useful to those wishing to study the subject. H. A. W.

Carnet de Notes d'un Voyageur en France. Par A. C. Poiré. Pp. viii + 169. (London: Macmillan and Co., Ltd., 1903.) Price 1s. 6d.

M. POIRÉ intends this note-book for boys who will in the future be merchants and manufacturers. The provinces and important commercial centres of France are described only from industrial, commercial and agricultural points of view; historical, administrative and geographical details have been omitted as being unnecessary for the particular class of student for whom the book is written.

At the bottom of each page is a vocabulary of difficult or unusual French words. By the time the student has worked through the volume he will not only have much improved his knowledge of French, but have acquired considerable acquaintance with the characteristics of different parts of France.

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.*]

Radium Emission.

CONCERNING the recently discovered heat emission from radium, it is perhaps worth noting that it appears to be connected with, and is probably an immediate consequence of, the remarkable observation by Rutherford that radium emits massive positively-charged particles, which are probably atoms, with a velocity comparable to one-tenth of the speed of light (see *Phil. Mag.*, February, 1893).

Because it is easy to reckon that the emission of a million heavy atoms per second, which is a small quantity barely weighable in a moderate time such as a few weeks (being about the twentieth part of a milligramme per century), with a speed equal to one-tenth that of light, would represent an amount of energy equal to one thousand ergs per second; that is to say, would correspond to heat enough to melt a milligramme of ice every hour. And inasmuch as these atoms are not at all of a penetrating kind, but are easily stopped by obstacles, they would most of them be stopped by a small thickness of air, and their energy would be thus chiefly expended in the immediate proximity of the source, which source would thereby tend to be kept warm.

It would appear on this view as if by enclosing a bit of radium in a small chamber formed of massively obstructing non-conducting walls that it could be made quite hot; provided always that the assumed necessary stimulus, or external supply of molecular energy, could get at it uninterruptedly.

If, in the open, the rate of escape of heat were such that on the average it accumulated for one minute before escaping, the temperature of source and ambient air, with an assumed heat-capacity equal to that of one milligramme of water, would amount to one and a half degrees centigrade. OLIVER LODGE.

March 28.

Radio-activity of Ordinary Materials.

IN connection with the article by Mr. Strutt on this subject in NATURE of February 19, and the letter by Prof. J. J. Thomson in the following week, it may be of interest to mention some work along similar lines that has been in progress in the McGill Physical Laboratory since September last.

At the same meeting of the American Physical Society in Washington last December, at which the interesting paper of Dr. MacLennan and Mr. Burton, referred to by Prof. J. J. Thomson, was presented, an account was given by Mr. H. L. Cooke and myself of some results showing that a very penetrating radiation was given off from the walls of buildings and from the surface of the earth itself.

The primary object of this investigation was to see if the natural ionisation of air observed in closed vessels was due, in part at least, to an external radiation which passed through the walls of the vessel. For this purpose the rate of discharge of a gold leaf electroscope in a brass vessel of about 1 litre capacity was observed. When the closed vessel was surrounded by thick screens of lead and iron, the rate of discharge was reduced about 30 per cent. A similar effect was observed when the electroscope was immersed in a deep water tank. No further reduction of the discharge was observed when the electroscope was surrounded with five tons of lead. These results showed conclusively that about 30 per cent. of the ionisation in closed vessels was due to an external radiation of great penetrating power which passed readily through 1 cm. of lead. In a brass electroscope, surrounded by thick screens, the number of ions produced was reduced to as low as five per c.c. per second. In the course of these experiments, Mr. Cooke observed that a layer of brick round the electroscope *increased* the rate of discharge instead of diminishing it, pointing to the conclusion that the brick was itself radio-active. Mr. Cooke has extended these observations, using cylinders of different metals placed inside the electroscope, with results of a similar character to those already recorded by Mr. Strutt in his article.

In addition, wood as well as brick was found to be strongly active under the conditions employed. Metals exposed for some time outside the buildings showed a marked increase of activity over the metal which had been carefully cleaned. E. RUTHERFORD.

McGill University, Montreal, March 12.

Mendel's Principles of Heredity in Mice.

THE points raised by Mr. Bateson in NATURE of March 19 cannot be discussed within the limits of a short letter; a full discussion will be published in an early number of *Biometrika*. In the meantime I would ask Mr. Bateson one question:—

He represents the mice used by Mr. Darbishire as differing in two characters; one (pinkness of eye with white coat) he calls G; the other (pinkness of eye with some colour in the coat) he calls G′. The hybrids produced by crossing these mice he calls GG′; and by reference to the mysterious properties of "heterozygotes" any difficulties presented by their eye-colour are avoided. But when these hybrids are paired *inter se*, they are said to produce offspring of three kinds, in the proportions

$$GG + 2GG' + G'G'.$$

Now the mice G′G′ are of the same constitution in respect of all the characters concerned as their pure-bred grand-parent G′. Mr. Darbishire has shown (*Biometrika*, vol. ii. part ii.) that they do not always resemble their grandparent, or either of their parents, in one of the characters (coat-colour) denoted by G′. They may show a new colour, "lilac," not present in any of their near ancestors. Six out of eighteen mice of this category, at present old enough for study, show lilac colour.

I would ask Mr. Bateson's explanation of this fact and of the coat-colour of the first hybrids GG′.

Oxford, March 24. W. F. R. WELDON.

Historical Note in regard to Determinants.

IN the last-issued part of the *American Journal of Mathematics*, vol. xxv. pp. 97–106, there is a short paper by Mr. E. D. Roe entitled "Note on Symmetric Functions" which in my opinion should not pass unnoticed. It concerns two fundamental theorems regarding alternants which it appears Mr. Roe had previously dealt with in the *American Mathematical Monthly*, vol. vi. (1899) p. 25, and had been there attributed by him to Prof. Gordan. In a footnote he now says:—

"Prof. Metzler has kindly called the writer's attention to the reference to Muir ('Determinants,' p. 176, § 129), from which it appears that Muir has the priority of publication, as far, at least, as theorem i. is concerned. It may, however, be added that in a recent letter Prof. Gordan states that he has used the two theorems for thirty years."

From this it might possibly be inferred that my publication of the said theorem twenty years ago, and Gordan's alleged private use of it thirty years ago, are matters of moment in connection with its history. This would be a fatal error, as the theorem has been in print for at least *seventy-eight* years, having been exhaustively dealt with by Schweins in his "Theorie der Differenzen und Differentiale, . . ." published at Heidelberg in 1825.[1]

The part of my connection with it which gives me most satisfaction is not the fact that I discovered it for myself, but that I discovered an earlier and neglected discoverer of it, Schweins, and have since tried my best to do justice to his merits. His treatise had been absolutely lost sight of, even in Germany, until the appearance of my paper, "An Overlooked Discoverer in the Theory of Determinants," which was published in the *Philosophical Magazine* for November, 1884. In this paper was given a brief account of that portion of his work which concerned *general* determinants, and at the same time it was indicated that this was but a small fraction of the whole contents, several *special* determinants being equally familiar to him. In 1888 the subject was returned to, and entered into more fully in the *Proceedings* Roy. Soc. Edinburgh, vol. xv. pp. 526–542, the account there given being afterwards republished in the first volume of my "History of Determinants," pp. 157–173. At a later date Schweins's chapter on alternants, extending to about thirty pages, was dealt with in a similar manner, the account appearing in a paper in the *Proc.* Roy. Soc. Edinburgh, vol. xxiii. pp. 93–132. On pp. 98–103 of this the theorem will be found, accompanied by considerable detail. To the present day, nevertheless, Schweins has not received his due from any of his own countrymen.

Speaking generally, I would urge that the greatest possible caution should be exercised by everyone who finds it necessary to attach to a theorem the name of an author, not merely when the theorem concerns alternants, but when it belongs to any part of the general subject of determinants. As a second example, let us take a case where the mathematician who is unfairly dealt with is not German but English. No fact ought to be better known than that the first discoverer of continuants was Sylvester, his paper containing the discovery having been published in the *Philosophical Magazine* for June, 1853. In the early part of 1875, however, S. Günther published a text-book which assigned the credit to the Danish mathematician, C. Ramus, and notwithstanding the fact that an effort was made in the *Philosophical Magazine* for February, 1877 (vol. iii. pp. 137–138), and still more pointedly in the *American Journal of Mathematics* for 1878 (vol. i. p. 344) to rectify the error, it has lingered on in Germany and the Continent of Europe to the present day. The details of the story are instructive. Günther's statement was:—

"Die Möglichkeit einer solchen Darstellung scheint zuerst von Ramus (*Kjöbenhavn, Vid. Selsk. Overs.* 1855, pp. 106–119) bemerkt worden zu sein: auch Spottiswoode (*Crelle's Journ.*, li. p. 374) und Heine (*Crelle's Journ.*, lvi. p. 97) wurden im Verlaufe anderweitiger Untersuchungen auf dieselbe geführt."

This was republished in 1877 without alteration. In opposition to it the following are the facts:—

(1) As above stated, Sylvester's discovery was published in June, 1853.

(2) Spottiswoode, writing in August of the same year, and having just become familiar with Sylvester's discovery, reproduced the substance of the latter's remarks in the second edition of his "Elementary Theorems Relating to Determinants," which appeared in *Crelle's Journal* in 1856.

(3) In September, 1853, Sylvester returned to the subject (*v. Phil. Mag.* [4] vi. pp. 297–299).

(4) In August, 1854, a result of Sylvester's on the subject appeared in the *Nouv. Annales de Math.*, xiii. p. 305, under the significant title "Théorème sur les Déterminants de M. Sylvester."

(5) In 1855, as Günther states, Ramus made his communication.

These five assertions have always been easily verifiable; and since the claim made publicly in 1877 and 1878, ought to have been verified by any writer who had to refer to the subject. Strange to say, this has never been done, the most recent text-book, Pascal's, having only got as far as the following sentence indicates:—

"I primi che si sono occupati dell' argomento sono stati Ramus, Sylvester, Spottiswoode, Heine, Thiele, e Günther."

If we turn for aid on such matters to the *Encyklopädie der math. Wissensch.*, which is now in course of publication, and aims at being a standard work of reference, there is nought for us but disappointment. In connection with alternants, therein called "Vandermonde'sche" or "Potenzdeterminanten," the name of Schweins is not mentioned, and as for the early history of continuants, we find the old confusion worse confounded. Ramus's paper, it is true, does not appear, but unfortunately we are referred to one of still later date (1858), by Painvin, and to a note which is attributed to Sylvester, but which Sylvester never wrote. The name "continuant," too, is wrongly attributed, and when in connection with the application to continued fractions Sylvester's name is again mentioned, the first date attached thereto is 1859! This may be a misprint for 1853, but if so there is a further error in the specification of the page. Heine's name is still to the fore; unluckily, however, it is not attached to the right paper. Something of Günther's is referred to, but the title is left out.

Cape Town, S.A., February 28. THOMAS MUIR.

[1] *V.* the second Abtheilung (pp. 369–398) and the second chapter of it in particular.

A RECENT STUDY OF MALARIA.[1]

WHEN Drs. Stephens and Christophers, the Royal Society's Commission on Malaria, were in India, Captain James had the advantage of being associated with them, and the present volume contains the result of his own observations, both at that time and since. The writer first gives a detailed and eminently practical description of the methods he has found most useful for detecting the malarial parasite in the blood of patients, and for tracing its further development in mosquitoes. An important point to which he draws attention is that the hospitals and jails of India are seriously discounted as fields for the study of the malarial parasite by the fact that the great majority of the patients are under the influence of quinine, in which case the parasites are apt to be banished from the peripheral circulation. In the investigation of malaria among the general population the same fact holds for India as Koch, Stephens, and Christophers have independently found for Africa, namely, that in any place which is more or less malarious, a certain number of young children will have malaria parasites in their blood, and the percentage of young children so affected affords the most accurate test of the amount of malaria and the liability to infection existing there. The percentage of infected children, or, as it is called, the "endemic index," is therefore the first thing to determine when investigating a village for malaria. The variety of parasites present in the children's blood, and the number of cases of "large infection," are further points to be observed, for if there are a good number of large infections, there will be more likelihood of finding infected anopheles. A search is then made for adult anopheles in the houses, outhouses, and stables, the variety and relative abundance of each species is noted, and it is determined by dissection (1) what species of anopheles are carrying malaria at the time, and (2) the percentage of these infected with sporozoites. Thirdly, a careful and detailed investigation is made in order to determine the exact position and extent of the breeding grounds of each species of anopheles present, special attention being paid to the breeding grounds of the species found to be infected. In the words of Captain James, "Every pool, stream, and collection of water of any kind within a radius of half a mile of the village should be thoroughly searched for larvæ." The accurate knowledge of the conditions determining the prevalence of malaria in the place under examination thus obtained permits of a definite system of prophylaxis being formulated for that place. An important point emphasised by Captain James is that no general system of prophylaxis will apply to every place, but that the malarial individuality of each must be studied.

As a model of what a malarial survey should be, he quotes the survey of Ennur, made in February, 1902. Ennur is a village on the coast near Madras, and was formerly a health resort for Europeans, but is now deserted by them on account of the fact that it is scarcely possible to pass even a single night there without getting fever. The source of infection was found to be the native children, 55 per cent. of whom had malarial parasites in their blood. With regard to the variety of parasite present, 81 per cent. of the infected children showed quartan parasites only, 5 per cent. tertian only, and 14 per cent. mixed infection. No malignant tertian parasites were found. Investigation of the mosquitoes showed that only two species were present in the houses, viz. *A. Rossii*, which was in great abundance, and *A. Culefacies*, which was moderately so. Dissection, however, showed that, while not one of 240 specimens of *A. Rossii* examined was infected, no less than 8.7 per cent. of *A. Culefacies* contained sporozoites. Captain James concludes that *A. Culefacies* is the chief carrier of malaria at Ennur, and that the high infection rate of this species indicates the great liability to infection of anyone residing in the place. Extensive breeding grounds for mosquitoes surrounded the village, the nearest being within ten to twenty yards of the houses. *A. Culefacies* was found to be breeding almost exclusively in the "borrow pits" by the side of the railway, and in the tanks in the compounds of the deserted European bungalows.

The observations of Captain James on malarial infection of native children have resulted in an important addition to our knowledge of this subject, for by careful investigation he has shown that the same febrile disturbance takes place in children about the time of segmentation of the parasites in their blood as in the case of adults, and that there is, in short, no essential difference between child infections and those occurring in adults.

The chapter on the causes which influence the spread of malaria in different parts of India, in which the writer has been helped by Drs. Stephens and Christophers, is one of the most valuable in the book. The data therein cited clearly show the great general influence on the prevalence of malaria due to the particular species of anopheles present, and to the nearness and abundance of anopheles' breeding grounds. The number of species of anopheles in India is large, and previous description of them inadequate. A considerable and well-illustrated part of the present monograph therefore is devoted to the differentiation of the various species of Indian anopheles, and promises to be of high practical value in future malaria investigations. The remarks on the subject of the favourite breeding places of the various species of anopheles are also of importance, and show how thorough inquiry in this direction ought to be. Captain James's observations on the usual distance of flight of anopheles in India go to show that this rarely, if ever, exceeds half a mile, and therefore that at this distance from a focus of infection "we are practically safe from malaria." With regard to the influence of altitude, it has been found that under 4000 feet has no effect by itself on the prevalence of malaria in India.

In reference to the prevention of malaria, the following remarks of Captain James are significant:—"Complete protection from malaria (and Blackwater fever) may be ensured by any individual who is willing to take the trouble to pay scrupulous attention to the use of a good mosquito curtain at night, and to adequately protect himself from being bitten by mosquitoes during the evening hours. If these simple precautions are taken it is quite unnecessary to use quinine as a prophylactic. No other precautions than these have been used by any of us during our tours through some of the most malarious parts of India, and none of us has experienced a day's fever during this time. By the use of the same precautions also, and without taking any quinine, Dr. Stephens previously passed two years in the most malarious parts of Africa without a single attack of malaria." When such success attends the adoption of simple measures of defence against malarial mosquitoes, there is good reason for hoping that additional preventive measures, such as separation of the residences of Europeans by a distance of at least half a mile from the dwellings of natives, and, above all, destruction of the breeding grounds of anopheles, will do much to eliminate a disease the death-tribute to which has been already far too costly.

M. H. GORDON.

[1] "Malaria in India." By Captain S. P. James, M.B. (Lond.), I.M.S. Issued under the authority of the Government of India by the Sanitary Commissioner with the Government of India, Simla. Published by the office of the Superintendent of Government Printing, Calcutta, 1902. Pp. 106. Price Rs. 1-8, or 2s. 3d.

THE ANDAMANS AND NICOBARS.[1]

ALTHOUGH much valuable information regarding the two most interesting groups of islands in the Bay of Bengal, known from very early times as the Andamans and Nicobars, has been published in Indian official reports and in scientific papers by officials of the islands, or by visitors to them, there is, so far as we know, no general connected monograph of them. The present volume will be welcomed, therefore, as containing an account of a three months' cruise among them, undertaken, in 1901, by the author's companion and host, Dr. W. L. Abbott, owner of the American schooner yacht *Terrapin*, of Singapore, to obtain collections of natural history, especially small mammals and ethnological objects, for the National Museum, Washington, U.S.A. It is well illustrated with photographs by the author, two maps and a hydrographical chart. We note that many of the ethnological portraits have been taken in full sunshine, and are disfigured by heavy, black shadows. Better results would have been obtained by photographing the subjects in the shade against a dark background, giving full exposure.

The first part of the book is devoted to the narrative of the cruise, and contains many interesting notes and observations upon the different islands visited, their inhabitants, fauna, flora, and physical characteristics. It opens with hints about the equipment and provisioning of a yacht for cruising in Indian seas, also regarding the guns and ammunition most suitable for a collecting naturalist. Crossing from Mergui early in January, the party first touched at Barren Island, a volcano which appears to be steadily cooling down, and passing through the Quangtung Strait, visited the convict settlement at Port Blair. Then touching at the South Andaman and the Cinques, they went to the north part of the Little Andaman, inhabited by the Öngés, who received them well. Here they found large thatched huts, very different from the palm-leaf shelters used by the natives of the northern isles.

Leaving the Andamans, they went south to the village of Mūs, in Sawi Bay, on Kar Nicobar. They were immediately struck by the entire change in place and people, from the dense forests of the Andamans to open grass land and groves of coco-palm, and from a little black-skinned, grizzly-haired Negrito race in an exceedingly low plane of existence and of little intellectual capacity, though well made and by no means repulsive in appearance, to a brown-complexioned, lank-haired, muscular people of Malay race, of fair height, intelligent and good linguists, almost semicivilised, living in well-built dwellings, cultivating food products, and possessing domesticated animals. The author gives a very interesting description of the village of Mūs, and of some peculiar institutions found there; the public halls for meetings and feasts, the maternity huts and huts for the dying on the outskirts. They then went to Tiliangchong, a forest-clad, uninhabited island where good collections of birds were made, and on to Trinkat. A week was spent in the beautiful harbour of Nankauri between the Islands of Camorta and Nankauri. A good account is given of the village of Malacca, or Nankauri, and of the customs of the inhabitants, which differ from the Kar Nicobarese. Of the convict settlement at Camorta, on the north side of the harbour, little now remains beyond

FIG. 1.—Huts of the Shom Peñ. (From "In the Andamans and Nicobars.")

[1] "In the Andamans and Nicobars." The Narrative of a Cruise in the schooner *Terrapin*, with Notices of the Islands, their Fauna, Ethnology, &c. By C. Boden Kloss. Pp. xvi+373. (London: John Murray, 1903.) Price 21*s*. net.

two graves, one being that of the unfortunate De Röepstorff, killed in 1883, whose memory is still cherished by the natives, and will not readily be forgotten by the members of the Eclipse expedition of 1875, for whom he did so much. He was one of the first to make a scientific study of these islands.

Leaving the harbour by the western exit, the party visited Dring, on Camorta, and thence passing by Bompoka, Teressa and Chaura, where all the Nicobar pottery is made, they anchored off Kachal, where they first found monkeys, and then crossed the Sombrero Channel to the island of Little Nicobar, east of Pulo Milo, where they found good anchorage. The author suggests this as a site for any future European settlement on account of the harbour, the fertility of the soil, and the presence of water. Here monkeys abounded, and in some caves they found a new leaf-nosed bat and the birds-nest swift living together, but never occupying the caves at the same time. After a halt at Kondul, they went to the north side of the Great Nicobar and spent nearly a month visiting villages on the west coast, ending with an excursion up the beautiful valley of the Galatea River. In this island they found some fairly civilised members of the Shom Pen tribe, who live in the interior, and many photographs of them are given. Fig. 1 shows one of their huts with a diagonal bracing to the props. The party left Singapore early in April.

In the second part, which is largely a compilation, the author discusses the two groups of islands more fully, as regards their history, geological formation, climate, products, languages, ethnographical characteristics and origin of the different races of inhabitants. Several illustrations are given of the ornaments, weapons, &c., used in both groups, and of the curious carved wooden images and painted screens used as charms or scare-devils by the Nicobarese. Dampier's narrative of his experiences in the Great Nicobar, in 1688, is reprinted, also an extract from an old account of Kar Nicobar by Dr. J. G. Koenig, a pupil of Linnæus. There is an account of the Kar Nicobarese from information given by Mr. V Solomon, a Christian catechist who has lived among them for many years.

At p. 320, the author has given a summary of his conclusions regarding the origin and variation of the fauna of these islands, based on the theory that the two groups are surrounded by deep sea, except on the north, towards Arakan, and that consequently they have never been connected with the Malay peninsula or Sumatra, and could not have derived their fauna from them. On his hydrographic chart, at p. 166, he shows a wide deep sea channel of more than 1000 fathoms running in from the west between Great Nicobar and Sumatra into the deep Andaman Sea. The depth of this channel has usually been put at about 760 fathoms, but in the latest chart of this part of the Indian Ocean there seems to be no such deep-sea passage between the islands, but a distinct shallowing with a ridge, over which the depth of water does not exceed 950 fathoms in the deepest part about midway between them. The author also estimates the depth of the Ten-Degree Channel at 600 fathoms, but the chart shows a ridge between Little Andaman and Kar Nicobar at a depth of not more than 450 fathoms. The fact that these channels and other ocean depths are so much shallower than the author has been led to believe may modify his conclusions. The question of the geological, zoological and botanical relationships of these islands is a very difficult one, and has engaged the attention of officers of the Indian scientific services for many years past. A great deal has been published on the subject in the official records of the Indian Museum, Marine and Geological Surveys, and the *Journal* of the Asiatic Society of Bengal, which the author seems to have overlooked, and a notice of which would have greatly enhanced the value of the book.

To zoologists, the fact that sixteen new species of mammals and ten hitherto undescribed species of birds from the two groups of islands were collected by Dr. Abbott and the author will be of interest. The former have been fully described by Mr. G. A. Miller, jun. (*Proc.* Nat. Museum, Washington, U.S.A., xxiv., 1902), but, considering that they include some well known forms, and that the islands have been constantly visited by experienced collectors from India for many years past, their all being new is doubtful. The same may be said of the new birds, a list of which is given by the author at p. 331.

Lists of the mammalian fauna, and of the birds of both groups, including the new species, are given with notes on their distribution. The work concludes with appendices relative to the climate, forest trees and timbers, population, education, &c., of the Andamans, also to the flora, population, trade articles, presents and barter, besides tables of measurements of members of different tribes of Nicobarese.

The author has had the great advantage of the assistance of Mr. E. H. Man, who is the greatest living authority on the islands, and the book is a very useful work of reference regarding them. J. W.

PULKOVA OBSERVATIONS OF NOVA PERSEI.

THE Pulkova Observatory has recently issued[1] a valuable contribution to our knowledge of Nova Persei, which attracted so much attention at the beginning of the year 1901. The observations which are here brought together and discussed were those made by M. Belopolsky, and were, for the main part, chiefly of a spectroscopic nature, both photographic and visual.

Fortunately, the high latitude of the observatory allowed this observer to photograph the spectrum of the star during its lower culmination, so that he was able to secure a complete series of 71 photographs, extending from February 26 to June 4; after this date, long exposures became impossible, and eye observations were substituted. In the first instance, the spectroscope employed was mounted on the astrographic refractor, but later (March 31) the 30-inch was substituted. In the present volume, M. Belopolsky gives a very complete account of each photograph, adding the reduced wave-lengths after the computation by the Cornu-Hartmann formula.

It will be remembered that the spectrum of this star underwent rapid changes, not only in intensity, but in the number and positions of the lines. The numerous bright lines with their dark components gradually became less in number, and when the Nova's magnitude began to undergo the short period light changes, the spectrum indicated a stellar and nebulous stage alternately; eventually, as the Nova grew fainter, the nebular spectrum predominated. All these changes are described in detail by M. Belopolsky, and he further gives the measurements of the width, intensity and displacement of the hydrogen and other lines at different epochs of the Nova's life.

In the discussion of the whole set of observations, this observer comes to conclusions which are different from those that are at present generally held. Thus, for instance, he is not inclined to believe that the displacements are due to movements of the Nova according to the Doppler-Fizeau principle. One of his reasons

[1] Publications de l'Observatoire Central Nicolas, vol. xvii. séries ii., 1902.

against this hypothesis is that, as in all new stars, the dark absorption bands are always on the violet side, and the bright radiation bands displaced towards the red; this implies that the former always move towards and the latter away from the sun, which, as he says, is highly improbable. M. Belopolsky does not consider the displacement of the bright lines towards the red end of the spectrum real at all, but only illusionary, in consequence of their unsymmetrical appearance. This unsymmetrical appearance is due, as he suggests, to the absorption bands, which lie nearer to the violet edges of the bright bands. In fact, he says, "streng gesagt existeren keine Ränder der Emissions-Banden," but that they merge into the continuous spectrum; it is only the existence of absorption bands which gives them their sharp edges on the violet side.

Another point which M. Bolopolsky dwells upon at some length is the apparent peculiarities in the behaviour of the intensities of some of the hydrogen and cleveite gas lines, and he is inclined to attribute these interchanges of intensity to actual changes of the lines themselves. Other observers have been more inclined to explain such apparent abnormal features by assuming that a neighbouring line of other origin was becoming bright, while the original line was on the wane. Thus, for instance, when the hydrogen spectrum of the Nova was dimming very considerably and the lines were all weak, one of the hydrogen lines, $H\epsilon$, on the other hand, was becoming stronger. Since the weakening of the hydrogen lines was accompanied by a strengthening of the nebular lines, it was fair to assume that at, or close to, the position of $H\epsilon$ a new line of unknown origin had made its appearance, especially if it were of a similar nature to the nebular lines.

Enough, perhaps, has been said to indicate the general lines M. Belopolsky has followed. There are, however, many other points, such as the individual structure of the bright bands (M. Belopolsky has divided $H\gamma$ into twenty-four and $H\delta$ into twenty-eight parts), to which reference might be made, but these must be left to those readers who will read the original. Four plates accompany the text, the first two giving in diagrammatic form the intensity curves of the hydrogen bands, and the rest reproductions of the spectra of the Nova, with the terrestrial comparison spectra on different dates. It seems a pity that the latter are so very narrow that it is difficult, even with the aid of a lens, to identify more than the very general features, while one can assume that the originals were full of detail. WILLIAM J. S. LOCKYER.

THE BRITISH ANTARCTIC EXPEDITION.

THE first news of the British Antarctic Expedition since the departure of the *Discovery* from New Zealand in December, 1901, has been brought by the relief vessel *Morning*, commanded by Captain Colbeck, which arrived at Lyttelton on March 25. Captain Colbeck found the *Discovery* in MacMurdo Bay (Victoria Land) on January 23, 1902; all was well on board and only one serious casualty had occurred—the loss of a seaman named Vince, who fell down an ice-slope into the sea and was drowned. Commander Scott's official report of the voyage of the *Discovery* up to the time of meeting with the *Morning* has been telegraphed home by Reuter, and is as follows:—

The *Discovery* entered the ice pack on January 23, 1902, in latitude 67° south. Cape Adare was reached on January 9, but there a heavy gale and ice delayed the expedition, which did not reach Wood Bay until January 18. A landing was effected on January 20 in an excellent harbour situated in latitude 76° 30′ south. A record of the voyage was deposited at Cape Crozier on January 22. The *Discovery* then proceeded along the barrier within a few cables' length, examining the edge and making repeated soundings. In longitude 165° the barrier altered its character and trended northward. Sounding here showed that the *Discovery* was in shallow water. From the edge of the barrier high snow slopes rose to an extensive heavily glaciated land with occasional bare precipitous peaks. The expedition followed the coast line as far as latitude 76°, longitude 152° 30′.

The heavy pack formation of the young ice caused the expedition to seek winter quarters in Victoria Land.

On February 3 the *Discovery* entered an inlet in the barrier in longitude 174°. A balloon was sent up, and a sledge party examined the land as far as latitude 78° 50′. Near Mounts Erebus and Terror, at the southern extremity of an island, excellent winter quarters were found. The expedition next observed the coast of Victoria Land, extending as far as a conspicuous cape in latitude 78° 50′. It was found that mountains do not exist here. Huts for living and for making magnetic observations were erected, and the expedition prepared for wintering. The weather was boisterous, but a reconnaissance of sledge parties was sent out, during which the seaman Vince lost his life, the remainder of the party narrowly escaping a similar fate. The ship was frozen in on March 24. The expedition passed a comfortable winter in well sheltered quarters. The lowest recorded temperature was 62° below zero.

The sledging was begun on September 2, parties being sent out in all directions. Lieutenant Royds, Mr. Skelton and party established a "record" in an expedition to Mount Terror, travelling over the barrier under severe sleighing conditions, with a temperature of 58° below zero.

Commander Scott, Dr. Wilson, and Lieutenant Shackleton travelled ninety-four miles to the south, reaching land in latitude 80° 17′ south, longitude 163° west, and establishing a world's "record" for the farthest point south. The journey was accomplished under trying conditions. The dogs all died, and the three men had to drag the sledges back to the ship. Lieutenant Shackleton almost died from exposure, but he has now quite recovered. The party found that ranges of high mountains continue through Victoria Land. At the meridian of 160° foothills much resembling the Admiralty Range were discovered.

The ice barrier is presumably afloat. It continues horizontal, and is slowly fed from the land ice. Mountains 10,000 feet to 12,000 feet high were seen in latitude 82° south, the coastline continuing at least as far as 83° 20′ nearly due south. A party ascending a glacier on the mainland found a new range of mountains. At a height of 9000 feet a level plain was reached, which was unbroken to the west as far as the horizon.

The scientific work of the expedition includes a rich collection of marine fauna, of which a large proportion are new species. Sea and magnetic observations were taken, as well as seismographic records and pendulum observations. A large collection of skins and skeletons of southern seals and sea birds has been made. A number of excellent photographs have been taken, and careful meteorological observations were made. Extensive quartz and grit accumulations were found horizontally bedded in volcanic rocks. Lava flows were found in the frequently recurring plutonic rock which forms the basement of the mountains.

Before the arrival of the *Morning* the *Discovery* had experienced some privation owing to part of the supplies having gone bad. This accounted for the death of all the dogs. She was revictualled from the *Morning*, however, and the explorers are now in a position to spend a comfortable winter.

As the *Discovery* left Port Chalmers on December 24, 1901, and reached Cape Adare on January 9, 1902, the statement that she entered the pack ice on January 23 is obviously an error; the correct reading is probably "January 2–3."

In addition to the above, the following telegrams have been transmitted by Reuter, under dates March 26, 27, and 28:—

Captain Colbeck, of the *Morning*, said in the course of an interview that he thought the chances of the *Discovery* being free this season were doubtful.

Nine of the *Discovery's* seamen, who are tired of the

work, have returned on board the *Morning*. Lieutenant Mulock has replaced Lieutenant Shackleton, who is invalided.

The sledge journey of Captain Scott, Dr. Wilson, and Lieutenant Shackleton, which resulted in the farthest point south being reached, took ninety-four days.

After the explorers had left a depôt which had been previously established sixty miles south of the ship, the snow became soft, and it was almost impossible to drag the sledges along. Half of the sledges had to be hauled five miles, and then the party returned and brought up the remainder, each five miles covered thus involving fifteen miles of travelling. This relay work lasted twenty-nine days.

The explorers established a depôt in latitude 80° 30′ south, and then discarded all superfluous gear, and set out on December 15 for a dash to the south. On January 1 they reached latitude 82° 17′ south. The southernmost depôt was regained on January 15, and the ship on February 3.

Lieutenant Armitage, second in command, on a sledge journey which he made to the westward, and which lasted fifty-two days, attained an altitude of 9000 feet. The party descended an ice slide to a glacier 3000 feet below. At one point of the journey they slid a distance of 1300 feet in one minute ten seconds, hanging by straps to the backs of the sledges. On the return journey Lieutenant Armitage fell into a crevasse and hung thirty feet below the surface. If he had not been harnessed to the others he would have fallen a depth of 2000 feet. In some places the sledges had to be lowered fifty feet, and then hauled up on the other side.

Captain Colbeck's opinion as to the *Discovery's* chances of getting clear of the ice is somewhat difficult to understand, as the *Morning* transferred a large quantity of stores to the *Discovery*, and had apparently no difficulty in getting out again, while it may be supposed that Commander Scott's decision to remain for another winter was made deliberately in pursuance of his original intention to spend two winters in the Antarctic regions. Further details will be awaited with great interest; the situation of the *Discovery*, as well as the statement in the last paragraph of the official report, emphasise the soundness of the policy which led to the dispatch of a relief vessel.

Even with the meagre information to hand, it is abundantly evident that the National Antarctic Expedition has already achieved a great success, both in the way of exploration and of scientific observation. The "record" for south latitude has been "broken" by one hundred miles, and, what is more important, an unknown mountain region, extending to at least 83° 20′ S. lat., has been discovered, suggesting, as Sir Clements Markham has remarked, that "land stretches to the Pole in a series of lofty mountains." The fact that the *Discovery* wintered at a point four hundred miles further south than any former expedition encourages the belief that her observations will be of real value to science—solving some of the crucial problems of terrestrial physics. Even greater results may be expected from the work still to be done, for Commander Scott and his comrades have the experience of one successful year to help them.

The success of the British expedition makes us look forward with the more interest to news from the German and Swedish expeditions, which are working in the "Weddell" and "Enderby" quadrants, and from which we may hear at any time. The Scottish Antarctic expedition will probably not be heard from for a year, as the *Scotia* only left the Falkland Islands on January 22, 1903, and Mr. Bruce, who is in command, has materially altered his plans, as appears from the following letter which he has sent to Reuter's Agency:—

"In a few hours we take our departure for the south. Contrary to my previous intention, I am going to winter the ship if we find a suitable winter harbour, for, on account of the lateness of the season, there will not be time to set up a separate house and set the ship free. We had a most successful passage south, having accomplished the voyage in fifty-nine days, in contrast to ninety-two days that we took in the *Balaena* in 1892. Systematic hydrometer observations and temperature observations of the surface of the sea from 30° N. have been taken, and those of the River Plate should prove of exceptional interest, since there are most remarkable and rapid changes both in density and temperature associated with strong currents. We have inspected and set up the meteorological station at Cape Pembroke, which should be as good as any in the Southern Hemisphere. This should form a very important sub-Antarctic station. We have sufficient funds to enable us to do this one year's work in the south. Now that we are on a solid basis it would be a great pity to come home before our work is really complete. A second winter, during which the ship could be kept going free, as well as the station, would be most valuable."

NOTES.

THE presidents of the sections of the British Association, for the meeting to be opened at Southport on September 9, are as follows:—*Mathematical and Physical Science*, Mr. C. V. Boys, F.R.S. (Chairman of Department for Astronomy and Meteorology, Dr. W. N. Shaw, F.R.S.); *Chemistry*, Prof. W. N. Hartley, F.R.S.; *Geology*, Prof. W. W. Watts; *Zoology*, Prof. S. J. Hickson, F.R.S.; *Geography*, Captain Ettrick W. Creak, C.B., F.R.S.; *Economic Science and Statistics*, Mr. E. W. Brabrook, C.B.; *Engineering*, Mr. C. Hawksley; *Anthropology*, Prof. J. Symington; *Botany*, Mr. A. C. Seward, F.R.S.; *Educational Science*, Sir William de W. Abney, K.C.B., F.R.S. On Friday, September 11, a discourse on "Man as Artist and Sportsman in the Palæolithic Period" will be delivered by Dr. Robert Munro, and on Monday, September 14, Dr. Arthur Rowe will lecture on "The Old Chalk Sea, and some of its Teachings."

THE *Times* of Monday contained in its latest intelligence columns two telegrams from the United States, one dated March 28 and the other March 29, both of which had been transmitted "By Marconigraph." This starts, as the *Times* says in a leader, a day-by-day transmission of news between the New and the Old World, undertaken on a contract basis, and thus distinctly marks a step forward in the development of wireless telegraphy. Mr. Cuthbert Hall stated to a representative of the *Westminster Gazette* that until the Post Office has granted the land connection for which the Wireless Co. ask (which has been granted in Canada and the United States), it is impossible to extend generally to the public and the Press the facilities afforded to the *Times*. Nevertheless, Transatlantic wireless telegraphy may now be considered on a practical commercial footing, since it is evident that the Marconi Co., and the *Times* also, feel confident of its trustworthiness if they make it the basis of an arrangement of this kind. We offer our sincere congratulations to Mr. Marconi on this advance. We have frequently commented in these columns on the extreme rapidity with which the practical development of wireless telegraphy has progressed in Mr. Marconi's hands; the present occasion affords another instance in point. There is pleasure in the remembrance of the part which pure science has played in leading to this development.

THE following have been elected fellows of the British Academy:—Dr. B. Bosanquet, Prof. E. G. Browne, Mr. Arthur Cohen, K.C., Mr. F. C. Conybeare, Prof. F. Y. Edgeworth, Dr. C. H. Firth, Prof. A. Campbell Fraser, Sir Edward Fry, Dr. F. J. Furnivall, Prof. P. Gardner, Dr. Henry Jackson, Dr. M. R. James, Dr. F. G. Kenyon,

Prof. W. P. Ker, Lord Lindley, Sir A. Lyall, Prof. W. R. Morfill, Dr. A. S. Murray, Prof. J. S. Nicholson, Dr. G. W. Prothero, the Very Rev. Dr. J. Armitage Robinson (Dean of Westminster), Dr. G. F. Stout. The number of the fellows is thus raised from forty-eight to seventy.

THE complimentary banquet given to Sir William White on Thursday last, March 26, by the presidents, vice-presidents, and members of council of the Institution of Civil Engineers, the Institution of Mechanical Engineers, the Institution of Electrical Engineers, the Institution of Naval Architects, and the Iron and Steel Institute was a function to which we refer with pleasure. The leading representatives of engineering science and practice in this country were present, and the assembly showed the high appreciation in which the work Sir William White has done for the country and the Navy is held by those who are best able to judge its value. It is not often that five scientific or engineering societies unite to do honour to one of their members in this way, but the example might well be followed more frequently. Men who have devoted their lives to the progress of pure and applied science ought to be made to feel that their fellow-workers respect and admire their labours. The public recognition of Sir William White's services on Thursday last has therefore been noticed with satisfaction by many who were not present at the banquet.

DURING the past week the British Islands have been visited by a succession of the barometric depressions which have been prevalent for some weeks, and have occasioned a persistent continuance of mild south-westerly winds, with day and night temperatures considerably above the average. On Wednesday, March 25, the Metropolis and southern parts of England experienced thunderstorms, and thunder and lightning occurred on succeeding days in various parts of the country. At Greenwich a temperature of 68° in the shade was recorded, which is the highest registered in March since 1894, and the reports issued by the Meteorological Office show that the temperature reached 65° at Oxford, 79° at Paris, and 81° at Biarritz. A peculiar feature of this abnormal temperature was that the highest readings occurred during the evening; a correspondent at Cambridge writes that he recorded 63° at 7h. 30m. p.m. In the neighbourhood of London, a reading of 68° was recorded at 8h. p.m.; this temperature is about 27° above the average, and fully 5° above the average evening summer readings. The clouds bore a somewhat unusual appearance, known as *mammato-cumulus*, or festoon-clouds.

THE following are among the lecture arrangements at the Royal Institution after Easter:—Prof. Allan Macfadyen, three lectures on the blood and some of its problems; Prof. G. H. Darwin, two lectures on the astronomical influence of the tides (the Tyndall lectures); Prof. E. J. Garwood, two lectures on the work of ice as a geological agent; Prof. Dewar, three lectures on hydrogen: gaseous, liquid and solid; Prof. S. H. Vines, two lectures on proteid-digestion in plants; Prof. J. A. Fleming, two lectures on electric resonance and wireless telegraphy; and Prof. S. P. Thompson, two lectures on the "De Magnete" and its author, (1) the book, (2) the man. The Friday evening meetings will be resumed on April 24, when a discourse will be given by the Hon. R. J. Strutt on some recent investigations on electrical conduction; succeeding discourses will probably be given by Prof. William J. Pope, Dr. D. H. Scott, the Prince of Monaco, and others.

THE Italian Senate has approved a Bill for the construction of a powerful radiographic station on the Marconi system.

IN the House of Commons on Monday, Sir J. Leng asked the Postmaster-General whether, in view of the fact that the Admiralty have come to an arrangement for the adoption of Marconi's system of wireless telegraphy, he would state what hindrance there is, if any, to the Telegraph Department giving the same facilities for transmitting Marconigrams over the public wires as are given to the cable companies, and can he state the present position of the negotiations. In reply Mr. Austen Chamberlain said: "I am prepared, on proof to my satisfaction that the company are in a position to deal satisfactorily with the business handed to them, subject to their compliance with certain conditions required in the public interest, to give them the necessary facilities for the transmission of telegrams to and from Poldhu station. I am in communication with the company and other departments on the subject."

THE electrification of the Lancashire and Yorkshire Railway between Liverpool and Southport is nearly finished, and the lines will be opened on the new system during the present year. Thirty-two miles of feeders, which are to be worked at a pressure of 10,000 volts, have been made by Messrs. Glover, of Manchester, and have just passed the factory tests at 60,000 volts. Messrs. Dick, Kerr and Co. are the engineers for the work.

THE first two trains constructed for the electrification of the Metropolitan District Railway have been delivered at South Harrow, and are being fitted with their electrical equipment. The new line from South Harrow to Ealing is being used experimentally for trial runs and so forth, power being supplied by a small station which has been specially built. The cars of the new trains are built somewhat on the same lines as those of the Central London Railway, the seats being along the sides instead of transversal. Electrical heating apparatus is installed beneath the seats. A train will be made up of seven cars, three of which, the two end ones and the middle, will be motor cars; this arrangement allows the trains to be divided into smaller units at periods of light traffic. Each car has a seating capacity of fifty, so that a complete train will carry 350 passengers in comfort, and probably as many again during busy hours, standing along the central gangway. At present no distinction of class has been made, and it is said that the company proposes to fix a uniform rate of 2½*d.* for any distance. The large generating station in Chelsea is as yet by no means finished, so it will probably be some time before the electrification is completed.

PROF. FLEMING, in his final lecture on wireless telegraphy at the Society of Arts last week, dealt with the question of interception of messages, and recounted the results of some experiments he had made the week before at Poldhu. Two series of messages were sent out from Poldhu, the one from the large aërial used in Transatlantic signalling, and the other from a small mast used for short distance experimental work. Some of the messages were in cipher, and they were all secret, being known only to Prof. Fleming; they were transmitted simultaneously, and received at the station at the Lizard, where there were two receiving circuits, one tuned to the large and the other to the small aërial. The messages were sorted out perfectly and printed on separate Morse tapes. The remainder of the lecture was devoted to a comparison between the Marconi and other syntonic systems, and to a consideration of some of the unsolved problems of wireless telegraphy. The lecturer pointed out that one fault of the receiving apparatus lay in the fact that it was unable to indicate the direction from which the received radiations were coming, or to give any gauge of its distance, thus making it impossible to localise the source.

THE report of Marconi's Wireless Telegraph Co., Ltd. which has just been issued, contains some interesting particulars of the work that has been done. The list of stations which have been erected, including Lloyd's stations, contains twenty-five names; three of these are the Transatlantic stations at Poldhu, Cape Breton and Cape Cod; of the rest eight are in England, four each in Ireland and the United States, two each in Canada and Germany, and one each in the Isle of Wight and Belgium. With reference to the Navy, it is stated that thirty-two ships have already been equipped, and arrangements have been made by which the use of wireless telegraphy in the Navy will be greatly extended. The subsidiary company, the Marconi International Marine Communication Co., Ltd., is able to report satisfactory progress; seven lines of steamships are using the system, the total number of ships so far equipped being thirty-one. The report also contains a number of details concerning the work which has been done by the Company and its offshoots in Italy, France, Germany, Belgium, the United States, Canada and other countries.

TWO reports referring to disturbances of the earth's crust have appeared since we went to press last week. They are as follows:—*Naples*, March 27. The activity of Vesuvius is again increasing. Explosions occur with frequency, and rumblings are heard. *Jerusalem*, March 30. A shock of earthquake occurred last night, at 12.35, throwing the entire population into a state of great excitement.

THE Board of Trade has received information, through the Colonial Office, that a uniform time, based on the 30th meridian, or two hours east of Greenwich, has been adopted by all the South African Governments with the exception of that of German South-West Africa. It is announced on the same authority that on February 28, at 11.30 p.m., the time was advanced to midnight in the Transvaal, and that similar steps were taken in the other South African colonies, except Natal, where no change was necessary.

A FEW details referring to the earthquake in the midland counties on March 24 (see p. 491) have reached us from correspondents. Mr. F. W. Shurlock says that at Derby a double shock occurred about 1.29 p.m., the two shocks being separated by a few seconds only, but no shock was felt at 1.10 p.m. At the Harris Institute, Preston, Mr. J. Harrison noticed a vibration of the building at about 1.32 p.m., and it was remarked that the suspended electric lamps were set swinging by the movement. Mr. W. French noticed a peculiar shaking of the floor of a room at Lancaster at about 1.30 p.m., and remarked that it was an earth tremor. A correspondent, writing from Rock Ferry, says there were three distinct shocks, the second being of a compound character. "There were about three principal movements in this middle shock, the first being most, and the last least, pronounced; but I could also distinguish in addition to this rolling a pitching motion at right angles to it, and a combination of the two, the greatest dip of the pitch being towards the N.E. Of the other two quakes the first had one chief motion towards the S.E., and the last had one similar but of less force, and then slight pitching which gradually died away. There was no noise, and the time the earthquake lasted appears to me to be longer than that given in the accounts I have seen." Prof. E. Wiechert records in the *Daily Mail* that the earthquake was registered by a seismograph at Göttingen.

THE death is announced of Dr. Gustav F. R. von Radde, who was born at Danzig on November 27, 1831, and distinguished himself as a naturalist. From the *Times* we learn that in 1855 he was called to St. Petersburg by the Russian Imperial Geographical Society, which was dispatching an important expedition to Eastern Siberia and Kamtchatka, to which he was attached. It extended over five years, and at the request of Count Muravieff, the then Governor General of Siberia, von Radde founded a Cossack settlement, which was named Raddowka after him, and is one of the most flourishing settlements in those parts. For the reports which he published on his travels the Russian Academy of Science awarded him the Demidoff prize, and published them at its own expense. In 1863 he accepted a call to the Caucasus and went to Tiflis. There he founded a Caucasian museum of natural history, ethnography, and archæology, of which he was made the director, a post he held until his death. He was able, nevertheless, to undertake many other scientific journeys, not only in Caucasia, but in Transcaspia and along the whole borderland of Russia in Asia, as well as in other parts of the East, which resulted in many very valuable contributions to the scientific literature of the day.

THE Royal Academy of Sciences of Turin offers the following prizes:—The Bressa prize of 9600 lire for the most valuable discovery made by an Italian in the period 1901–1904, in a large number of various specified departments covering a very extended portion of the domain of science. Two prizes of 30,000 lire, both open to foreigners, are offered, one for the best printed work on Latin literature, published in 1903–1906, the other for the most valuable work on any of the physical sciences printed in 1907–1910. Finally, a prize of 2500 lire, founded by Gautieri, is offered for the best work on philosophy, including the history of philosophy, published in 1900–1902.

THE Royal Meteorological Institute of the Netherlands has published its fifty-third year-book, containing observations and results for 1901. For the last few years the value of this publication has been much enhanced by its conformity to the scheme adopted by the International Meteorological Committee. Hourly observations are published for four stations, tri-daily observations and monthly and annual summaries for a number of other stations, and rainfall values for 106 stations. An appendix gives an interesting account of the storm-warning service; 74·5 per cent. of the warnings issued met with complete success, and 15 per cent. with partial success. Recognition is made of the value of special warning messages received from the English Meteorological Office.

WE have received from the president of the International Aëronautical Committee a preliminary report upon the balloon and kite ascents made in Europe and the United States on the morning of February 5. The space at our disposal will only allow of reference to the most noteworthy altitudes attained by the registering balloons. At Trappes the register recorded a height of 15,700 metres; the minimum temperature, −59°·8 C., was registered at 10,940 metres. The reading on the ground was 5°·4; at 1850 metres there was an inversion, 1°·8. At Itteville the greatest height was 15,020 metres, minimum temperature −61°·2 at 11,650 metres, temperature on the ground 5°, inversion 0°·6 at 1880 metres. At Strassburg the low temperature of −66°·0 was recorded at 12,500 metres, reading at starting 0°; two inversions were shown, 2°·4 at 300 metres and 6°·4 at 1400 metres. A second balloon recorded −62°·0 at 12,100 metres, inversion 5°·5 at 1850 metres. These ascents were made in an area of high barometric pressure.

THE annual meeting of the Scottish Meteorological Society was held on March 25. The report of the council, presented

to the meeting, states that Sir Arthur Mitchell has resigned the office of honorary secretary, and has been succeeded by Mr. R. T. Omond. The council also reports that the work at the two Ben Nevis observatories has gone on satisfactorily. The arrangements for resuming the observations during the summer at the half-way station (2200 feet) were carried out in August last. A very complete series of observations was obtained, both at the half-way station, and also for part of the time at three other intermediate stations. Dr. Buchan has been chiefly occupied with a continuation of the discussion of the hourly observations of pressure, temperature, humidity, rainfall, and sunshine, with their inter-relations, at the Ben Nevis and Fort William observatories from 1890 to 1902. As regards the temperature and pressure inter-relations, the "constants" have now been determined for all temperature differences, for differences of 12°·0 or less, and for differences of 18°·0 or more. The relations which the results bear to the cyclones and anticyclones of north-western Europe have been pointed out. A beginning has been made with a discussion on the hourly hygrometric differences. The relations of the various hourly and daily differences thus ascertained to weather changes are also in course of examination.

PROF. T. D. A. COCKERELL, of the New Mexico Normal University, East Las Vegas, writes concerning the advantages of the wall museums which he has used in the department of biology under his care. The cases are shallow, and consist of frame and back of wood, and a glass front screwed down tightly so as to keep out dust. Wall museums of this kind occupy no space needed for other purposes, and can be placed in any rooms continually used by students. A similar plan has been advocated by some teachers in this country, who will be glad to hear of the success which Prof. Cockerell has found to attend the employment of wall cases in his biological instruction.

To be able to attach, by means of an adapter, a telephoto lens to the objective of one's camera is a desideratum which will be appreciated by many photographers. Such an acquisition has recently been placed on the market by Messrs. J. H. Dallmeyer, Ltd., in the form of "the Adon" lens, which is a very compact, light and well-finished article. It is mounted in aluminium, has a rack and pinion adjustment, and an adapter for mounting it on other lenses, or a flange for using it by itself, and an iris diaphram, the whole of which is contained in a neat leather case. The system itself is composed of two achromatic combinations, the front being a positive lens of focal length 4½ inches, and the back a negative lens 2¼ inches in focal length. The focusing is manipulated by the rack and pinion, thus obviating the necessity of altering the extension of the camera. When used in front of an ordinary lens, there is a limit to the magnification obtainable, but by itself it has no such limitation; in the first case magnification from 2 to 2½ diameters can be secured. The illustrations contained in the booklet which describes the methods of use and results obtained with this lens show specimens of the kind of work that can be accomplished, and speak well for the definition of the combination.

MR. F. E. IVES has described in the *Journal of the Franklin Institute* a very simple way of measuring objects under the microscope by projecting an image of an illuminated scale—a jeweller's saw was used—on the plane of the object by means of the substage condenser.

THE unfortunate controversy that has arisen between Major Ross and Prof. Grassi regarding the discovery of the mosquito phase of the malaria parasite continues, and a lengthy pamphlet dealing with the whole matter has been issued by the last named. To an impartial observer, it would seem that the credit of the discovery must undoubtedly be given to Major Ross, but that a vast amount of detail as to the exact metamorphoses undergone by the parasite and the elucidation of the species of mosquito concerned have been contributed by Prof. Grassi.

As is well known, a high body temperature is incompatible with life, and when it rises to about nine degrees above the normal (from 98°·4 to 107° F.), and continues at this for any length of time death ensues. Drs. Halliburton and Mott show that this temperature coincides with the coagulation of one of the proteids, cell-globulin, of the cells of the nerve-centres, and probably of other cells of the body, and suggest, therefore, that the physico-chemical cause of death from hyperpyrexia is the coagulation of cell-globulin.

IT is announced that commencing with the current volume, the *Physical Review* will be conducted with the cooperation of the American Physical Society, and the proceedings of the Society will be published in the *Review* instead of in the *Bulletin* previously issued.

PROF. LUIGI SALA publishes in the Lombardy *Rendiconti* an account of the work of Giovanni Zola, professor of anatomy in the University of Pavia, who died on December 15, 1899. Prof. Zola was the author of more than seventy writings dealing with anatomy, his largest work being his description of the museum of human anatomy at Pavia. He was also one of the founders, in 1879, of the *Bollettino scientifico*, which he edited jointly with Profs. A. de Giovanni, of Padua, and Leopoldo Maggi, of Pavia.

IN a note contributed to the *Physical Review* on the dimensions of large inductance coils, Mr. James E. Ives gives numerical results showing that a coil of maximum inductance must have a square cross section, that the inductance of a coil with given length of wire increases rapidly as the mean radius is increased up to the maximum inductance, and then decreases slowly, and that for coils of maximum inductance the inductance increases rapidly as the length of wire increases, but not quite proportionately to the square of the length. The second conclusion shows that it is better to make the mean radius too large than too small.

IN certain notes on the anatomy of the 9-banded armadillo (*Tatusia novemcincta*), published in vol. xvii. of *Mem. Soc. Antonio-Alzate*, Dr. Duges alludes to the animal under the name of *Cachicama novemcincta*. We have been unable to find that generic term in any list, and if the author intends it to supersede Tatusia (or Tatu, as some would have it), this should have been definitely stated.

IN continuation of previous articles on exterminated animals, Mr. G. Renshaw, in the March number of the *Zoologist*, publishes one on the black emeu (*Dromaeus ater*), of Kangaroo Island, which was exterminated by a squatter some time during the last century. A stuffed specimen in the Paris Museum is the only complete skin of this bird known to exist.

MUCH interest attaches to an article by Mr. E. C. Case in the February number of the *American Naturalist* on the "Pelycosaurian" reptiles of the Permian and Triassic formations of North America. These reptiles were near relatives of the anomodonts (theriodonts and dicynodonts) of the Trias of South Africa and other countries of the Old World. The author now finds that the American forms, in the retention of two temporal arcades to the skull, display affinities to the tuatera (Rhynchocephalia) which are lost in their African allies, the two temporal arcades having in these

latter more or less completely coalesced. We have thus further evidence of the derivation of mammals, firstly through forms allied to the American pelycosaurians, and then through the Old World theriodonts, from the primitive rhynchocephalian type.

MR. F. FINN has sent us a copy of a paper on variation in birds, reprinted from the *Journal* of the Asiatic Society of Bengal. Among the abnormalities is a five-toed quail; while colour-variations are well illustrated by a plate showing three different phases in the pintail snipe. As regards variation under domestication, the author believes this to be due to conditions favouring the preservation of abnormal individuals rather than to an inherent tendency to vary. Neither, he believes, is climate directly conducive to variation. The coarse and heavy body form noticeable in so many domesticated birds, especially waterfowl, appears to be due to the aggregate result of small tendencies in this direction, which, in the wild state, would have been soon eliminated. Possibly the ultra development of fleshy structures, such as combs and wattles, among many domesticated birds is due to this tendency towards a coarse and heavy habit.

THE investigations of Prof. Vines upon the nature of ferments in plants which act upon proteids—on which subject a second paper appears in the *Annals of Botany*—suggest that these are of two kinds. The ferment found in seeds and fruits, notably pineapples and figs, or other storage organs, can break down the more complex proteids, but the digestive substance detected in many leaves, stems and roots can only act upon simpler proteid bodies; this may correspond to the ferment termed *erepsin*, which has been discovered in the small intestine of animals.

INFORMATION from the neighbourhood of Newfoundland and Nova Scotia indicates that this is likely to be a great ice season. Before the end of February vessels were already being seriously delayed by extensive ice-fields and floes, and scores of large bergs. In some cases it has been necessary to steam southward for many hours to get clear of the danger. The bergs are met with well to the eastward of the Newfoundland bank, and it will not be surprising if they drift as far as the 40th meridian, or even to 35° W., judging by the welling-up, thus far to the eastward, of the very cold water of an under current which probably comes from the ice region. Round 50° N., 35° W., in December and January last, such exceptionally low sea temperatures as 32° to 40° were observed.

DUST storms and ice are amongst the interesting features of the Meteorological Office pilot chart for the month of April. It is now a comparatively easy matter to explain the fall of dust which was so generally observed over the south of England and in many Continental countries, from the Bay of Biscay to Austria, on February 22–23 last. The meteorological logs from various ships show that since the middle of December immense quantities of sand have been borne by the African harmattan wind over the Gulf of Guinea and out on the Atlantic to about 30° W. longitude. At first the phenomenon was limited to the tropical region, but in February, when we had such a remarkably persistent southerly to south-westerly wind in the British Isles, the north-east trade was displaced by a south-easterly to south-westerly breeze, at least down to the latitude of 13° N. The dust was therefore carried northward by this current, and there are a number of records of falls in various latitudes. On February 21, the day before the fall in Europe, a fine, light reddish dust was deposited on a ship in 40° N., 23½° W., the dust coming up from south-south-west or south-west. There seems to be sufficient evidence available to negative the theory that the dust falls had their origin in the West Indian volcanic outbursts of last year.

MESSRS. CHARLES GRIFFIN AND CO., LTD., have reissued at 6*s*. net the third edition of "A Short Manual of Inorganic Chemistry," by Dr. A. Dupré, F.R.S., and Dr. H. W. Hake.

AN eighteenth edition of Trautwine's "Civil Engineer's Pocket-Book" has been published by Messrs. John Wiley and Sons in New York, and Messrs. Chapman and Hall in this country. The new edition is larger by about 100 pages than its recent predecessors. Numerous new articles have been introduced, and about twenty others have been rewritten. It is thirty years since the first edition of the pocket-book appeared, and in its new form it should have another long lease of life.

THE second part of the second German edition of Prof. J. H. van 't Hoff's "Vorlesungen über theoretische und physikalische Chemie" has been published by Messrs. F. Vieweg and Son, Brunswick. It will be remembered that the work is based upon lectures delivered in the University of Berlin, and contains a clear and concise statement of the principles of physical chemistry. The first part deals with chemical dynamics, and the part before us is concerned with chemical statics. The price of this part is four marks.

THE *Berichte* for March 7 contains a very striking paper by Messrs. Bamberger and Seligman on the tertiary nitroso-paraffins. The three compounds described are blue when in a monomolecular state, but, like nitrogen peroxide, readily polymerise to colourless bimolecular compounds. Thus the blue ethereal solutions deposit colourless crystals, and the evaporation of the last trace of ether is accompanied by an abrupt bleaching of the whole mass. The change is, however, by no means instantaneous, and a solution of the white polymer only gradually develops the normal blue tint. By determining at intervals of a few minutes the freezing point of a freshly-prepared solution in benzene, the gradual course of the depolymerisation was followed, and it was found that the decrease of molecular weight, which continued during four hours, exactly corresponded with the development of the blue colour. Depolymerisation takes place most rapidly when the compounds are dissolved in chloroform or benzene, and least rapidly when oxygenated solvents such as ethyl acetate or acetic acid are used. Aqueous solutions become blue very slowly, and even on heating to the boiling point the development of colour is not instantaneous. These results are directly contrary to what has previously been observed with reference to the influence of solvents on the velocity of chemical change, and further investigations should yield important results. The contrast with nitrogen peroxide is further illustrated by the fact that the white and blue compounds differ not only in solubility, but also in smell, the white form being odourless, whilst the blue form has a sharp, pungent smell.

THE additions to the Zoological Society's Gardens during the past week include two Chanting Hawks (*Melierax musicus*) from South Africa, presented by Mr. A. W. Guthrie; a Nonpareil Finch (*Cyanospiza ciris*), an Indigo Bird (*Cyanospiza cyanea*) from North America, presented by Miss Anne Ricardo; a Broad-fronted Crocodile (*Osteoloemus tetraspis*) from Nigeria, presented by Mr. C. V. Fox; a Hagenbeck's Mangabey (*Cercocebus hagenbecki*) from the Upper Congo, a Black-handed Spider-Monkey (*Ateles geoffroyi*) from Central America, deposited; eight Mandarin Ducks (*Æx galericulata*) from China, received in exchange.

OUR ASTRONOMICAL COLUMN.

A NEW STAR IN GEMINI.—A communication received from Prof. H. H. Turner on March 25 announced that the image of a Nova, or a variable, had been discovered on a photograph taken at the University Observatory, Oxford, on March 16. The position of the object was given as

R.A. = 6h. 37m. 48·9s., Dec. = +30° 2′ 39″ (1900),

which is situated in the constellation Gemini near to the border of Auriga, and about half-way between θ and ϵ Geminorum, a little preceding the straight line joining them. This position was confirmed by an observation made at Oxford on the evening of March 24. A telegram from the Kiel Centralstelle confirmed the discovery.

In a second communication from Oxford it was announced that Mr. Newall had observed the spectrum with a direct vision spectroscope attached to the Sheepshanks equatorial at Cambridge, and had little doubt that the object was a Nova. He found that bright lines—both numerous and strong—were present, those in the green part of the spectrum being especially bright.

In a letter to the *Times* of Saturday, March 28, Prof. Turner stated that the object was not bright enough for its image to appear on plates taken on February 24 and earlier, and as no apparent movement had taken place between March 16 and 24, it was certainly not a planet.

The magnitude of the new star is about 7, and, as it is at present near to the zenith during a greater part of the evening, it should be easy to observe, given favourable meteorological conditions. The accompanying chart shows the approximate position of the Nova in regard to the surrounding stars.

A *Circular* (No. 58) from the Kiel Centralstelle announces that Prof. Hartmann, at Potsdam, examined the visual spectrum on March 27. He found the hydrogen lines Hβ and Hα to be present, the latter appearing especially bright; the yellow part of the spectrum is extremely faint as compared with the blue, which contains many bright lines superimposed on a continuous spectrum. The spectrum leads to the conclusion that the star is either a Nova or a variable of the Mira type.

Prof. Hale, at Yerkes Observatory, observed the Nova on March 27·75 (G.M.T.), and found its position to be α = 6h. 37m. 49s., δ = +30° 2′ 38″, and its magnitude 8·5. The spectrum contains bright lines (or bands), and the colour of the Nova is red.

THE SOLAR CONSTANT.—In a paper read before the American Association for the Advancement of Science on December 30, Prof. S. P. Langley discussed the values which have hitherto been obtained for the constant of solar radiation, and gave an outline of the course of study of this constant that it is proposed to carry out in the immediate future at the Smithsonian Astrophysical Observatory.

The author, in his opening remarks, drew attention to the vital importance to humanity of obtaining definite knowledge of the magnitude, nature and possible variations of this radiation, and stated that whilst many other astronomical problems are of great interest from a purely scientific point of view, this one problem is of intensely practical importance; he then summarised this view in the following statement:—"I recognise that every nebula might be wiped out of the sky to-night without affecting the price of a labourer's dinner, while a small change in the solar radiation may conceivably cause the deaths of numberless men in an Indian famine."

Thus recognising the grave importance of a minute study of solar physics, Prof. Langley devoted a great deal of attention to its problems whilst connected with the Allegheny Observatory and the Mount Whitney expedition, and with his bolometer made a long series of observations which led to the conclusion that the values obtained by Pouillet and other observers were far too small. By measuring the solar radiations wave-length by wave-length, he obtained values varying from 3·0 to 3·5, thus nearly doubling the classical value, 1·76 calories, obtained by Pouillet.

Using the bolometric method it is now possible to obtain results in fifteen minutes which it previously took two days to obtain, and the Smithsonian Observatory proposes to commence, in the immediate future, a series of observations in order to determine (*a*) the coefficients of atmospheric transmission under all conditions, and (*b*) the coefficients of transmission of the various parts of the apparatus. In doing this the observers will become familiar with the experimental methods which, it is hoped, will be used later at more elevated stations where the atmospheric conditions are much more favourable, and they will also obtain values more nearly approximate to the true values than those hitherto obtained (*Astrophysical Journal*, vol. xvii. No. 2).

THE MAGNESIUM SPECTRUM LINE AT λ 4481.—Sir William and Lady Huggins communicate to the March number of the *Astrophysical Journal* the preliminary results obtained by them in a series of experiments made in order to determine under what laboratory conditions the line at λ 4481 in the magnesium spectrum assumes the sharp, narrow appearance it has in many stellar spectra.

The authors have arrived at the conclusion that the quantity and the electromotive force of the electricity which acts during the spark discharge between magnesium poles, have only a small influence on the character of this line, but that the suddenness of the blow of the discharge determines its character.

In a plate which accompanies the article is shown a reproduction of the spark spectrum where the discharge of the secondary took place directly between the magnesium poles, the jar having been removed from the circuit; in this case the blow of the discharge is less sudden, through the incoming of the full self-induction of the coil itself, and the line assumes the sharp appearance seen in stellar spectra. Other spectra which are reproduced show the difference in the appearance of this line under various conditions of spark discharge.

THE EMANATIONS OF RADIUM.[1]

A SOLUTION of almost pure radium nitrate which had been used for spectrographic work was evaporated to dryness in a dish, and the crystalline residue examined in a dark room. It was feebly luminous.

A screen of platinocyanide of barium brought near the residue glowed with a green light, the intensity varying with the distance separating them. The phosphorescence disappeared as soon as the screen was removed from the influence of the radium.

A screen of Sidot's hexagonal blende (zinc sulphide), said to be useful for detecting polonium radiations, was almost as luminous as the platinocyanide screen in presence of radium, but there was more residual phosphorescence, lasting from a few minutes to half an hour or more according to the strength and duration of the initial excitement.

The persistence of radio-activity on glass vessels which

1 By Sir William Crookes, F.R.S. Read at the Royal Society on March 19.

have contained radium is remarkable. Filters, beakers, and dishes used in the laboratory for operations with radium, after having been washed in the usual way, remain radioactive; a piece of blende screen held inside the beaker or other vessel immediately glowing with the presence of radium.

The blende screen itself is sensitive to mechanical shocks. A tap with the tip of a penknife will produce a sudden spark of light, and a scratch with the blade will show itself as an evanescent luminous line.

A diamond crystal brought near the radium nitrate glowed with a pale bluish-green light, as it would in a "Radiant Matter" tube under the influence of kathodic bombardment. On removing the diamond from the radium it ceased to glow, but when laid on the sensitive screen, it produced phosphorescence beneath which lasted some minutes.

During these manipulations the diamond accidentally touched the radium nitrate in the dish, and thus a few imperceptible grains of the radium salt got on to the zinc sulphide screen. The surface was immediately dotted about with brilliant specks of green light, some being a millimetre or more across, although the inducing particles were too small to be detected on the white screen when examined by daylight.

In a dark room, under a microscope with a $\frac{2}{3}$-inch objective, each luminous spot is seen to have a dull centre surrounded by a luminous halo extending for some distance around. The dark centre itself appears to shoot out light at intervals in different directions. Outside the halo, the dark surface of the screen scintillates with sparks of light. No two flashes succeed one another on the same spot, but are scattered over the surface, coming and going instantaneously, no movement of translation being seen.

The scintillations are somewhat better seen with a pocket lens magnifying about 20 diameters. They are less visible on the barium platinocyanide than on the zinc sulphide screen.

A powerful electromagnet has no apparent effect on the scintillations, which appear quite unaffected when the current is made or broken, the screen being close to the poles and arranged axially or equatorially.

A solid piece of radium nitrate is slowly brought near the screen. The general phosphorescence of the screen as visible to the naked eye varies according to the distance of the radium from it. On now examining the surface with the pocket lens, the radium being far off and the screen faintly luminous, the scintillating spots are sparsely scattered over the surface. On bringing the radium nearer the screen the scintillations become more numerous and brighter, until when close together the flashes follow each other so quickly that the surface looks like a turbulent luminous sea. When the scintillating points are few there is no residual phosphorescence to be seen, and the sparks succeeding each other appear like stars on a black sky. When, however, the bombardment exceeds a certain intensity, the residual phosphorescent glow spreads over the screen, without, however, interfering with the scintillations.

If the end of a platinum wire which has been dipped in a solution of radium nitrate and dried is brought near the screen, the scintillations become very numerous and energetic, and cease immediately the wire is removed. If, however, the end of the wire touches the screen, a luminous spot is produced which then becomes a centre of activity, and the screen remains alive with scintillations in the neighbourhood of the spot for many weeks afterwards.

"Polonium" basic nitrate produces a similar effect on the screen, but the scintillations are not so numerous.

Microscopic glass, very thin aluminum foil, and thin mica do not stop the general luminosity of the screen from the X-rays, but arrest the scintillations.

I could detect no variation in the scintillations when a rapid blast of air was blown between the screen and the radium salt.

A beam of X-rays from an active tube was passed through a hole in a lead plate on to a blende screen. A luminous spot was produced on the screen, but I could detect no scintillations, only a smooth uniform phosphorescence. A piece of radium salt brought near gave the scintillations as usual, superposed on the fainter phosphorescence caused by the X-rays, and they were not interfered with in any degree by the presence of X-rays falling on the same spot.

During these experiments the fingers soon become soiled with radium, and produce phosphorescence when brought near the screen. On turning the lens to the, apparently, uniformly lighted edge of the screen close to the finger, the scintillations are seen to be closer and more numerous; what to the naked eye appears like a uniform "milky way," under the lens is a multitude of stellar points, flashing over the whole surface. A clean finger does not show any effect, but a touch with a soiled finger is sufficient to confer on it the property. Washing the fingers stops their action.

It was of interest to see if rarefying the air would have any effect on the scintillations. A blende screen was fixed near a flat glass window in a vacuum tube, and a piece of radium salt was attached to an iron rocker, so that the movement of an outside magnet would either bring the radium opposite the screen or draw it away altogether. A microscope gave a good image of the surface of the screen, and in a dark room the scintillations were well seen. No particular difference was observed in a high vacuum; indeed, if anything, the sparks appeared a trifle brighter and sharper in air than in vacuo. A duplicate apparatus in air was put close to the one in the vacuum tube, so that the eye could pass rapidly from one to the other, and it was so adjusted that the scintillations were about equal when each was in air. The vacuum apparatus was now exhausted to a very high point, and the appearance on each screen was noticed. Here again I thought the sparks in the vacuum were not quite so bright as in air, and on breaking the capillary tube of the pump, and observing as the air entered, the same impression was left on my mind; but the differences, if any, are very minute, and are scarcely greater than might arise from errors of observation.

It is difficult to form an estimate of the number of flashes of light per second. But with the radium at about 5 cm. off the screen they are barely detectable, not being more than one or two per second. As the distance of the radium diminishes the flashes become more frequent, until at 1 or 2 cm. they are too numerous to count.

[*Added March* 18.—On bringing alternately a Sidot's blende screen and one of barium platinocyanide, face downwards, near a dish of "polonium" sub-nitrate, each became luminous, the blende screen being very little brighter of the two. On testing the two screens over a crucible containing dry radium nitrate, both glowed; in this case the blende screen being much the brighter. Examined with a lens, the light of the blende screen was seen to consist of a mass of scintillations, while that of the platinocyanide screen was a uniform glow, on which the scintillations were much less apparent.

The screens were now turned face upwards so that emanations from the active bodies would have to pass through the thickness of card before reaching the sensitive surface. Placed over the "polonium" neither screen showed any light. Over the radium the platinocyanide screen showed a very luminous disc, corresponding with the opening of the crucible, but the blende disc remained quite dark.

It therefore appears that practically the whole of the luminosity on the blende screen, whether due to radium or "polonium," is occasioned by emanations which will not penetrate card. These are the emanations which cause the scintillations, and the reason why they are distinct on the blende and feeble on the platinocyanide screen is that with the latter the sparks are seen on a luminous ground of general phosphorescence which renders the eye less able to see the scintillations.

Considering how coarse-grained the structure of matter must be to particles forming the emanations from radium, I cannot imagine that their relative penetrative powers depend on difference of size. I attribute the arrest of the scintillating particles to their electrical character, and to the ready way in which they are attracted by the coarser atoms or molecules of matter. I have shown that radium emanations cohere to almost everything with which they come into contact. Bismuth,[1] lead, platinum, thorium uranium, elements of high atomic weight and density, possess this attraction in a high degree, and only lose the emanations very slowly, giving rise to what is known as "induced radio-activity." The emanations so absorbed from radium by bismuth, platinum, and probably other

[1] I have been quite unable to detect any lines but those of bismuth (and of known impurities) in the spectrum of the strongest and most active "polonium" salt I have been able to procure.

bodies, retain the property of producing scintillations on a blende screen, and are non-penetrating].

It seems probable that in these phenomena we are actually witnessing the bombardment of the screen by the electrons[1] hurled off by radium with a velocity of the order of that of light; each scintillation rendering visible the impact of an electron on the screen. Although, at present, I have not been able to form even a rough approximation to the number of electrons hitting the screen in a given time, it is evident that this is not of an order of magnitude inconceivably great. Each electron is rendered apparent only by the enormous extent of lateral disturbance produced by its impact on the sensitive surface, just as individual drops of rain falling on a still pool are not seen as such, but by reason of the splash they make on impact, and the ripples and waves they produce in ever-widening circles.

THE PSYCHOLOGY AND NATURAL DEVELOPMENT OF GEOMETRY.

IN connection with recent endeavours to place the teaching of geometry on the best possible basis, much interest attaches to Dr. Mach's attempt to trace the order in which geometrical facts first made themselves known in the natural order of evolution.

The earliest notions of space must have been suggested by the relations of physical bodies to the parts of the human body, the spacial behaviour of bodies towards one another subsequently acquiring a mediate and indirect interest far transcending that of the momentary sensations. While the senses of sight and touch only give rise to sensations of surface, crude physical experience soon impels us to conceive the notion of volume, and the *constancy of volume* of bodies would be one of the first attributes to manifest themselves to our senses. Geometry, although asserted to be concerned with ideal objects only, arose from the consideration of the space relations of physical bodies. The earliest units of measurement were derived from our hands and feet. But the material properties of bodies rather than their spacial properties possess the greatest interest for us, and Dr. Mach considers that the first ideas of measurement were those of volume, and arose from counting the number of equal identical immediately adjacent bodies which would fill a given space. The notion of *areas* would be derived from the number of food-bearing plants which a given field would contain or the labour required in planting them, *distance* would be estimated by hours of travel. The measurement of lines and areas by means of *solids* is a notion now completely estranged from our geometrical ideas, but in early times we should have measured lengths and areas by the number of solid bodies placed in line or distributed over a surface required to cover them, an idea which is borne out by the remarkably elegant methods of mensuration expounded in the seventeenth century by Cavalieri.

Although movable bodies present different spacial sensations to the visual sense dependent on the position and distance of the observer, the notion of spacial constancy becomes associated with them both by the sense of touch and by combined experience.

The earliest conceptions of *purely spacial* properties naturally asserted themselves in the pursuit of trades and arts. The property that a number of equal and similar triangles of any shape can be fitted together in regular order to form a pavement or mosaic naturally leads to the property that the three angles of a triangle are together equal to a straight angle. A consideration of the way in which the triangles run in rows would lead to the notion of parallels, and the property that the adjacent angles made by the parallel lines with any transversal are together equal to two right angles. The theorem of the Pythagoreans, according to which superficial space can only be partitioned into regular polygons in three ways, namely, into equilateral triangles, squares, or hexagons, naturally finds its origin in the same source.

A stretched string furnishes the simplest visualisation of a straight line, and leads to the property that a straight line is the shortest distance between two points, but Dr. Mach reminds us that this property cannot be regarded as being established by mere visualisation. It is true that we have learnt instinctively to reproduce in our imagination some method of demonstrating that, for example, two sides of a triangle are greater than the third side, but the source of our knowledge here is *physical experience* derived from our knowledge of material bodies. Another property of straight lines, namely, that a straight line is self-congruent if made to slide or rotate upon itself, is also a result of experience with straight and bent wires.

The knowledge that the measures of geometry depend on one another was reached in divers ways. The division of a parallelogrammatic field into smaller fields gave rise to the area being measured by the product of the length and breadth, and the knowledge that the area of a rectangle is greater than that of a parallelogram having the same sides gave rise to the idea that the area also depended on the angles.

In regard to *angles*, Dr. Mach points out that the definition of an angle as the difference between two directions is a *physiological* definition, the notion of direction being a purely physiological conception. In *abstract space*, obtained by metrical experiences with physical objects, differences of direction do not exist. An angle is determined when the distance is assigned between two points on its arm at given distances from the vertex, but, as Dr. Mach points out, this measure, though closely resembling those adopted in trigonometry, was not used in geometry, because angles so measured would not possess *additive* properties. The simpler measure of an angle by the arc or area which it intercepts on a circle surrounding the vertex thus became generally adopted. In connection with Dr. Mach's views on this point, it may be maintained that even with our present experience of geometry an angle instinctively suggests the idea of *space*, extending, no doubt, indefinitely from the vertex, but possessing the remarkable property of being a definite fraction of the whole space surrounding that point.

The object of geometry is to answer questions that occur repeatedly in the same form, and with this object has arisen the study of deductive geometry, which takes theorems and proves them once for all. But it will be seen that Dr. Mach strongly emphasises the *physical* and *material origin* of geometry, and his studies will naturally support the view that geometry is likely to be best understood when taught in its early stages from the experimental side.

THE EUCALYPTS.[1]

THE economic importance of the genus Eucalyptus to our Australian Colonies accounts, no doubt, for the somewhat extensive official literature which has grown up there on this subject. This includes numerous publications by the Government botanists and forest officials of the Australian colonies, and especially the classic "Eucalyptographia," now, unfortunately, no longer obtainable, of the late Baron von Mueller, whose enthusiasm for the genus is mainly responsible for the large Eucalyptus plantations now existing in Italy, France, Algeria, California and other countries.

Messrs. Baker and Smith, in their contribution to Eucalyptus literature, give an account of the results they have secured in the course of a systematic study of the Eucalypts, both from the botanical and chemical points of view, and they conclude from the data so obtained that the trees belonging to this genus may be divided into a series of natural groups, in which there is a striking correlation between the structure of the leaves, and to a certain extent, also, of the barks, and the composition of the essential oils produced by the species; thus, in *Eucalyptus tesselaris*, which the authors regard as the primitive type, the leaves have a characteristic parallel lateral venation and furnish

[1] Radiant matter, satellites, corpuscles, nuclei; whatever they are, they act like material masses.

[2] Abstract of a paper by Dr. E. Mach in the *Monist*. Translated by T. J. McCormack.

[1] "A Research on the Eucalypts especially in regard to their Essential Oils." By R. T. Baker, F.L.S., and H. G. Smith, F.C.S. Pp. 295; with 9 plates. (Technological Museum: New South Wales.)

"Eucalypts Cultivated in the United States." By A. J. McClatchie, M.A. Pp. 101; with 91 plates. (Department of Agriculture, U.S.A.)

an oil consisting principally of pinene; this is also the case with about thirteen other species, which together form Group I. in this system of classification. In the succeeding groups, the lateral venation of the leaves becomes gradually more complex, a marginal vein appears, and at the same time the oils produced undergo what may be called a corresponding change; thus pinene is partially replaced by cineol, until, as in the *Eucalyptus globulus*, which the authors appear to regard, probably in deference to its commercial value, as the highest evolutionary product of the genus, this constituent amounts to 60 per cent. of the oil obtained. In the course of this evolution there have appeared several side issues furnishing oils in which cineol is replaced by aromadendral, piperitone, geranyl acetate or citronellal and pinene, wholly or partially by the terpene phellandrene, and in each of these groups, also, there exists a corresponding leaf structure.

Interesting as is this correlation of morphology and constituents in the Eucalyptus species, it may be pointed out that a knowledge of the constituents of a plant is never likely to play such an important part in systematic botany as the authors appear to believe, since there are already known numerous instances of plants which, grown under different climatic conditions, show no morphological change, yet exhibit remarkable variation in constituents, and, on the other hand, plants which are not at all closely related, frequently contain the same colouring matters, alkaloids, &c., so that the necessary specific constancy of constituents, which alone would make such criteria useful, is wanting. The authors lay stress on observations made by them as to the absence of marked variation in the composition of oils yielded by the same Eucalyptus species grown in different districts of Australia, but the evidence of constancy in this respect would be greatly strengthened if it could be shown to hold for the same species grown outside Australia; for an investigation of this kind ample material now exists in foreign plantations.

The principal feature of the volume is, however, the publication of results obtained in the examination of the oils yielded by practically all the Eucalyptus species indigenous to Australia. A short description of the oil obtained, with its physical constants and those of its principal fractions, is appended to the botanical description of each species, and in order to render these more readily available, they are tabulated in special appendices.

The evidence adduced by the authors of the occurrence in the Eucalyptus oils examined of the normal constituents cineol, pinene, phellandrene, &c., is, as a rule, unexceptionable, but occasionally there are lapses which perhaps are due more to the magnitude of the authors' task in recording such a mass of facts than to their lack of scientific thoroughness, *e.g.* a minute difference in the lævorotation of two fractions seems insufficient evidence for the assumption that aromadendral exists in the oil of *E. corymbosa* (p. 26); similarly, the coincidence of the melting point of the nitrosochloride of the terpene of *E. botryoides* with that of pinene nitrosochloride is not conclusive evidence of the presence therein of pinene, and it is usual in such a case to prepare in addition the nitrol-piperide or similar derivative. The evidence given for the occurrence of a valeric acid ester in *E. umbra* (p. 37) is worthless, whilst the lemon-like odour of a particular fraction of the oil of *E. fraxinoides* scarcely warrants the assumption that it is due to citral without characterisation of this aldehyde by the preparation of at least one of its readily obtained derivatives. The authors also appear to be unaware that the reaction (p. 235) which they employ for the identification of geraniol, viz. its oxidation to citral by chromic acid, is equally well given by the isomeride linalool. The formation of an alcohol (cineol) of the composition $C_{10}H_{18}O$ (p. 223) by the oxidation of an aldehyde (aromadendral) of the composition $C_{10}H_{14}O$ is, if it really occurs—and on this point the evidence is slender—a unique reaction, and requires further investigation. It seems unfortunate, also, that whilst the specific rotation and solubility of the oils have invariably been determined, the authors did not utilise their unique opportunity to record such useful constants as the refractive index and dispersion. Exception must also be taken to the use of the name eucalyptol in place of cineol in a scientific publication of this kind.

The volume, as a whole, is remarkably well printed, and the plates depicting leaves of the typical groups clearly exhibit the characteristic features to which attention is drawn in the text.

The mere collection of the material necessary for an elaborate investigation of this kind is a task of considerable magnitude, and when there is added to this the tedious experimental work involved in the investigation of a large number of oils of similar composition, some idea may be obtained of the industry and perseverance the authors have expended on this work. The results should be of inestimable advantage to the colony far-sighted enough to encourage the prosecution of such investigations.

The American volume is intended primarily to enable forest proprietors to identify the Eucalyptus species in their possession, and is therefore largely a compilation of the diagnostic characters of the fifty odd species which have been introduced into the south-western States. The author, however, devotes some space to extolling the ornamental and useful character of these trees, and points out their value, particularly as wind breaks, shade trees, improvers of climate and as sources of timber and essential oil. The virtues of the latter, when of American origin, are described in language somewhat reminiscent of the advertisements of transpontine proprietary medicines. The chemistry of the volume is occasionally at fault, as, for instance, when it is stated that (p. 13) "the exudations from the trees are in most cases *not* gums, but resins," and "the chief ingredient of the lemon-scented Eucalypt is *citronellon*" (p. 39). The volume is, like most of the publications of the U.S. Department of Agriculture, well printed and copiously provided with useful and artistic illustrations.

T. A. HENRY.

OPPOSITION OF MARS.

MARS is now brightly visible during the whole night, and well placed in the sky for observation. He occupies a position on the equator in Virgo, but the present apparition is not really a favourable one, the distance of Mars from the earth on the date of opposition (March 28) being nearly sixty millions of miles. The apparent diameter of the planet, as given in the *Nautical Almanac*, will be 14″·6; this is only half the value (29″·5) which the planet presented in the best circumstances in August, 1892, and September, 1877. At those periods, however, the declination of Mars was more than 24° south of the equator, so that telescopic observations were rendered very difficult at stations in high northern latitudes. A comparison of the last few oppositions of this planet gives the following figures:—

Opposition.		Apparent Diameter.	Declination.	Distance. Millions of Miles.
	h.	″	° ′	
1894, October	20 ... 10	... 25·6	... + 8 32	... 40
1896, December	10 ... 18	... 16·6	... +25 39	... 52
1899, January	18 ... 12	... 14·4	... +24 42	... 61
1901, February	21 ... 18	... 13·8	... +14 36	... 63
1903, March	28 ... 20	... 14·6	... − 0 7	... 60

Though the conditions under which Mars is now displayed compare unfavourably with those at a really good opposition, it is quite possible to distinguish a large amount of detail on the disc. The principal features are very dark and well pronounced, and may all be recognised under pretty high powers. Fortunately, Mars satisfactorily bears more extreme magnification than Jupiter. In studying the latter object with a 10-inch reflecting telescope, the writer has found a power of 252 very efficient and 312 ample for every purpose, but on Mars the most serviceable powers appear to be from 332 to 488.

The study of Mars is essentially different in character from that of Jupiter. The latter does not exhibit his real disc, but a series of vaporous, longitudinal currents, in which are floating a number of changing spots of various tints. Mars shows real surface markings, which appear subject to certain temporary differences due to atmospheric interference. In fact, the aim of an observer of Mars is to distinguish the outlines of the markings in a comprehensive

manner, as regards both their positions and forms, while the student of Jupiter occupies himself in taking transits of the various spots visible in order to ascertain the rotation periods of objects situated in different latitudes. The rotation period of Mars is much more exactly known than that of any other planet (the earth excepted), and Prof. Bakhuyzen's value for this is 24h. 37m. 22·66s., deduced from 220 years' observations.

It seems desirable to note the accurate times when certain well-defined objects on Mars cross the central meridian in order to test the correctness of the ephemeris (*Monthly Notices*, June, 1902). Such transits will be most precisely obtained by micrometrical measurement. The particular forms, relative prominence and positions of the various dark and bright markings require further careful record, and must always be regarded as the most important aims in the observational study of this object. A large number of excellent charts of Mars have been published affording a useful means of comparison, but the observer need feel no disappointment should he fail to discern the supposed double canals, the oases, or the thick network of interlacing lines which eminently distinguish some of the drawings and impart a very singular aspect to Martian topography. With the planet's diameter apparently very small, as at present, no observer can expect to secure comprehensive views of detail.

For obvious reasons the transit times of spots on Mars cannot be determined with the same accuracy as those of Jovian markings. The small disc of Mars, and its comparatively slow rate of axial motion, are responsible for this. In one hour rotation carries the surface of Mars through only 14°·62, whereas on Jupiter the value is 36°·7. At intervals of about forty days the various features on Mars are presented at nearly the same times as before. Early in March that conspicuous marking known as *Syrtis Major* was favourably displayed in the evenings, and it will be similarly well seen near the middle of April.

W. F. DENNING.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

DR. ALEXANDER PAINE, of the Jenner Institute, has been appointed lecturer in bacteriology at the Bedford College for Women.

DR. BLEIBTREU, of Bonn, has been appointed to the chair of physiology at the University of Greifswald in succession to the late Prof. Landois.

THE authorities of the Clark University, Worcester, Mass., have arranged again this year to hold a summer school from July 13–July 25, where university students, teachers, lecturers in pedagogy, and others may take courses of work in psychology, biology, pedagogy, and anthropology. The lectures and demonstrations will be under the direct supervision of President G. Stanley Hall and other professors of the University.

A TELEGRAM through Laffan's Agency from New York, dated March 28, states that Mr. Carnegie has presented an additional 310,000*l.* to the Carnegie Institution at Pittsburg, bringing up his total donations towards the cost of the buildings and their endowment to 1,570,000*l.*, exclusive of the 400,000*l.* given for branch libraries of the institution, for fossil excavations in Wyoming, and for other purposes. In addition to this, Mr. Carnegie has promised from 600,000*l.* to 1,000,000*l.* for a new technical institute.

IN a recent paper read before the Society of Arts on "Education in the Netherlands," Mr. J. C. Medd remarks that in Holland "few things in recent years have been more striking than the development in nature-study. It is taught universally in schools of every grade, urban and rural, for its great educational value in developing certain faculties, especially those of observation, quite apart from its value as a preparation for science, or in its possible relation to rural pursuits. . . . Text-books are seldom used. Plants and flowers, gathered by the children themselves, are studied objectively, and their structure explained."

THE calendar for the session 1902–3 of the University College of Sheffield provides numerous interesting facts concerning the work of the college. For instance, the new endowment fund started in 1895, and the scheme of which was later enlarged when, in 1897, the original Firth College was constituted by Royal Charter a university college, has now reached about 42,000*l.* The calendar shows that the scattered and inadequate nature of the buildings has long been a serious hindrance to the college. Funds have been raised towards the erection of new buildings on a single site for the whole college, and it is hoped a beginning will be made during the current session. Further donations for this purpose are much needed.

THE first volume of the report of the U.S. Commissioner of Education for the year 1900-1901 contains, as usual, a great wealth of material for the student of educational problems. It is impossible here even to enumerate the articles contained in the 1216 pages which the volume contains. Among those of more immediate interest to readers of NATURE may be mentioned the Commissioner's introduction; the review of education in Central Europe—in which due prominence is given to university and technical education; the account of the International Association for the Advancement of Science, Arts, and Education; the address of the director of the U.S. Geological Survey on the relations of the national Government to higher education and research; the Carnegie Institution of Washington, with a list of the most notable gifts of money by Mr. Carnegie for libraries and other educational purposes—this list shows that Mr. Carnegie has given away in this manner more than thirteen millions sterling; and the chapter on higher commercial education. There can be no doubt the Bureau of Education is not only assisting American education by the issue of these reports, but that of all the great countries of the world.

THE retirement of Sir William Abney from the principal assistant-secretaryship of the Board of Education, South Kensington, was marked on Tuesday by the presentation to Lady Abney of his bust in bronze, the work of Prof. Lautéri. Sir John Gorst made the presentation, and in the course of his remarks he referred to the great influence Sir William Abney has exerted upon educational progress in this country. The bronze bust presented to Lady Abney is a token of the esteem in which Sir William Abney is held by his colleagues and a mark of regret at his retirement. The valuable work now being done in schools of science owes its initiative almost entirely to Sir William Abney, who is responsible for the development of scientific instruction in schools since he took charge of the work of the old Department of Science and Art. With a man like Sir Wiliam Abney at the head of affairs, proper provision was secured for the study of science in schools under his control, and the work of these schools has forced other secondary schools to find a place in the curriculum for rational scientific instruction. It is impossible to estimate the great influence which Sir William Abney has thus exerted upon scientific education in this country, but all who know his work understand that his retirement deprives science of one who has always promoted her educational interests.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, March 5.—"The Electrical Conductivity of Solutions at the Freezing Point of Water." By W. C. D. **Whetham**, F.R.S.

The paper contains an account of experiments which bring to greater concentrations a series of measurements on the conductivities of dilute solutions at the freezing point, communicated to the Royal Society in February, 1900.

The earlier experiments were conducted in a platinum cell, with the object of eliminating any solvent action of glass. Any such action would be quite inappreciable at the concentrations used in the experiments now to be described; resistance cells of glass were consequently used, and the labour of observation was much reduced.

The measurement of the electrical resistance was performed exactly as in the earlier set of experiments. The current from one or two dry cells was alternated by means

of a revolving commutator, which was driven by a hand wheel and cord, the connections of a D'Arsonval galvanometer being simultaneously alternated by the same instrument. The alternating currents were passed through a Wheatstone bridge, in one of the arms of which was inserted the electrolytic cell.

In order to obtain the most probable results for the ratio of the equivalent conductivities to their values at infinite dilution, curves were drawn on squared paper between $m^{\frac{1}{2}}$ and k/m, and the smoothed readings taken at the required places. It is usual to call this ratio the coefficient of ionisation, but at the high concentrations here dealt with, we cannot assume that it really gives the fraction of the number of the molecules which is at any moment ionised; in the light of probable changes in the ionic fluidity of the liquids, and of the possible existence of complex ions, such an assumption is clearly unjustified. For the sake of convenience, the results previously obtained, as well as those of the experiments now described, are tabulated as the equivalent conductivities at 0° referred to the limiting value as unity.

In the earlier set of experiments, approximate values only were obtained for the absolute equivalent conductivities. From the values of the constants of the glass cells now used, it is possible to calculate throughout the whole range of concentration of both sets of observations the exact equivalent conductivities of the salts investigated.

Geological Society, March 11.—Prof. Charles Lapworth, F.R.S., president, in the chair.—Petrological notes on rocks from Southern Abyssinia, collected by Dr. Reginald Kœttlitz, by Dr. Catherine A. **Raisin**. The specimens were collected on an expedition (in 1898–99) starting from Berbera, westward through Somaliland and Southern Abyssinia, and turning northward to the Blue Nile. The crystalline rocks include granite, gneiss, and hornblende-schist or foliated diorite, together with more basic types. Some of the gneisses exhibit pressure effects. The more basic types include diabase, hornblende-gabbro, and one lustre-mottled hornblende-pyroxenite, resembling a picrite. The sandstones (chiefly from Somaliland and the south-east of Abyssinia) are sometimes compacted into quartzites, and are often ferruginous. Some of the limestones are concretionary, others dolomitic, and several from different localities are fossiliferous, containing at Jigjiga Pass Turritella in great numbers. The volcanic rocks include one which is practically a limburgite, many basalts, various less basic volcanic rocks and several pumiceous tuffs. But the most interesting are the phonolites and allied rocks, containing nepheline, riebeckite, or other alkaline minerals. The specimens here described may form a connecting-link between the volcanic rocks of other East African localities.—The overthrust Torridonian Rocks of the Isle of Rum and the associated gneisses, by Mr. Alfred **Harker**, F.R.S. The chief conclusions which the author wishes to establish are:—(1) That the highly disturbed region of the north-west Highlands, already known to extend into the south-eastern part of Skye, is further prolonged into the Isle of Rum. (2) That at numerous places along the disturbed belt which borders the principal mountain-group of the island, the Tertiary plutonic intrusions assume the character of well-banded gneisses, comprising alternations of different lithological types. (3) That these complex gneisses were formed mainly by fluxion in a heterogeneous mass, the heterogeneity being due to the inclusion and incorporation in a granitic magma of relics of ultrabasic and basic rocks.

Zoological Society, March 17.—Mr. G. A. Boulenger, F.R.S., vice-president, in the chair.—Mr. Oldfield **Thomas** exhibited the skin of a monkey from Kwei-chow, China, which appeared to represent a new species of Rhinopithecus. Mr. Thomas also exhibited adult and young examples of a new bush-duiker from British East Africa, which he proposed to call *Cephalophus ignifer*.—Mr. J. T. **Cunningham** read a paper in which were described experiments he had made on two cocks of the long-tailed Japanese fowls in his possession, to ascertain what effect the artificial treatment asserted by some to be practised by the Japanese fanciers would have. The two birds had been hatched on the same date, January 13, 1901. One of the birds was left to nature, except that the tail was tied up in paper when the bird was at liberty, to keep the feathers from injury. In this bird the longest feather was 2 feet 4½ inches in length in 1902, and growth ceased in March, and the feathers were moulted normally in the following autumn. In the other bird the feathers were stroked every day between the finger and thumb, so as to pull slightly on the roots. In this specimen growth continued until the middle of July, and a length of more than 2 feet 9 inches was attained in some of the feathers of the first adult plumage. The author considered still more important the fact that ten of the feathers came out under the treatment, and that successors to these immediately grew again, and continued to grow through and beyond the following moulting season. The author concluded that the great length of feather and suppression of the moult were produced by the Japanese fanciers in the same way, by thus stimulating the feathers and extracting them when or before they had completed their growth.—A communication was read from Sir Charles **Eliot**, K.C.M.G., in which two new genera (Ceratophyllidia and Pleurophyllidiella) and five new species were described, and notes given on some already known forms.—Mr. W. P. **Pycraft** read a paper on the osteology of the Cuculiformes=Cuculidæ+Musophagidæ, in which he showed that the isolated position which this suborder held among the Coraciomorphæ was as evident from a study of the osteology of the group as from other points of view.

MANCHESTER.

Literary and Philosophical Society, March 17.—Mr. Charles Bailey, president, in the chair.—Mr. J. Cosmo **Melvill** exhibited two letters written by Linnæus which had recently been rediscovered after being missing for more than eighty years, together with a Wedgwood plaque of Linnæus, given to him by Sir Joseph Hooker, with the information that it had been pronounced by Dr. Solander to be "a better likeness of his master than any ever painted."—Prof. W. Boyd **Dawkins** exhibited a series of mammalian remains from a cavern at Doveholes, near Buxton. He said that the remains belonged to the Pliocene age, and that this was the only cave in Europe which had yielded remains of that period.

PARIS.

Academy of Sciences, March 25.—M. Albert Gaudry in the chair.—On Abelian functions with complex multiplication, by M. G. **Humbert**.—A study of the combination of carbonic acid with potassium hydride, by M. Henri **Moissan**. The formation of potassium formate from potassium hydride and carbon dioxide has been indicated in a previous paper; it is now shown that the presence of a trace of moisture plays an important part in this synthesis. With perfectly dried materials, there is no reaction under a temperature of 54° C., but the amount of water vapour given off by ice at −85° C. is sufficient to start the reaction, and in presence of moisture the reaction is practically independent of the temperature.—On the physiological causes which determine the constitution of the mollusc type, by MM. Edmond **Perrier** and Ch. **Gravier**.—On the seat and the nature of the hypnagogic images, by M. Yves **Delage**. The question as to whether the hypnagogic images are retinal or cerebral has been much discussed; the author proposes a simple criterion; these images are retinal if they follow the movements of the eyes, or cerebral if they do not. From an experimental study the conclusion is drawn that the former is the case.—On waves in the midst of a vitreous medium affected with viscosity and very slightly deformed, by M. P. **Duhem**.—On a new kind of light, by M. R. **Blondlot**. It has been shown in previous papers that the radiation from a focus tube, filtered from light rays by passing through a thin sheet of aluminium or black paper, proves to be polarised when examined with a small spark, and the plane of polarisation is rotated by quartz or sugar. It has now been found that a rotation of the plane is also produced when the rays are passed through a Reusch mica pile. A single sheet of mica produces elliptical polarisation, thus indicating that these rays are liable to double refraction. But if this is the case, there should also be simple refraction. Using a small spark as detector, the refraction of these rays by a prism was clearly made out, and an attempt to concentrate the rays by means of a quartz lens was also successful. These effects cannot be due to the X-rays, since the latter undergo neither refraction nor reflection. These results indicate the existence of a new set of radiations

emitted by a Röntgen tube; these rays pass through aluminium, paper, wood, are rectilinearly polarised on their emission, are susceptible of both rotatory and elliptical polarisation, can be reflected and refracted, but produce neither fluorescence nor photographic action.—The catalytic decomposition of ethyl alcohol by finely divided metals: the regular formation of aldehyde, by MM. Paul **Sabatier** and J. B. **Senderens.** The action of reduced copper, nickel, cobalt, and platinum upon alcohol has been studied at varying temperatures. With copper at about 300° C. the alcohol is split up into hydrogen and aldehyde without any secondary reactions. With the other metals the primary reaction would appear to be the same, but the aldehyde is attacked, methane and carbon monoxide accompanying the hydrogen.—On the spectrum of the comet 1902 *b*, by M. A. **de la Baume-Pluvinel.** Owing to the very feeble luminosity of the comet a special arrangement of apparatus was required in order to obtain a photograph of the spectrum, but a negative was finally obtained on October 24 sufficiently good for measurements to be taken. The wave-lengths found are referred to the carbon spectrum, hydrocarbon and cyanogen.—Propagation in conducting media, by M. Marcel **Brillouin.**—On the sub-salts of barium, by M. **Guntz.** By fusing the haloid salts of barium with sodium, compounds of the formula BaXNaX, where X represents the halogen, were obtained. Heated in a vacuum at 700° C., sodium is volatilised and the ordinary barium salt is left.—On methylmonobromocamphor, bromomethylcamphor and methylene-camphor, by M. J. **Minguin.**—On the hydration of the acetylene acids. A new method for the synthesis of non-substituted β-ketonic esters and acids, by MM. Ch. **Moureu** and R. **Delange.** The ordinary method of adding water to acetylene compounds by means of sulphuric acid or mercuric salts having given poor results, caustic alkalies were used with satisfactory results. A description is given of the preparation and properties of several ketonic acids synthesised in this way.—The action of phosphorus trichloride upon glycol, by M. P. **Carré.** The chief product is a compound $P_2.(O.CH_2)_4Cl_2$, the decomposition products of which with water have been studied.—The action of mixed organo-magnesium compounds on bodies containing nitrogen, by M. Louis **Meunier.** Ammonia with ethyl-magnesium iodide gives ethane and $NH_2.MgI$, and aniline, diazoamidobenzene and phenylhydrazine give analogous products.—On the pyrogallol-sulphonic acids, by M. Marcel **Delage.**—Remarks on the soluble ferments which determine the hydrolysis of polysaccharides, by M. Em. **Bourquelot.** The number of soluble ferments or enzymes is greater than is usually supposed; the intervention of the enzymes in the natural phenomena of hydrolysis is governed by relatively simple laws.—The existence of glycerine in normal blood, by M. Maurice **Nicloux.** By applying the method of estimation described in a previous note the author has been able to prove the existence of glycerine in normal blood in very small proportion.—On the mechanism of lipolytic actions, by M. Henri **Pottevin.**—A contribution to the study of the Diplozoa, by M. P. A. **Dangeard.**—On the existence and extension of the pith in the petiole of Phanerogams, by M. **Bouygues.**—On the origin of leaves and on the foliar origin of the stem, by M. Léon **Flot.**—On the dust which fell on February 22, by M. A. B. **Chauveau.** The dust probably came from the Sahara.—Remarks by M. **Mascart** on the preceding note.—On the physiology of the internal ear, by M. **Marage.** A reply to a note of M. Pierre Bonnier.—Experimental researches on the psychophysiology of sleep, by MM. N. **Vaschide** and Cl. **Vurpas.**

DIARY OF SOCIETIES.

THURSDAY, APRIL 2.

LINNEAN SOCIETY, at 8.—List of Marine Algæ collected at the Maldive and Laccadive Islands by J. Stanley Gardiner: Mrs. Gepp (Ethel S. Barton).—The Comparative Anatomy of Cyatheaceæ and other Ferns: D. T. Gwynne-Vaughan.

CHEMICAL SOCIETY, at 8.—On the Absorption Spectra of Nitric Acid in Various States of Concentration: W. N. Hartley.—The Dioximes of Camphorquinone and Other Derivatives of *iso*Nitrosocamphor: M. O. Forster.—Salts of a Mercaptoid Isomeric Form of Thioallophanic Acid, and a New Synthesis of Iminocarbaminethioalkyls: A. E. Dixon.—Discoloured Rain: E. G. Clayton.—Derivatives of *o*-Aminobenzophenone and *p*-Aminobenzophenone: F. D. Chattaway.

ROYAL GEOGRAPHICAL SOCIETY, at 4.—Geographical Education; with Special Reference to Globular Contoured Maps, Globes and Reliefs: Prof. E. Reclus.

RÖNTGEN SOCIETY, at 8.30.—Some Effects produced by Radiations: J. H. Gardiner.

FRIDAY, APRIL 3.

MALACOLOGICAL SOCIETY, at 8.—Additions to the genus Streptaxis: G. K. Gude.—On a New Species of the genus Xylophaga from the English Coast: E. A. Smith.—Notes on some New or Little Known Members of the Family Doridiidæ: Sir Charles Eliot.—On a New Species of Cerastus from near Aden, with a Note on *Otopoma clausum*, Sby.: E. R Sykes.—Descriptions of Two Supposed New Species of Cyathopoma: H. B. Preston.—On Shells Floating on the Surface of the Sea: August Krogh.

ROYAL INSTITUTION, at 9.—Drops and Surface Tension: Lord Rayleigh.

GEOLOGISTS' ASSOCIATION, at 8.—The Geology of North Staffordshire (with Special Reference to the Whitsuntide Excursion): Dr. Wheelton Hind.—Coal Measures of North Staffordshire: Walcot Gibson.

SATURDAY, APRIL 4

ROYAL INSTITUTION, at 3.—Light: Its Origin and Nature: Lord Rayleigh.

MONDAY APRIL 6

VICTORIA INSTITUTE, at 4.30.—Modern Theories concerning the Composition of Holy Scripture: Rev. John Tuckwell.

SOCIETY OF CHEMICAL INDUSTRY, at 8.—The Manufacture of Iodine from Nitrate Liquors: Dr. W. Newton.—New Modification of Coffignier's Prussian Blue Reaction, and a possible Application: Watson Smith.—The Explosion of Potassium Chlorate at St. Helen's: Dr. A. Dupré, F.R.S.

TUESDAY, APRIL 7.

INSTITUTION OF CIVIL ENGINEERS, at 8.—American Locomotive Practice: P. J. Cowan.

WEDNESDAY, APRIL 8.

ROYAL ASTRONOMICAL SOCIETY, at 5.—Rotation Period of the Markings on Jupiter: W. F. Denning—Standard Scale for Telescopic Observation: Percival Lowell.—The Madras Observatory and its Work: Prof. Michie Smith.

GEOLOGICAL SOCIETY, at 8.—On the Probable Source of the Pebbles of the Triassic Pebble-Beds of South Devon and of the Midland Counties: O. A. Shrubsole.—Note on the Occurrence of Keisley Limestone-Pebbles in the Red Sandstone-Rocks of Peel (Isle of Man): E. Leonard Gill.

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