THURSDAY, NOVEMBER 10, 1910.

PHYSIOLOGY AS A SPECULATIVE SCIENCE.

Biological Physics, Physic, and Metaphysic. Studies and Essays. By Thomas Logan, Edited by Q. McLennan and P. H. Aitken. Vol i., Biological Physics. Pp. xxx+576. Vol. ii., Physic. Pp. viii+284. Vol iii., Metaphysics. Pp. vi+110. (London: H. K. Lewis, 1910.) Price, 3 vols., 24*s.* net.

IN a prefatory note we read that Dr. Thomas Logan was an Ayrshire man, who received his medical education at Glasgow and Aberdeen, and spent almost half a century on busy practice as a public health officer and general practitioner, first in Scotland, latterly in Yorkshire. He died three years ago, at the age of sixty-nine, leaving behind him the manuscript of the three volumes now published. It is stated that his editors were not permitted to make alterations or excisions of any of the text, which therefore appears in the form the author wished, and is illustrated by a number of cuts borrowed from standard works on anatomy and histology. The first volume is entitled "Biological Physics," the second "Physic," the third "Metaphysics."

Dr. Logan would appear to have been very early impressed with the truth of the aphorism, "Circulatio Circulationum omnia Circulatio," and the great bulk of his volumes is devoted to the repetition and amplification of this text. He possessed a great facility with the pen, and was never at a loss for a word or words to express his meaning. Hence his sentences run to 10, 15, or, in favourable instances, 25 lines or more in length. As a philosopher, he committed himself to unbridled speculation and unchastened teleology, employing the deductive method that has found so little favour since the end of the sixteenth century. Thus, for example, he showed (i., p. 165) that the axon of a nerve-cell must be—and therefore is—

"a compound of at least four tubes circulating fluids and substances of different consistence, and qualities, along its intra-spaces, each circulation differing from the other according to the consistence of its material and the freedom from obstacles to its onward progress, the two inner being necessarily slow, but the two outer necessarily relatively quick."

With every nerve-fibre acting as a four-fold tube, there can be no doubt that circulation might proceed merrily indeed; but anatomical or microscopical evidence either that these fibres are tubes, or that they do serve as circulatory channels. Dr. Logan offered none. He was, also, on purely *a priori* grounds, a firm believer in the importance and activity of the pituitary gland. After describing its position in the skull, he went on to say (i., p. 94):—

"Situated thus, it, the pituitary body, must become the receptacle of a mixture of materials, consisting of cerebro-spinal lymph, endothelial cell debris, neuroglial oozings, and whatever else obtains an entrance into it, which it must of anatomical necessity dispose of, and *this*, we claim, must be *its function*; and surely no mean function, yea, a function second to none in the whole category of glandular functions in its direct bearings on the great problem of life and health."

It may be noted in passing that he offered a solution for one at least of these great problems, by saying what life is (i., p. 445):—

"Life, therefore, is a tripartite, but indissolubly united, transcendental entity, beginning with the vitalisation of the elements of nutrition, culminating in their organic incorporation, and ending with their devitalisation and elimination."

Discussing the pituitary and pineal bodies, he did not agree that they are survivals of once important organs (i., p. 97):—

"*Survivals forsooth!* 'Tis nothing less than an insult to *nature*, and an impeachment of her working and administration of the law of 'evolution,' to manufacture and propagate this story of her prodigality in the use of most valuable cephalic, or brain, space as a museum for the storage of obsolete organisms, and her persistent exhibition of a juvenile affection for the display of some of the works of her 'prentice hand in this, the gallery of her latest, best, and finest productions! These structures, called pituitary and pineal glands respectively, are illustrations of the truth of this exclamation and contention, and, it seems to us, that their more exhaustive study will reveal many facts indicating that they are structures of the greatest functional importance in the regulation of the cerebro-spinal lymph circulation, a circulation of equal importance with the great blood-circulation, and a circulation, in fact, emanating from the blood-circulation, and the last of the *great series* of circulations involved in the *chain of vital processes* called by the names deglutition, digestion, absorption, circulation proper, nutrition, assimilation, secretion, and excretion."

Dr. Logan was no less successful in tracing out the path followed by these pituitary products; speaking of the tongue, he said (i., p. 545):—

"Here, then, we claim to see the theatre of one of the concluding acts of the great cerebro-excretory circulation and the final disposal of the residual pituitary material, which finds its way through the pituitary gland, and which in turn finds its way through the lateral sphenoidal foraminal openings into the tonsillar bodies, and thence into the amorphous and semi-adipose material matrix, in the inter-muscular spaces of the tongue, where it affords that semi-plastic and faintly-fluid material in the discharge of which the epithelial covering and papillary structures of that organ are constantly engaged."

One may doubt whether obscurantism could go further. Enough of Dr. Logan's writing has been quoted to exhibit the surge and flow of verbiage on which he launched his *a priori* theories, and floated his elaborate yet elusive and illusory deductions. Throughout his essays he was content with speculation and assertion, rarely did he come down to the level of simple fact and commonplace proof of his novel views. So little was he in agreement with the modern spirit or methods of scientific investigation that one cannot but see in him a writer fated to live some two or three centuries after his time. His volumes illustrate very clearly the strength and the weakness of the undisciplined scientific imagination, so-called, and show the limitations of the arm-chair man of science to perfection. They should be of no little interest to collectors of the literary curiosities of science.

A. J. J. B.

THE COMPLETE BOTANY-TEACHER.

The Teaching Botanist. A Manual of Information upon Botanical Instruction, including Outlines and Directions for a Synthetic General Course. By Prof. W. F. Ganong. Second edition, revised. Pp. xi+439. (New York: The Macmillan Company; London: Macmillan and Co., Ltd., 1910.) Price 5*s.* net.

THE first edition of Prof. Ganong's book received a welcome on this side the Atlantic such as is accorded to few elementary botanical works produced in America, and it has proved of the greatest value to many engaged in the teaching of elementary botany, or in training as future teachers of the subject. The second edition, lately published, has been thoroughly revised, and, indeed, re-written almost throughout, besides being considerably enlarged, though the general plan, and, above all, the animating spirit of the book, not to mention the very moderate price, remain unchanged. To all intents and purposes this edition is a new work, and should be in the hands of all botanical teachers, both *in esse* and *in posse*, whether or not they already possess the first edition.

In part i., occupying, roughly, half of the book, the author deals in a practical, yet philosophic and stimulating, manner with the place of the sciences in education and of botany among the sciences, followed by a thoughtful and vigorous discussion of the pertinent question, "What botany is most worth?" and proceeds to the consideration of the training of the good botanical teacher, the methods of good botanical teaching, botanical drawings and descriptions, the equipment of laboratories, and the arrangement of collections. A valuable chapter follows on botanical books and their use, with a bibliography—by no means exclusively American—which, with a few deletions, would serve as the catalogue of an ideal library for any institution in which the subject is taught. One is inclined to wonder when there will be found an author—and publisher—courageous enough to publish a "black list" of undesirable books on botany and nature-study generally; but, after all, this would merely postpone for a time the oblivion into which bad books are bound to sink sooner or later.

As is well known, Prof. Ganong has shown himself, especially in his valuable "Plant Physiology," to be an acute critic of many erroneous facts and ideas, and of faulty methods of experimentation, which are only too common in botanical literature, not only in books of the baser sort, but even in standard and authoritative works. In the present work he ends part i. with a breezy and delightful chapter—only too short—on some common errors prejudicial to good botanical teaching, which will bring some discomfort to conscientious teachers, while pointing out to them the better way. Such teachers will, however, be to some extent consoled by the author's candid confession that he, too, has occasionally perpetuated, and even originated, ideas and phrases which are "unfortunate if not erroneous." This chapter is certainly deserving of most careful study by all teaching botanists.

In part ii. Prof. Ganong outlines a general course in elementary botany—not a mere skeleton or series of headings, but a thoroughly practical, fairly detailed, and altogether excellent syllabus of instructions for the carrying out of a very full year's work in the morphology and physiology of plants. It would be difficult to devise a better guide to the elements of botany for those who may go no farther with the subject, or a more suitable first-year course for those who intend to proceed to more advanced work in botany. This admirable and wisely designed course of instruction may be warmly commended, not only to teachers of botany, but to those who are responsible for the drafting of examination syllabuses in the subject in this country. F. C.

CLIMATIC CONDITIONS AND ORGANIC EVOLUTION.

Die klimatischen Verhältnisse der geologischen Vorzeit vom Praecambrium an bis zur Jetztzeit und ihr Einfluss auf die Entwickelung der Haupttypen des Tier- und Pflanzenreiches. By Dr. Emil Carthaus. Pp. v+256. (Berlin: R. Friedländer und Sohn, 1910.) Price 8 marks.

THIS treatise commences with a consideration of the views of different authors upon the early evolution of the earth. Of the rocks in the earth's crust, Olivine rock (Dunite) is considered by the author to be the most primitive, its formation having taken place before the condensation of the water-vapour contained in the very earliest atmosphere. The gneisses, however, were formed after such condensation had occurred. The beginnings of organic life were present in the original atmosphere of water-vapour, but the author doubts the view of Arrhenius that the early spores could have reached the earth from other heavenly bodies. The period between the Upper Cambrian and Purbeckian was one of little rain, the existence of salt deposits in the early formations at various places widely separated from one another, and the complete absence of real freshwater calcareous deposits prior to the Jurassic being cited as evidence in support of that view. In this connection the interesting questions are propounded: Why have no remains older than the fauna of late Tertiary or diluvial times been found in the caves of Devonian, Carboniferous, Triassic, and Jurassic limestones? Why did cave formation thus probably begin first in Tertiary times?

The occurrence of forests of Rhizophora (Dicotyledons) in the sea of the Malay Archipelago is instanced as a reason against the assumption of the necessarily freshwater origin of the Ferns, Sigillaria, Lepidodendron, Equisetites, Conifers, and Cycads of the older geological formations. Great stress is laid upon the difference in the movements of the sea-water as affecting the forms of life at different times. The increase of these movements in later geological periods tended to destroy the brachiopods, the bilateral symmetry of the Tetracoralla gave way to the radial symmetry of the Hexacoralla, while the later Echinoidea, as compared with the earlier, underwent

changes in the number and arrangement of plates; the increasing complication of the ammonite sutures is explained on the same ground. It is pointed out that the multiplication in number of the sinupalliate Lamellibranchiata in Cretaceous time and their further acceleration in company with the Heterodont forms in the Tertiary period correspond with the incoming and continuance of freshwater conditions. In recent times certain Lamellibranch species in the Black Sea and Caspian Sea have wandered into brackish and fresh water, and as a result there is an increase in length of the siphon, a gaping of the shell, and the formation of a mantle-sinus.

The work has been written in the seclusion of an Indian hotel without the immediate advantages of close contact with the scientific world and its literature. This explains to a great extent the semi-popular nature of the book, and accounts, perhaps, for the omission of a bibliography other than rare and general references in the text. A division into chapters and the inclusion of a more extensive index would have been a decided improvement. Although controversial in many of its statements, the contribution has the undoubted merit of arousing interest and thought. The author appears to be a strong believer in the inheritance of acquired characteristics, and is not inclined to the assumption of an indwelling tendency towards perfection in forms of life; the followers of Cope, von Baer, Naegeli, and von Eimer would, therefore, find much material for debate. The statement that land or fresh-water animals and plants older than of Tertiary age are not found in the earth clefts of primary and secondary formations is certainly erroneous. For instance, the teeth of Microlestes found by Charles Moore and submitted to Owen in 1858 came from a Rhaetic breccia filling a fissure in the mountain Limestone, near Frome, Somersetshire.

IVOR THOMAS.

COMMERCIAL ORGANIC ANALYSIS.

Allen's Commercial Organic Analysis. Edited by Prof. H. Leffmann and W. A. Davis. Vol. II., Fixed Oils, Fats and Waxes, Soap, Glycerol, Cholesterols, &c. Fourth edition, entirely rewritten. Pp. x+520. (London: J. and A. Churchill, 1910.) Price 21*s.* net.

MOST analysts are aware that a fourth edition of Allen's well-known work is in course of preparation. Two of the eight volumes composing the edition have now appeared, and a notice of Vol. I. will be found in NATURE of June 16 last. Two more are announced for publication this year, and the remaining four are promised without undue delay. The plan of having both an American and an English editor has been adopted, and articles are contributed by writers from each side of the Atlantic. This seems a sensible arrangement, as with comparatively little modification the book is made to serve the needs of chemists in both countries.

The volume now under review is much extended and improved as compared with its predecessor of the last edition. Mr. C. A. Mitchell is responsible for the opening section describing the general properties of the fixed oils and fats, as well as the common processes of analysis, whilst the special characters of the individual products, and the particular methods of examining them, are discussed by Mr. L. Archbutt. Having regard to the scope of the book, both sections appear to be very well done. As much trustworthy information as could well be given in the space allotted will be found in these two sections, and no point of importance calling for adverse remark has been noticed by the present writer in looking through a number of representative pages. Perhaps the articles on arachis oil, olive oil, and the beeswax group may be singled out as good examples of compressed essentials. Sometimes, indeed, the compression is a trifle too marked. Many references, however, are given to original papers, so that fuller details can often be obtained.

Certain products, including butter, soap, and glycerol, are each given a special section. Messrs. Revis and Bolton have taken charge of the chapter on butter fat. They have studied their subject well, and, among other things, have grasped a fact which seems to have puzzled some experts on butter analysis —namely, that the addition of lard to butter may produce a distinct (apparent) increase of the "Polenske figure," which might be taken by the unwary as indicating the presence of cocoanut oil. One or two small errors have crept in; thus the Zeiss values in the first table on p. 290 are wrongly given as being taken at 40° C. instead of 45°, and there are two misprints in the second table on the same page. A favourable opinion, based upon the authors' own experiments, is expressed in reference to Lallemant's "barium saponification" method of examining butter fat. How far the commendation is deserved cannot be judged from the particulars given. For example, granted that the method detects cocoanut oil in butter, it may yet be that the detection could be made just as certainly and much more readily by older processes. The really difficult problem is the recognition of lard or beef-fat when present in butter, and it is in the promise of this that the chief importance of Lallemant's process lies. It will be interesting to see how it stands the test of experience when applied, on a sufficiently extended scale, to genuine butter having Reichert-Wollny values in the region of 23 and 24.

Of Prof. Leffmann's chapter on soaps and the other special contributions it must suffice to note that they contain all that an analyst will generally require to know on the subjects. They help to make the volume a distinct improvement upon the former editions.

C. S.

THE SEVEN LAMPS OF BIOLOGY.

Das System der Biologie in Forschung und Lehre. Eine historisch-kritische Studie. By Dr. Phil. S. Tschulok, Zürich. Pp. x+409. (Jena: Gustav Fischer, 1910.) Price 9 marks.

THE author discusses at great length some of the attempts that have been made to define the scope of biology, and to indicate the logical sub-divisions of the science. Starting with early workers like Ray,

he works on to A. P. De Candolle and Schleiden (of whose importance he is very appreciative), and thence to Haeckel and Spencer, Karl Pearson, and Burckhardt. This laborious historical survey, which must have cost the author much time and trouble, is interesting to those who care for such questions, but it seems to us to be robbed of some of its value by being overloaded and by a lack of perspective. Dr. Tschulok quotes classifications of the different departments of biology from a large number of text-books, some of which are rather humdrum performances, while others are by men who left a deep mark on the science, but had neither any particular interest in mapping out its subdivisions, nor any special aptitude for so doing.

To illustrate, a man like Burckhardt was a good zoologist—too early lost to science—but he was also a philosopher. He went the length of thinking about the classification of the sciences, about the relation of biology to other disciplines, about methodology, and so on, his writings sometimes reminding us of those of Prof. Patrick Geddes in this country. Naturally, therefore, we are glad to have from Dr. Tschulok an exposition of Burckhardt's views, and we are especially grateful for the unearthing of an essay on the history of biological "Systematiks," well-buried "an einem ziemlich versteckten Orte." But what we regret is the space that is given to what are really incompetent classifications. The author wearies us with citations from manuals of botany, which start with commonplace mappings out of the science, sometimes beginning with a weird word like "Glossology," and ending up with "Fossil Botany." The last is a careless usage, which in an interesting irony sometimes justifies itself. Our regret that the author has been at such pains to expose the nakedness of the land is heightened when we find that he has missed most of the few really illuminating British contributions to the subject of his book. We may refer, for instance, to well-known encyclopædia articles by Prof. Patrick Geddes and Sir E. Ray Lankester.

The author divides biology into Biotaxis and Biophysik. The first has to do with the establishment of conceptual relations, the second with the establishment of real relations—causal and teleological. Classification, for instance, is "biotactic"; physiological analysis is "biophysical." He contrasts his dual division with others, *e.g.*, with morphology and physiology (which is a "scholasticism," he says), or with biostatics and biodynamics, which expresses a different idea. But does Dr. Tschulok mean more than this, that we have in biology, as elsewhere, to discover the orderliness of sequences and to sum this up in conceptual formulæ?

The author's chief contribution is a scheme of the subdivisions of biology. His idea is that there are seven kinds of inquiry which are individually indispensable and collectively exhaustive. These are: taxonomy, morphology, physiology, œcology, chorology, chronology, and genetics. This appears to us to illustrate most of the vices of classification, such as overlapping, cross-division, and inequality of values. It appears to us, for instance, that taxonomy and morphology are inseparably bound together; that œcology, as Semper said, is part of physiology; that chorology is not an independent division of the science; and so on. It must be noted, however, that Dr. Tschulok defends his seven-fold classification with enthusiasm and learning. J. A. T.

A MONOGRAPH OF THE PETRELS.

A Monograph of the Petrels (Order Tubinares). By F. Du Cane Godman, F.R.S. With hand-coloured plates by J. G. Keulemans. Part iv., pp. 233–296; part v., pp. 297–381+lv. (London: Witherby and Co.) Price 15*l.* 15*s.*, bound in full morocco.

THE fourth and fifth parts of the "Monograph of the Petrels," completing this beautiful and valuable work, have been received, and the whole work can now be had, bound in full morocco, price fifteen guineas. It contains 436 pages printed on rag paper, and over one hundred hand-coloured plates by Keulemans, our best ornithological artist. In every respect this beautiful volume has been produced in the best possible style. Nor is the letterpress any less excellent. The work was projected, if not actually begun, by the late O. Salvin, who wrote the "Tubinares" for the British Museum catalogue of birds, and the author has endeavoured to carry out the work on the lines laid down by Salvin, taking the catalogue as his guide. The final part contains a masterly introduction to the order Tubinares, a systematic list of species, a classification and key to the genera and species, and an essay by Mr. Pycraft on the systematic position of the petrels.

Petrels apparently belong to an ancient race of birds, as their remains have been found in a fossil state in various parts of the world, mostly in superficial deposits, one species, however, being known from the Red Crag of Norfolk. In external appearance the families of petrels differ in an extraordinary manner, and the species vary in size from the tiny storm petrel to the wandering albatross. Notwithstanding their wide differences, petrels may at once be distinguished from all other birds by their prominent tubular nostrils and by their bills, which consist of several horny pieces separated by deep grooves. They are dispersed throughout the oceans of the world, penetrating to the ice barrier at both Poles, though they are more numerous in the southern than in the northern hemispheres. They are oceanic wanderers, and, unless storm-driven, seldom, if ever, come to land except for the purpose of breeding.

The two parts now before us comprise the rest of the genus Œstrelata, and the genera Pagodroma (the snowy or ice petrel) Bulweria, Macronectes (the "stinker or Nelly" of the sailors), Fulmarus, Daption (the well-known "Cape Pigeon"), Halobæna, and Prion, completing the family Puffinidæ; the family Pelecanoididæ comprising one curious genus; and the family Diomedeidæ (the albatrosses), comprising the genera Diomedea, Thalassogeron, and Phœbetria. Certainly the most curious and perhaps the most interesting of all these are the strange little

diving petrels peculiar to the southern seas, and absurdly resembling the little auk of the northern seas both in appearance and habit—diving, fishing, and flying—although widely differing in structure. Darwin wrote of one of them:—

"No one seeing the bird for the first time, thus diving like a grebe, and flying in a straight line, by the rapid movements of its short wings, like an auk, would believe that it was a member of the family of petrels, the greater number of which are eminently pelagic in their habits, do not dive, and whose flight is usually most graceful and continuous."

Since the completion of Salvin's catalogue the present monograph has derived much benefit from the considerable additions to the national collection made through the several expeditions sent to the Antarctic regions, among which may be mentioned the voyages of the *Discovery*, the *Southern Cross*, the *Scotia*; and from the cruises of the *Valhalla*; as well as from the expedition sent to the Hawaiian Islands by the Hon. Walter Rothschild; these together have considerably increased our knowledge of the distribution of the petrels. A full index brings this important volume to a close.

OUR BOOK SHELF.

Eugenics, the Science of Human Improvement by Better Breeding. By C. B. Davenport. Pp. 35. (New York: Holt and Co., 1910.) Price 50 cents net.

THIS useful little book consists of two parts. The first is an account of the principles which determine whether a given marriage will produce fit or unfit offspring, the second contains suggestions for future eugenic research. In the somewhat limited class of characters and diseases for which definite Mendelian laws of inheritance have already been made out, it is possible to predict with an approach to certainty the proportion of the children which will or will not be affected. Thus the malformation of the fingers known as brachydactyly is a Mendelian dominant.

"An abnormal person married to a normal will beget 100 per cent., or 50 per cent. abnormal, according to circumstances, and such a marriage is unfit; but two parents who, though derived from brachydactyl strains," are themselves normal, "will have only normal children . . . such a union is entirely fit."

Deaf-mutism may be due to any one of a variety of defects, but in different individuals of the same family the chance is large that it is due to the same defect. Such defects are often recessives, and may appear in the offspring of normal parents of deaf-mute stocks. Intermarriage between two such parents, especially of cousins, is "unfit." Again, too, imbecile parents, whether related or not, produce only imbecile offspring, a fact which should impress those responsible for the long delay in embodying in legislation the recommendations of the Royal Commission on the Care and Control of the Feeble-Minded.

In concluding his suggestions for future inquiry, Mr. Davenport rightly points out the contrast between the difficulty of raising funds for such scientific inquiries, and the ease with which money is obtained for charitable and humanitarian action which often proves to have been ill-judged.

"One cannot fail to wonder that, where tens of millions have been given to bolster up the weak and alleviate the suffering of the sick, no important means have been provided to enable us to learn how the stream of weak and susceptible protoplasm may be checked." W. C. D. W.

The Book of the Dry Fly. By G. A. B. Dewar. New edition. Pp. xxvii+277. (London: A. and C. Black, 1910.) Price 7*s.* 6*d.* net.

THE second edition of Mr. Dewar's "Book of the Dry Fly" follows the first after an interval of thirteen years. It is to be regretted that this second edition is, in reality, little more than a reprint of the first; the art of dry-fly fishing has been developed, and knowledge of the natural history of the trout and of the aquatic creatures upon which it feeds has advanced during these years, and it is a little deceptive to find that references to "last year" in a book with 1910 on the title-page refer to 1896. The deception may even be turned to confusion by the addition of a footnote modifying or contradicting the statements made in the text.

However much we may regret that the book has not undergone a more complete revision, we may still be glad to find that a second edition has been published. Mr. Dewar is a student of nature, as well as a fisherman, and he writes with obvious enthusiasm and interest of various chalk and limestone streams and their surroundings. He deals well with the elements of dry-fly fishing, and appears to touch on most points likely to interest a student of that art.

There are some matters in which we find Mr. Dewar hard to follow, such as his discussion of the modern higher education of trout, but as a rule his explanations are lucid and his opinions clearly expressed. The grayling is, perhaps, treated with rather scant courtesy in the text, although the footnotes show signs of a change of view. A singular misuse of the term "dropper" in chapter ii. is obviously the result of an oversight, and this should be corrected in any future edition.

An attractive feature of the present edition of Mr. Dewar's book is the series of excellent reproductions of water-colour sketches of typical chalk and limestone streams; these should assist the fisherman who does not know the waters of Hampshire or other southern and Midland counties to appreciate the conditions which have brought dry-fly fishing into being far more easily than any mere description in words.

Last, but not least, there is a good index.

Die Entwicklung des menschlichen Geistes. By Max Verworn. Pp. iv+52. (Jena: Gustav Fischer, 1910.) Price 1 mark.

THIS is a lecture by the well-known professor of physiology in the University of Bonn, and is a kind of popular survey of human development. After dealing with the fact that "the development history of the individual form is a short recapitulation of its race development" (Fritz Müller) and with the elaboration of this by Haeckel, Dr. Verworn goes on to emphasise the importance of child-study with relation to pedagogics. A eulogy of Charles Darwin follows, and a curious and interesting table of supposed psychological development from the Eolithic to the present time.

The British Empire in Pictures. A Geographical Reading Book. By H. Clive Barnard. Pp. 64 (London: A. and C. Black, 1910.) Price 1*s.* 6*d.*

THE thirty-two excellent illustrations in colour which form the distinguishing characteristic of this book will serve excellently to predispose young pupils in favour of the study of geography. As a supplement to the more serious work of the class-room, the book should prove useful, and it should not be difficult to get children to read the book as a leisure-hour undertaking.

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.*]

Origin of Dun Horses.

IN discussing the colours and stripes of horses in "Animals and Plants under Domestication," Mr. Darwin says:—"I have endeavoured, but with poor success, to discover whether duns, which are so much more oftener striped than other coloured horses, are ever produced from the crossing of two horses, neither of which are duns. . . . One case, however, has fallen under my own observation of a foal from a black mare by a bay horse, which when fully grown was a dark yellow-dun and had a narrow but a plain spinal stripe."[1]

In a recent number (October 15) of the *Veterinary Record* Mr. J. B. Robertson gives the following instances of reversion to dun from the last eleven and first four volumes of the General Stud Book:—

(1) Bay-dun filly (1907), by Ash (chestnut), out of Unexpected (bay).

(2) Dun filly, Sarah Curran (1892), by Robert Emmett (bay or brown), out of Cellulites (black).

(3) Dun colt (1897), by Sir Frederick (bay), out of Lobelia (bay or brown).

(4) Light dun filly (1886), by Lord Gough (bay), out of Danseuse (brown).

(5) Dun or chestnut filly, Sancta (1884), by Exminster (bay), out of Halloween (chestnut).

(6) Dun filly (1763), by Young Cade (bay), out of Miss Thigh (grey).

(7) Dun colt (1730), by King George II.'s one-eyed grey Arabian, out of Young Kitty Burdett (bay).

(8) Dun filly (1829), by Lottery (brown), out of Octavia (bay).

Mr. Robertson also mentions (1) that a half-bred yellow-dun filly was obtained out of a liver-chestnut Welsh cob by a bay thoroughbred with a dorsal band—this filly "during early foalhood was profusely striped on the face, neck, and quarters"; and (2) that of 45 duns given in the tables included in his paper, 39 cannot be traced to an original dun ancestor. They sprang from the union of Silverlocks (chestnut) and the Godolphin Arabian (brown), "and hence afford incontrovertible evidence that a gametic line of duns—which in this case extended to four generations—may spring from parents neither of which are dun."

The University, Edinburgh. J. C. EWART.

Markings of Mars.

I HAVE recently returned by way of Tasmania from a series of visits to the chief observatories in the United States, which included a month's stay at the Lowell Observatory during the past opposition of Mars. This visit was made with the express object of testing by my own observation the reality of the data on which Dr. Lowell has based his speculations.

I find on my return that so much scepticism has been raised by the observations and arguments of M. Antoniadi and others that a record of my own experience may be of some value.

When I first looked at Mars at Flagstaff (September 27, 1909) I saw with great difficulty three streaks, presumably canals. The seeing was bad, and the general faintness of the planet's markings at that time is admitted by all. I continued to observe Mars on every possible night (which was nearly every night) until October 25, and as my eye became accustomed to the work I saw more and more. The canals were seen repeatedly better—this with the 24-inch refractor generally stopped down to about 18 inches. I found that with more than 20 inches the air was nearly always too unsteady, and with less than 15 inches too much separating power was lost. The canals were seen best with a power of 390 diameters.

Clearer they became each night until, on October 25, the seeing being the best I ever experienced, the canals came out with amazing clearness and steadiness, sharp and clean, like telegraph wires against the sky, the oases also being exquisitely defined. Whereas on previous nights the canals could be held only by short glimpses of perhaps half a second at a time, they were now steadily visible for three or four seconds together, when a short flicker would sweep over them; during the lucid intervals the limb also of the planet was perfectly steady, as I have never seen it before or since. Of the objective existence of these markings in the image at the focus of the telescope there could be no manner of doubt, and Lowell's representations of them are nearer the actual appearance than any I have seen, though even in his drawings the lines seem hardly fine enough. The effect produced on my mind by this remarkable definition, which lasted for upwards of one and a half hours (from about 8.30 until after 10 p.m.), was staggering and ineffaceable. Soon after ten the definition went to pieces.

It may be relevant to mention that a few evenings previously I had obtained a fair and convincing view of the canals with the 40-inch reflector (full aperture and a power of about 700), when they had appeared hazy and broader, but the image had been very unsteady, and only obtained in very short flashes; but nothing that I had hitherto seen had prepared me for the astonishing steadiness and *fineness* of the details visible on this superb night.

There is in my mind no sort of doubt that the revelation of this night was due both to the perfection of the instrument (which its maker long ago pronounced to be the best that the firm of Alvan Clark ever turned out) and the atmospheric conditions which are found at Flagstaff. With respect to these I would mention, as pointing to the freedom from water vapour, that I have seen the thermometer fall from more than 70° F. at 3 p.m. to below the freezing point at 3 a.m. without a trace of hoar-frost, and the general clearness of the air was such that I could see Uranus with the naked eye within 5° of the horizon, and could nearly every night count nine stars in the Pleiades and separate ϵ and 5 Lyræ.

The telescope also afforded on other nights ample evidence of the extraordinary clearness of the air. On many occasions both satellites of Mars, when not very near the limb, could be seen, without screening the planet, with 18 inches of aperture; and on one occasion with this aperture I picked up one of them unawares while looking for canals with *a yellow screen*. (N.B.—The importance of colour screens in rendering the canals visible does not seem to be sufficiently appreciated.)

In the face of all this positive evidence, and in the absence of any evidence that the observing conditions at Meudon, just outside Paris, ever approach these best conditions at Flagstaff, I find it impossible myself to attach any serious weight to the ingenious and plausible contentions of M. Antoniadi, which seem to have been much too hastily accepted in this country.

As to the deductions which Dr. Lowell has drawn from his observations I have nothing to say except that the startlingly artificial and geometrical appearance of the markings did *force* itself upon me.

JAMES H. WORTHINGTON.

Wycombe Court, High Wycombe, October 31.

November Meteors.

THE moon is full about the time when the Leonids become due in the present year, but that is no reason why these meteors should elude observation, for the Sickle has furnished some notable displays of shooting stars. With the moon in opposition in mid-November, as, for instance, in 1799 and 1867, though the coming apparition cannot be expected to vie as regards brilliancy with either of these historic events, yet in its way it may not prove unimportant nor be allowed to pass unobserved. Besides the Leonid epoch, there are also some other meteoric events that occur in November, of which the following particulars have been computed by the writer:—

Epoch, November 11, 9h. (G.M.T.), approximately second order of magnitude. Principal maximum,

[1] "Animals and Plants under Domestication," vol. i., p. 62. (1872.)

November 12, 5h. 45m.; secondary maximum, November 12, 9h.

Leonid epoch, November 17, 21h., twenty-eighth order of magnitude. Principal maximum, November 16, 13h. 45m.; secondary maxima, November 16, 13h. 20m. and 15h. 30m.

Epoch, November 19, 9h., eighth order of magnitude. Principal maximum, November 20, 15h. 15m.; secondary maxima, November 20, 6h. 30m. and 16h. 30m.

Epoch, November 19, 9h. 30m., fifth order of magnitude. Principal maximum, November 20, 14h. 30m.; secondary maxima, November 19, 20h. 30m., and November 21, 0h. 30m.

Epoch, November 23, 22h., approximately second order of magnitude. Principal maximum, November 21, 20h. 30m.; secondary maximum, November 22, 1h.

Epoch, November 28, 6h., approximately second order of magnitude. Principal maximum, November 30, 14h. 30m.; secondary maxima, November 30, 2h. 30m. and 11h. 30m.

It may be seen from the foregoing that there are four periods during the last three weeks of November that will probably be characterised by an unusual degree of meteoric activity, viz. November 12, 16, 20–21, and 30. The circumstance that the moon will be eclipsed in the night of November 16 may favour and stimulate Leonid observations, but the former phenomenon will perhaps have nearly ended before the latter may put in an appearance.

November 7. JOHN R. HENRY.

Early Burial Customs in Egypt.

IT is suggested in Prof. Elliot Smith's letter (October 27, p. 529) that the burial customs in other countries influenced our observation of the burials in Egypt. On the contrary, the occasional practice of dismemberment in Egypt was a surprise to myself and to others; it is only gradually that the evidence for the wide distribution of such customs elsewhere has been brought forward as a parallel.

In place of all workers in Egypt finding "precisely the same state of affairs," many entire differences of custom are found in other material facts besides dismemberment, as thirty years' experience has proved.

The first principle for the archæologist to realise in Egypt is the great diversity of thought and custom which prevailed. With four totally incompatible beliefs about the future life, shown by diverse funeral customs throughout the history, it is quite natural that diversity should occur in the treatment of the body in the earlier ages. When the long-promised publication of Dr. Reisner on prehistoric Egypt is accessible, we shall be in a position to define some more localities where certain customs ruled. Discussion of these local variations before the fresh facts are published is premature.

W. M. FLINDERS PETRIE.

STRIPPED of all irrelevant considerations, the question at issue resolves itself into this, "Is there any real evidence to prove, or even to suggest, that the ancient Egyptians ever mutilated the bodies of their dead?"

In reply, I maintain that there is no evidence whatsoever capable of being twisted into the semblance of support to Prof. Flinders Petrie's contention.

Of all the multitudes of so-called "dissected burials" recorded by him, there is only one (see "Deshasheh," 1898) which carries conviction to those familiar with Egyptian conditions as a genuine case of secondary burial. Prof. Flinders Petrie says he has found two more cases this year. That may well be so. We found more than a score of such cases in Nubia.

But they are not evidence of deliberate mutilation of the body. They are all of them instances of some unintentional damage to the corpse—either by unskilled embalmers or by accident.

In reference to Prof. Flinders Petrie's closing remarks, I may state that by the time this letter is printed there will be published in Cairo Dr. Reisner's report (vol. i.) on the Archæological Survey of Nubia, containing his observations on prehistoric Egypt and Nubia.

G. ELLIOT SMITH.

Simulium and Pellagra.

THE interesting discovery by Dr. Louis Sambon that pellagra is due to a protozoal parasite conveyed by flies of the genus Simulium (NATURE, October 27) is, we may presume, merely the prelude to an energetic campaign of extermination directed against the insect.

It is well that medical men and sanitary officials should realise at the outset of such a campaign that the destruction of Simulium flies in any given area is an infinitely harder task than the destruction of mosquitoes. The larvæ of Simulium live in rapid streams, attached to submerged rocks and stones, and it is difficult to see how these streams can be drained dry if they are numerous in any particular district. Even if it were practicable to cover the surface of these streams with a film of oil, such a procedure would have no effect on the Simulium larvæ, for, unlike mosquito larvæ, the little creatures derive the oxygen necessary for their existence from the water bathing the gills situated at the anterior end of their bodies. In other words, the Simulium larva cannot be suffocated as can the mosquito larva.

Finally, it may be noted that the species of Simulium are very small flies, consequently to exclude them from houses wire gauze or muslin screens of extremely fine mesh must be employed. Such screens are bound to interfere seriously with the circulation of air in a house, and in a warm climate the discomfort entailed will be almost intolerable.

R. SHELFORD.

Hope Department, Oxford University Museum.

The Cocos-Keeling Atoll.

DURING a very short visit to these islands some years ago I was taken across the lagoon in a light canoe, and when wading to land, about a quarter of a mile distant, over the rough surface of fresh coral branches, I suddenly crashed downwards for about 2 feet into a mass of rotten coral which spread over an irregular area some 20 or 30 yards across. I did not investigate this further, as a shark's fin appeared above the water off shore, but Mr. Ross informed me that a good deal of the coral in the lagoon had been "killed" at various times by sulphurous exhalations from below, and had become black and rotten in consequence. Mr. Ross (the owner of the island group) supposed that the wide and deep well-like holes and broad irregular patches of varying depth in the lagoon were due to this cause, which he compared to the sulphurous steam constantly roaring from the crater of the Gedeh and other mountains in Java.

If this comparison be correct, as it doubtless is, the Cocos ring is around the submerged summit of a volcanic cone which has not quite lost its solfataric activity. I have never seen it suggested that such poisonous exhalations coming into the still water confined within the atoll ring might account for the slower growth of the coral, and the deepening of the lagoon by the degradation of the coral branches where the polyps had been suddenly poisoned. It is, however, possible that some such influence may cooperate to prevent the coral flourishing as rapidly as it does outside the ring in the boisterous wash of the fresher waves that are constantly stirred by the trades.

I have not yet read Mr. Wood-Jones's book, but it was the decided opinion of Mr. Ross, founded upon boat navigation, that the lagoon was shallowing, because, as he thought, the submerged summit was slowly rising. If this be so something more than slower growth is necessary to account for the continued existence of the lagoon, since, however slow the growth, it must ultimately in a rising area bring the summit up at least to water-level; but if there is this kind of active degradation, neither slow upheaval nor slower growth could prevail against such rapid destruction, and a comparatively deep atoll with irregular bottom contours would result.

Waterstock, Oxon, October 31. E. C. SPICER.

IT would be ungenerous, after the frank admissions of inaccuracy on the part of the reviewer (NATURE, October 27), to criticise the substance of his review in any more detail; but it is necessary to make some reply to his assertions concerning the development of atolls.

From the general trend of his first article (NATURE, October 6) I gathered that the reviewer was an advocate of the "solution" theory of Sir John Murray, and by carefully reading his second contribution (October 27) I have not entirely dispelled this impression. Yet he says, "I do not regard the lagoon in an atoll, which was formed, as Darwin suggested, by subsidence, as covering a reef at all."

This would seem to suggest a belief in Darwin's theory, and, if it is the case that the reviewer upholds this theory (as well as the opposed one of "solution"), it may be well to point out that I too would not regard the lagoon of an atoll, formed by subsidence, as covering a reef. I should not have imagined it probable that anyone would so regard a lagoon were it formed in such a manner. The essential difference between such a view and the one that I have attempted to uphold is that I do not regard the lagoon as being formed by subsidence at all; but I do look on the lagoon as being a "slightly submerged reef" having a raised rim upon which islets are developed. Does the reviewer genuinely regard the lagoon as being formed by subsidence? If he does, why does he also plead the opposed theory of solution, and appeal to the *elevated* islands of Fiji? If he does not, why does he urge the statement as an argument against my views?

I am glad to see that he is prepared to admit that the various well-known phases of development of atoll-shaped reefs are "indirect evidence" of the truth of what I have maintained; but the Funafuti bore, he thinks, does not support it. The reviewer states that he does not think "the borings in the lagoon at Funafuti suggest a reef such as surrounds a lagoon." I should not have expected them to have suggested a reef such as *surrounds* a lagoon, for that reef is a consolidated and specialised "breccia platform." What might be expected is that such a bore would show the characters of a submerged reef—the open coral bank—*plus* the lagoon accumulations added since the completion of the atoll.

When such a successful bore is driven we may look for such appearances; but it is surely within the knowledge of the reviewer that the only bore at Funafuti which met with any success was *not situated in the lagoon*. The lagoon bore ("bore L") penetrated only 144 feet, and then failed; the only successful bore (on the results of which alone any safe argument may be based) was situated on the seaward reef, far removed from the lagoon. The successful bore ("main bore"), which reached a depth of 1114 feet, was driven on the extreme windward edge of a large atoll reef. In such a situation one would confidently expect the bore to penetrate the talus slope of the outwardly growing reef, and, from the description of the core obtained, it would appear that this expectation was realised. The Funafuti "main bore" tells little of the development of atolls save that they grow to windward on their own talus slopes—a fact hardly requiring a laborious boring for its acceptance.

The "L bore" can support no particular theory by reason of its very incompleteness; but such evidence as it does afford in no way contradicts, but rather goes to support, the supposition that it penetrated the lagoon débris of a submerged reef.

Whether the reviewer regards the Funafuti boring as evidence supporting Darwin's theory of subsidence or Sir John Murray's theory of solution I cannot quite determine; but he next defends the solution theory in the case of the Fijian Islands. He says that these islands have reefs "which superficially appear to be of the ordinary coral-reef type. Such reefs cannot have existed when the islands were first elevated, and it seems to me that Agassiz's photographs show that high islands do crumble to pieces within the calm of encircling barrier reefs." I own that I fail to follow this argument, for, granting that the reef is new since the island was elevated, what proof—or what probability—is there that the coast erosion was not present before the development of the reef, when the same condition is seen quite apart from reefs, or any other coral structures, all over the world?

The problem of the formation of coral structures (fringing reefs, barrier reefs, open reefs, atoll-shaped reefs, and atolls) is not, I think, to be solved by appeals to a multitude of opposed theories, and no critic's position is likely to gain strength by a series of fallacious arguments based alternately on the theory of subsidence, the theory of solution, and the results of the Funafuti bore.

F. WOOD-JONES.

St. Thomas's Hospital Medical School.

As a reviewer I would point out that I do not desire to uphold any theory, but merely to show what is good and what is bad in the book which I am reviewing, what facts are new, how far these and other facts support any theories, &c. An essay on the duties of a reviewer might be a suitable suggestion to the Editor of NATURE, but obviously I am not the author to present such an article.

In the first paragraph of Mr. Wood-Jones's letter of October 27 I am practically accused of being an "anonymous destructive critic" of, I suppose, the constructions erected by the facts brought together by Mr. Wood-Jones, some of them new and some old. I regard some of the bricks of his building as faulty, and I scarcely think there are enough bricks with which to complete the building. I intended to indicate in my review that I considered that science had gaine by the attempt to build, and I desired indirectly to indicate some of the bricks which I thought future workers should attempt to collect. I do not believe any researcher on the coral-reef problem will consider my review as in any way unfair if he regards (*as I did*) Mr. Wood-Jones's book as a *contribution to science*.

I shall after this letter not continue this correspondence, not caring for Mr. Wood-Jones's style of writing. I would, however, make myself clear on two points. Mr. Wood-Jones admits that he assumes the lagoon of an atoll to be a slightly submerged reef. I point out that the nature of the material underlying the lagoons of atolls is doubtful. I appeal to the lagoon boring at Funafuti as giving the most valuable facts we have as to its nature. Do these facts, the best known geographical facts, support the theory of a *slightly submerged reef*, such as is supposed to exist at Cocos-Keeling? Down to 27 fathoms the first Funafuti lagoon boring passed through lagoon débris, and from that depth to 41 fathoms there occurred some firmly compacted masses of coral rock. In the second boring, which was carried to nearly 36 fathoms, a similar section was obtained. I do not consider that these two borings are sufficient to justify Mr. Wood-Jones's assumption, and I did not consider that the evidence given as to Cocos-Keeling lagoon justifies it. I quite fail to remember any description of the material under the Cocos-Keeling lagoon such as would suggest the open coral bank which is mentioned in Mr. Wood-Jones's letter, while its shallowness made it a peculiarly favourable place for investigation.

The fringing reefs round the high limestone islands in Fiji I certainly am inclined to regard as platforms left at low tide-level when those islands were washed away. In this sense they are new. They formed part of the bases of the islands when they were first elevated. Possibly the edges of these platforms have extended seaward since the land was removed by solution, and, still more important, by the erosion of the numerous small particles carried in the swirling waters. I consider these views are amply supported by published evidence. High limestone islands are also being washed away within barrier reefs, and I think it is a fair inference from the evidence that many of these barrier reefs were once similar shelves cut out from the land, or, to put it another way, left behind when the land was removed.

THE REVIEWER.

Note on Winter Whitening in Mammals.

I HAVE just seen a letter in NATURE of March 24 by Miss I. B. J. Sollas, in which, commenting on Mr. Mudge's observations, it is suggested that the yellow body produced artificially by Mr. Mudge in the fur of the albino rat is a substance similar to the yellow pigment of the stoat's winter coat, and therefore probably represents a stage in the reduction of the pigment to the condition in which it exists in the white hairs.

I had previously read Mr. Mudge's observations with great interest, and had suggested to him that they would throw light on the hitherto unexplained yellow tints in

the fur of the winter-whitened stoat, as well as in the permanently white polar bear. I think Mr. Mudge's observations are a distinct help to us in getting at the meaning of these white coats. I should like to see what Miss Sollas can do with the hair of the variable hare, as in the whitened specimens of this animal I have never seen any trace of the yellow tints found in the stoat.

Mr. Mudge's note that the white areas of a piebald mouse can be turned pink by immersion in 5 per cent. nitric acid in 78 per cent. spirit, but only in summer or a warm temperature, is also of great interest. Does it not suggest a reason why pink colour in feathers is mostly found in summer plumages and in warm climates? And is not his production of brown in the hairs of white rats exposed to damp warm weather comparable with the well-known saturated tints so prevalent in animals living naturally in damp but warm countries?

While writing on winter whitening it may be well to direct attention to another point, which has always been difficult to explain on physiological grounds, namely, the fact that the black ear tips of the hare and the black tail tip of the stoat are not subject to winter whitening. This, however, would be explicable if, whereas the general body coat of both these animals is cast twice a year, the black hairs on the ears and tail are renewed only once a year. If they are renewed only once they must remain (apart from fading) of the same colour throughout the year. That such a single moult is possible, and even probable, in these two instances is shown by the fact that in the squirrel there are two moults of the general body coat, but only one of the ear tufts and tail hairs. Similarly in the Equidæ (according to Ewart), there are two moults of the general coat but one only of the mane and tail.

G. E. H. BARRETT-HAMILTON.

Kilmanock House, Campile, Co. Wexford, Ireland, November 3.

Helium and Geological Time.

I MUST apologise for an error in my letter published in NATURE of November 3. The sixteenth line and onwards should read " . . . for we have no knowledge of chemical affinity between helium and solid substances; while, in respect of solubility, it would probably be inferior to the other gases."

R. J. STRUTT.

Imperial College of Science, South Kensington.

THE SUBANTARCTIC ISLANDS OF NEW ZEALAND.[1]

THE naturalists of New Zealand have always shown themselves eager to take advantage of any opportunity for extending our knowledge of the fauna and flora of their country. Such opportunities are presented from time to time by the periodical official visits of the Government steamer to the outlying islands. In November, 1907, the s.s. *Hinemoa* deposited a large party of New Zealand men of science on Auckland and Campbell Islands, calling for them again on her return trip more than a week later. The expedition was undertaken at the instance of the Philosophical Institute of Canterbury, primarily for the purpose of extending the magnetic survey of New Zealand to the outlying southern islands, but the volumes before us consist chiefly of zoological and botanical observations, though there are also articles on geophysics and geology.

The work has been issued under the editorship of Dr. Charles Chilton, and the publication has been rendered possible by a substantial subsidy from the New Zealand Government. It comes at an opportune moment, and acquires a special interest in relation to the exploration of the Antarctic continent now in progress.

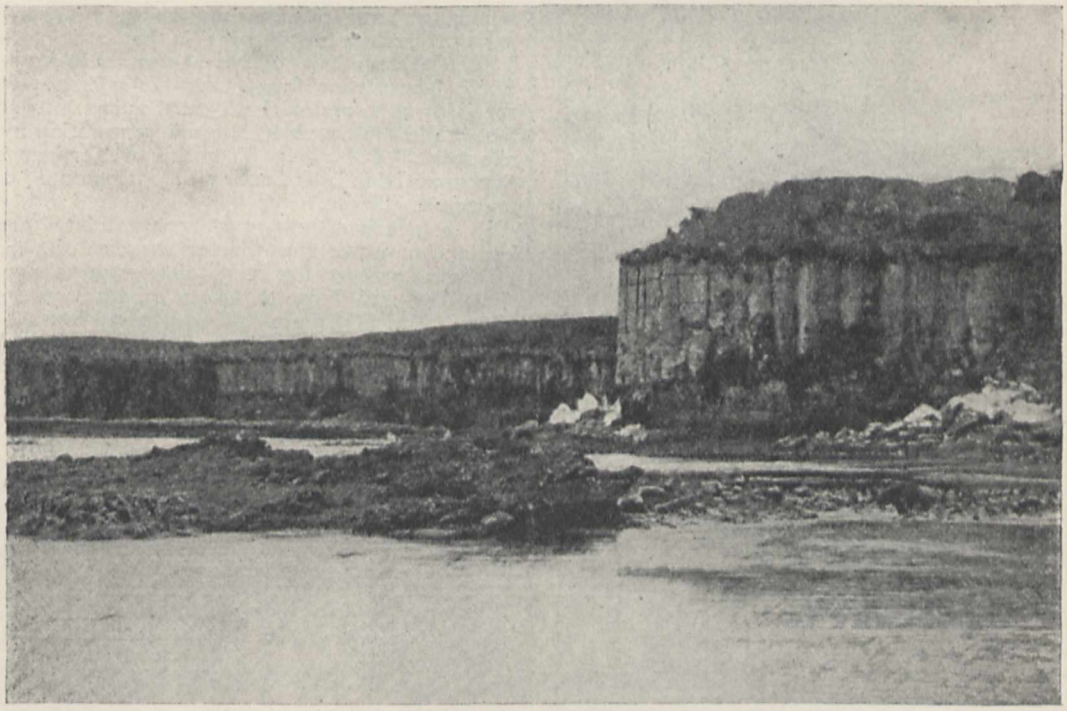

FIG. 1.—Cliffs of Columnar Basalt, Enderby Island. From " The Subantarctic Islands of New Zealand."

The time at the disposal of the expedition was, of course, all too short for a complete biological survey, and the collections were evidently, at any rate in many cases, very fragmentary, but many very interesting results were obtained. The zoologists were undoubtedly right in devoting most of their energies to the terrestrial fauna, which is much more likely to be modified or even exterminated by human agency than the marine fauna, but we cannot help wishing

[1] The Subantarctic Islands of New Zealand. Reports on the Geo-Physics, Geology, Zoology, and Botany of the Islands lying to the South of New Zealand. Based mainly on Observations and Collections made during an Expedition in the Government Steamer *Hinemoa* (Capt. I. Bellons) in November, 1907. Edited by Prof. Charles Chilton. Vol. i., pp. xxxv+388; vol. ii., pp. 389–848. (Wellington, N.Z.: Philosophical Institute of Canterbury. London: Dulau and Co., Ltd., 1909.) 2 vols. Price 42s. net.

that the latter had received a little more attention. No fewer than 168 species and varieties of Foraminifera were discovered by Mr. Chapman in the dredgings sent to him, and if other groups are equally well represented in these seas there must be a rich harvest waiting to be reaped. Incidentally we may note the surprising and very satisfactory fact that of these 168 species and varieties of Foraminifera, from a practically unknown region, only four species and two varieties had to be described as new! Such a record gives one hope that some day our systematic knowledge of the marine fauna will be approximately complete. In the report on the sponges, on the other hand, Prof. Kirk mentions only two species, and of holothurians there were only three.

A large proportion of the collections, both botanical and zoological, has been worked up and reported on

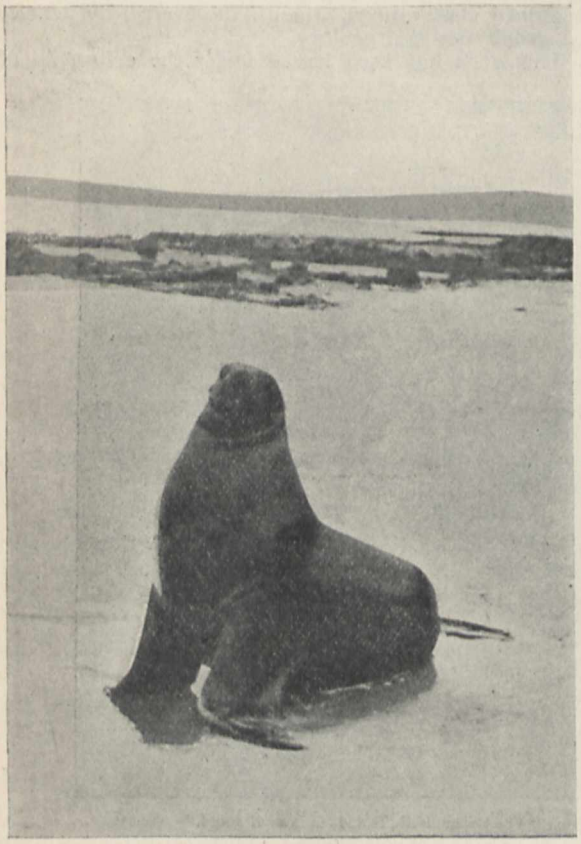

FIG. 2.—Young Sea-lion (*Arctocephalus hookeri*), Carnley Harbour, Auckland Islands. From "The Subantarctic Islands of New Zealand."

by local naturalists, Prof. Benham, Prof. Chilton, Prof. H. B. Kirk, Mr. Edgar Waite, Mr. Henry Suter, Mr. E. V. Hudson, Mr. T. Brown, Mr. T. F. Cheeseman, Dr. L. Cockayne, Mr. R. M. Laing, and Mr. Donald Petrie, many of whom also took part in the expedition. Other collections were sent to specialists in other countries and reported upon by them.

Amongst the more interesting forms obtained, we may note two new species of land nemertines, from Auckland and Enderby Islands, a remarkable addition to this extremely limited group. These are described by Mr. A. D. Darbishire, who contributes some useful notes on the taxonomic value of certain anatomical characters. In addition to the purely systematic reports, we have others of more general interest. Thus Dr. Cockayne contributes a long essay on the ecological botany of the islands, with a number of beautiful photographic illustrations, and Dr. Chilton gives us an account of the history of the scientific investigation of the islands, and a very useful summary of the biological results of the expedition, especially from the biogeographical point of view.

The results in general appear to support the current view that the existing islands of New Zealand are mere fragments of a very much larger land area, which at one time extended southwards beyond Campbell Island, eastwards beyond Chatham Island and Antipodes Island, and north-westwards towards New Guinea. Thus the fauna and flora are essentially Novæ-Zealandian in aspect, but with a large Antarctic element which may perhaps be accounted for by a former northward extension of the Antarctic continent. The existence of an Antarctic continent has, of course, long been used in explanation of certain striking resemblances between the fauna and flora of New Zealand and those of South America, but, as Dr. Chilton points out, we must also suppose that at some former time the climate of Antarctica was sufficiently mild to allow of the existence of a far more abundant animal and vegetable population than we find there to-day. Such a supposition is justified by the geological observations of recent Antarctic expeditions. Fossil leaves were found near the winter quarters of the *Discovery*, and coal still further south by Shackleton, while the Swedish Antarctic expedition met with abundant fossil plants in rocks of Tertiary age on Seymour Island, indicating a temperate or subtemperate climate.

In conclusion, we must congratulate the New Zealand naturalists on the performance of a fine piece of work, and at the same time express our regret that they still have to labour under numerous disadvantages. Of these the want of adequate scientific libraries appears to be one of the most serious. The New Zealand Institute, with its various local branches, has for many years past played a most useful part in promoting scientific research in the dominion, and it appears to us that the Government might do well to assist in some scheme whereby the defect referred to might be remedied, and the necessary scientific literature provided, not only for Wellington, which is the headquarters of the New Zealand Institute, but also for those large provincial towns where the principal branches of the institute are situated.

ARTHUR DENDY.

BIRD MIGRATION.[1]

OF all the many problems of animated nature awaiting solution, few, if any, have of late received more attention than—perhaps the most mysterious of all—the migration of birds.

Mr. Eagle Clarke and the other painstaking observers working with him have during the last few years learnt and taught us much, but only enough to show that still, as Prof. Newton wrote some twenty years ago, "our ignorance is immense."

What is the propelling power which at the appointed seasons sets the great hosts in motion? It seems now at least probable that almost every bird is in some degree migratory, and that even the robins and thrushes that come to the windows for crumbs in winter are more often than not other birds than those which nested in the garden in the spring.

When and how in the long-past eternity were the great aërial highways from zone to zone first marked out, to last apparently for all time? Our boasted

1 "Ornithological Notes from a South London Suburb, 1874–1909. A Summary of Thirty-five Years' Observations, with some Facts and Fancies concerning Migration." By F. D. Power. Pp. 60+chart. (London: Henry J. Glaisher, 55–57 Wigmore Street, W.) Price 3*s.* 6*d.* net.

Roman roads, Aitken streets and Watling streets are, compared to these, things of yesterday.

How is the knowledge of the chart passed on, without fault or break, from generation to generation? If old birds led the way the matter would be less incomprehensible. But, writes Herr Gätke, as "the *incontestable result*" of fifty years' watch in Heligoland:—

"under normal conditions, the autumn migration is initiated by the young birds from about six or eight weeks after leaving the nest.

"The parents of these young individuals," he adds, "do not follow until one or two months later"!

How and under what physical conditions are the journeys made?

Mr. Pycraft is a writer to whom ornithologists already owe much, and from whom they confidently look for more. His views will always carry weight, but they may change. Just now he thinks it "hardly necessary to attempt to bring rebutting evidence" to confute Herr Gätke's closely-reasoned argument that migration flights must be made at speeds which,

> "Through the mists and vapours,
> Amid these earthly damps,"

may well seem incredible; but, with atmospheric resistance removed, need seem no longer so.

The veteran ornithologist's dream of "the existence of a special respiratory mechanism, enabling birds to remain in strata of the atmosphere beyond the reach of all other organised beings," may yet prove true. There are things more improbable. Then we shall think nothing of flights at a speed of "a hundred and eighty miles an hour."

> "Airy navies grappling in the central blue"

not many months ago seemed impossibilities. Now they seem uncomfortable probabilities.

These are a few only of the questions which have yet to be answered before we can hope to understand what the migration of birds means. The answers are not likely to be given in the lifetime of our generation, if ever. It is only by the patient collation of trustworthy observations, spread over a long series of years, that any general conclusions can be hoped for. We may sow, but others must reap.

A modest and unpretending little volume, lately published, "Ornithological Notes from a South London Suburb, 1874–1909," by Mr. F. D. Power, is a useful contribution to the general stock of knowledge of a fascinating subject. The first chapters of the book, well worth publication though they are, will appeal rather to local than to general readers.

It is interesting to know what birds are to be looked for in one's own neighbourhood, and where and when they have been seen there. But there is not much to be said of thrushes and tits in Surrey or Middlesex which is not to be noted as well in other counties.

There is the usual sad tale to tell—and it is very well told—of wild life crowded out by growing human populations.

The lake in Dulwich Park, for instance, was once, Mr. Power writes, a favourite resting-place for passing ducks. He has seen "on and about this comparatively small sheet of water seven species not observed elsewhere in the district. In one day in October, 1898, there were five scaups and four shovellers on the lake, and the tufted duck nested on the island for three or four years." The common sandpiper was a regular visitor, and the kingfisher not uncommon. Boats have been placed on the water, and "the saddened bird-lover has now little chance of even an early morning note of extra interest."

On Mitcham Common, once a favourite nesting-place of many small birds, golf balls have taken the place of eggs.

It is in the "Migration Notes," and more especially in a broadsheet table printed at the end, that the chief interest of the volume for ornithologists living beyond the "South London Suburb" will be found, and a very real interest it is.

Mr. Power has, during a long succession of autumn migrations, kept careful records of the forces and direction of the wind and of the size and direction of the flights passing within sight of his garden. In a simple and admirably clear chart, the results of his observations are shown for every day, without a single gap, for the month of October for twenty-five years.

The rather surprising conclusions to which his observations have led him would seem to find at least *prima facie* justification in the facts tabulated. He sums up as follows:—

"It used to be supposed, and by many the idea is still held, that birds come and go with wind favouring them. . . . My observations during these many years have convinced me that migrants travel best and by choice *against* the wind. . . . My experience is [he is speaking of the autumnal migration] that the only *visible* and *sustained* migration *in numbers* is invariably in a N.W., W., or S.W. direction *almost directly against the wind*, even when such approaches a stiff breeze, the birds in their progress meeting the wind on the right or left breast."

The italics are Mr. Power's.

The photograph of "the garden from which the migration notes were taken" does not, certainly, suggest exceptionally favourable opportunities.

His little book, like Alphonse Kerr's delightful "Voyage autour de mon jardin," shows how much is to be seen by "the observing eye" without going far from home. T. DIGBY PIGOTT.

NEW DISCOVERIES AT KNOSSOS.

ON September 16 a letter appeared in the *Times* from Dr. Arthur Evans, describing the results of his excavations this year at Knossos. All archæologists will congratulate themselves on the fact that Dr. Evans has passed out of the path of politics, which he had essayed to tread, back into the more peaceful (?) ways of archæology. For there were many more things that we wanted to know about Knossos, and one of them has been made clear by the work of this season. The great domed pit, the *tholos*, as it seemed to be, over which part of the southern quarter of the palace was built, has been excavated to the bottom, not without danger to the workmen. And it turns out to be a great *tholos*-like reservoir, with a spiral staircase round the inside of it, which breaks off, as in other similar cases, at what must have been the average water-level. The springs that supplied this reservoir are now dry, and no doubt were so before the place was entirely filled up. This was done, as we know from the character of the potsherds found in it, in the first "Middle Minoan" age.

"In other words the reservoir itself belonged to the Early Minoan Age, and was filled in at the time of the construction of the first Palace of which we have any existing remains—the object of the work being to obtain a secure foundation for the South Porch and adjoining parts of the outer wall. The filling materials themselves were probably supplied by the levelling away at this time of the summit of the 'Tell' of Knossos in order to gain the area for the Central Court of the Palace." There was also a smaller reservoir on another part of the mound, "and from the magnitude of the work we may well conclude that some earlier predecessor of the Great Palace already existed on the site that it has since occupied."

This is an important conclusion. If we are to judge by the reservoir, the early Minoan palace was probably a great architectural work. The "Early Minoan III." architects were perhaps almost as capable as their contemporaries, the Egyptian pyramid-builders of the fifth and sixth dynasties.

In the small "palace" on the hillside west of Knossos further discoveries have been made, including a paved way with the rut-marks of ancient Minoan chariots. In this part of the site more recent remains, of classical and Roman date, constantly are found above the Minoan level; whereas in the main palace, "whether owing to a superstitious awe or to other causes, the hilltop . . . was never invaded by later habitations." A fine metope of a Doric temple, contemporary with the Parthenon sculptures, was found over the western palace.

Mr. Doll has proceeded with the work of conserving the palace buildings, and has run the great staircase another flight higher. Also the nature and composition of the frescoes have been studied by Mr. Noel Heaton.

In the tomb-field of Isopata further important discoveries have been made, owing to the *flair* of Gregori, Dr. Evans's Cypriote foreman,

"the most expert tomb-hunter of the Levant. . . . The wild, long-rooted fennel, which seeks out by preference the spots above ancient cuttings, served him, as often before, as a guide, and the result was the discovery of six chamber-tombs, some of which for their size and the interest attaching to their contents and arrangement surpass any hitherto known of this class."

The date of the tombs is the second late Minoan period, about 1450 B.C., contemporary with the eighteenth dynasty of Egypt. The most remarkable point about these tombs is the information as to Minoan religion which they give us. In one tomb, where "the religious interest culminated," was found an arrangement wholly new, which "rather recalled the domestic Etruscan ideas of the after-life than anything yet known of the Minoan age." The tomb was made to resemble a house of the living, with stone-cut benches, as if for family gatherings. And at the head of the sepulchral cist were found the remains of a double-axe shrine, with an offering-vessel, in the shape of a bull's head, lying close by. These tomb-chambers seem not to have been kept open regularly, but were opened for solemn service on the anniversary of the death probably. They were rifled of their more valuable contents by robbers of the early Iron age (geometrical period), who left behind them traces by which we can identify their date.

"It will be seen that the 'Tomb of the Double Axes' has produced more definite evidence regarding the sepulchral cult and religious ideas as to the after-world than any grave yet opened in Crete or prehistoric Greece."

Dr. Evans's comparison of the interior of the tomb with that of an Etruscan grave is very apposite and suggestive. This Etruscan impression has already been given by the great painted sarcophagus found by the Italians at Agia Triada, and it is most interesting to see how a relationship between the Etruscan, Minoan, and Anatolian (Hittite) cultures in matters of religious cult is gradually becoming clearer to us.

H. R. HALL.

NOTES.

THE following is a list of those who have been recommended by the president and council of the Royal Society for election into the council for the year 1911 at the anniversary meeting on November 30:—*President*, Sir Archibald Geikie, K.C.B.; *treasurer*, Mr. Alfred Bray Kempe; *secretaries*, Sir Joseph Larmor and Dr. John Rose Bradford; *foreign secretary*, Sir William Crookes; *other members of the council*, Mr. L. Fletcher, Dr. W. H. Gaskell, Sir David Gill, K.C.B., Dr. E. H. Griffiths, Prof. W. M. Hicks, Prof. F. S. Kipping, Major P. A. MacMahon, Mr. H. R. A. Mallock, Dr. C. J. Martin, the Duke of Northumberland, K.G., Prof. W. J. Pope, Prof. J. H. Poynting, Prof. E. Rutherford, Mr. A. E. Shipley, Mr. M. R. Oldfield Thomas, and Mr. Harold W. T. Wager.

THE Royal Society's medals have this year been adjudicated by the president and council as follows:—The Copley medal to Sir Francis Galton, F.R.S., for his researches on heredity; the Rumford medal to Prof. Heinrich Rubens, for his researches on radiation, especially of long wave-length; a Royal medal to Prof. Frederick O. Bower, F.R.S., for his treatise on the origin of a land flora; a Royal medal to Prof. John Joly, F.R.S., for his researches in physics and geology; the Davy medal to Prof. Theodore W. Richards, for his researches on the determination of atomic weights; the Darwin medal to Mr. Roland Trimen, F.R.S., for his South African bionomic researches, in large part undertaken as the outcome of correspondence with Charles Darwin; the Sylvester medal to Dr. Henry F. Baker, F.R.S., for his researches in the theory of Abelian functions and for his edition of Sylvester's "Collected Works"; the Hughes medal to Prof. John A. Fleming, F.R.S., for his researches in electricity and electrical measurements. The King has been graciously pleased to approve of the award of the Royal medals.

AT the meeting of the Royal Society of Edinburgh held on November 7, the following honorary fellows were elected:—*British*: Prof. J. G. Frazer, Sir Joseph Larmor, F.R.S., Dr. Alfred Russel Wallace, O.M., F.R.S. *Foreign*: Prof. Hugo de Vries, Amsterdam; Mr. F. A. Forel, Morges; Prof. Karl F. von Goebel, Munich; Prof. J. C. Kepteyn, Gröningen; Prof. Elie Metchnikoff, Paris; Prof. A. A. Michelson, F.R.S., Chicago; Prof. W. Ostwald, Leipzig; Prof. F. W. Putnam, Harvard University; and Prof. A. F. L. Weismann, Freiburg (Baden).

IT is reported from Stockholm that the Academy of Sciences has decided to award this year's Nobel prize for physics to Prof. J. D. van der Waals, of Amsterdam, for his work on gases and liquids.

WE regret to see the announcement of the death of Mr. Theodore Cooke, for many years principal of the Poona College of Science, at seventy-four years of age.

A REUTER telegram from Wellington, New Zealand, states that Mr. Priestly, who accompanied Sir Ernest Shackleton, as geologist, on his Antarctic expedition, is going out with Captain Scott in the place of Mr. Thompson, who is ill.

THE date of the annual exhibition held by the Physical Society of London, which was fixed some time ago for December 13, has been altered to Tuesday, December 20. The exhibition will be open in the afternoon as well as in the evening.

THE annual Huxley memorial lecture of the Royal Anthropological Institute will be delivered on Tuesday, November 22, at the theatre of the Civil Service Commission, Burlington Gardens, W., by Prof. W. Boyd Dawkins, F.R.S., whose subject will be "The Arrival of Man in Britain in the Pleistocene Age."

MRS. TYNDALL has presented to the Royal Institution two Nicol's prisms, constructed for the lectures on light given by Dr. Tyndall in America in 1872, and used by him sub-

sequently in his researches and lectures; also two pieces of rocksalt, the remains of a large block given to Dr. Tyndall by the King of Württemberg in 1867.

THE eighty-fifth Christmas course of juvenile lectures, founded at the Royal Institution in 1826 by Michael Faraday, will be delivered this year by Prof. Silvanus P. Thompson, F.R.S., his subject being "Sound, Musical and Non-musical: a Course of Experimental Acoustics."

THE General Purposes Committee of the Birmingham City Council has recommended to the council that an invitation be given to the British Association to meet in that city in 1913. The council will cooperate with the University and other public institutions in making the necessary arrangements.

THE death is announced of Dr. Carl S. N. Hallberg, professor of pharmacy in the Chicago College of Pharmacy in connection with the University of Illinois. He was born in Sweden in 1856, and emigrated to America when a lad. He organised in 1885, and subsequently directed, the National Institute of Pharmacy. Since 1906 he had edited the Bulletin of the American Pharmaceutical Association.

THE Simon Newcomb library, which has been presented to the New York City College by Mr. John Claflin, has just been classified and catalogued. It is a collection of 4000 volumes and 6000 pamphlets, and includes many mathematical and astronomical publications of unusual interest. Among them may be mentioned an early edition of Euclid's Elements, a Pacioli of 1494, the 1515 edition of the Almagest of Ptolemy, and the first book ever published on sun-spots.

MR. G. M. MEYER sends us an extract from the Madrid weekly periodical *Nuevo Mundo* of October 6 in which a Spanish case of eugenic policy is described. It appears that an illustrious Salamancan, Don Federico Gómez-Arias, founded an annual prize of 1000 pesetas, which is awarded every year to a young woman of Salamanca from fifteen to twenty-three years of age, of good physical constitution, attractive, and well conducted, who must have received at least an elementary education and be on the point of being married to a man of similar physical and moral condition and of suitable age.

BY the generosity of Sir Julius Wernher, who recently placed a sum of 10,000*l.* at the disposal of the committee for the purpose, a much needed extension of the department of metallurgy of the National Physical Laboratory has now been commenced. The department has been accommodated in scattered rooms in Bushy House, which, in consequence of the increase and importance of the work, have become quite inadequate. Plans have been prepared in consultation with Dr. Rosenhain, the superintendent of the department, and the contract has been let to Messrs. Dick, Kerr and Co., who have already made good progress with the foundations.

THE programme for the 157th session of the Royal Society of Arts is being issued to the members. There will be five ordinary meetings before Christmas, at the first of which the usual address will be given by the chairman of the council, Sir John Cameron Lamb. The papers announced for the other four meetings are by Sir Henry H. Cunynghame, K.C.B., "Detecting Fire-damp"; Mr. C. P. Ogilvie, "Argentina"; Dr. Vaughan Cornish, "The Panama Canal"; and Mr. Reginald Smith, "Roman London." There will also be a meeting of the Colonial Section, at which Mr. A. Montgomery will read a paper on "Mining in Western Australia," and one of the Indian Section to be occupied by a paper by Mr. R. F. Chisholm, on "The Taj Mahal." On the four Mondays before Christmas Mr. C. R. Darling is to give a course of Cantor lectures on "Industrial Pyrometry." There is also a very full list of papers and lectures for the part of the session after Christmas.

A QUARTERLY periodical entitled the *Botanical Journal* is issued as the official organ of the Royal Botanic Society of London. The first number contains an account of the history of the society since 1839, the date of the Royal Charter, in which are set forth the objects which have been served in that period. In recent years progress has been impeded by a lack of sufficient financial support, and consequent increase of debt, but the latest report shows that in some measure, at least, this condition is being remedied. The number of Fellows now is 1834, as compared with 1570 last year. The debenture debt is 14,714*l.*, as compared with 24,248*l.*, and the current liabilities 572*l.* instead of 3050*l.* Prof. A. J. Ewart, of Melbourne University, has an article on "The Flora of Victoria," and other subjects treated upon include "Our Native Lawns," "The Melbourne Botanic Gardens," "Fruit-growing in Queensland," and "Art in the Garden." There are notes upon botanical questions of interest and recently issued books. Two plates in colour from paintings by Miss Bertha Maguire prettily illustrate chrysanthemums, but their value is purely decorative, for they shed no light on the evolution of the flower, as would appear to be the case from the title. Mr. Butler's colour photographs are welcome, because they illustrate interesting plants in the society's collection. The number is not entirely free from the blemishes common to first issues; especially is this the case in the awkwardness of some of the titles to the subject-matter. The journal is issued by Messrs. Page and Pratt, and the price is one shilling.

THE Bulletin of the Johns Hopkins Hospital for October (xxi., No. 235) contains an appreciation of the life and work of Lord Lister, by Mr. Charles Judd, with bibliography; an historical inquiry on the decussation of the pyramids (nerve tracts in the brain), by Dr. Thomas; and an historical sketch of the practice of blood-letting, by Dr. Joseph Smith. Dr. Thomas ascribes the first definite observation of the crossing in the medulla of the great motor tracts passing from the brain to the spinal cord to François Pourfour du Petit (1664–1741). The practice of blood-letting or "bleeding" is at least two thousand years old, and is mentioned by the earliest medical writers.

UNDER the provisions of the Indian Museum Act of 1910, the ethnological and art collections have been separated from those of economic products, and in his last report of the museum as originally constituted, the curator, Mr. I. H. Burkill, has given a useful account of its past history and present condition. The museum was first started by the Asiatic Society in 1814, the first donor being the Countess of Loudoun. The collections have passed through many vicissitudes, due to the absence of suitable accommodation. Under the present scheme of reorganisation they have at last been placed upon a satisfactory footing. The ethnological gallery now contains about 11,000 exhibits, but it still lacks a proper descriptive catalogue, which can be prepared only by a competent ethnologist. The progress of the art series has been stimulated by the patronage of Lord Curzon, who provided an annual State grant of about 400*l.* for the purchase of specimens. Most of the older economical exhibits have perished, but these are being gradually replaced. It is satisfactory to learn that these important

collections are now being arranged in suitable galleries, and it only remains for the Government of India to provide a series of descriptive catalogues prepared by competent experts, which will render the exhibits available for study by students of art, anthropology, and the exonomic sciences in Europe.

PART 8 of vol. v. of the Annals of the South African Museum contains five articles on the entomology of the country. Among these, Mr. E. Meyrick continues his description of new Microlepidoptera, while Messrs. A. Raffray and L. B. Billecoq treat, in separate communications, of two groups of Coleoptera.

TO the *Journal of Economic Biology* for October Messrs. Collinge and Shoebotham contribute a long article on the Apterygota (Thysanura and Collembola) of Hertfordshire, to which they have devoted special study. Before they commenced there appear to have been no records of these minute insects from the "county of Hertfordshire," but the authors are now enabled to enumerate four species of Thysanura and sixty-nine of Collembola.

TO the *Anales* of the National Museum of Buenos Aires, ser. 3, vol. xiii., p. 317, Dr. F. Ameghino contributes a note on certain teeth from a cavern in Cuba, which are referred to a large monkey the dental formula of which is identical with that of the Cebidæ, but the cheek-teeth of which are stated to approximate to those of Old World monkeys and man. For this monkey the new generic and specific name of *Montaneia antropomorpha* is proposed. It is noteworthy that no wild monkeys are found in Cuba at the present day.

IN the October issue of the *Journal of Economic Biology* Prof. Hickson discusses the place of economic zoology in a modern university, and the best way of training students in that branch of science. After pointing out that there is a growing demand for the services of men capable of dealing with the problems of economic biology in a practical manner, the author observes that the qualifications usually associated with what is termed "a good field-entomologist" will not suffice, and that a man who aspires to a post of this nature must have a working acquaintance with parasitism, parthenogenesis, heredity, and embryology; while he should possess special knowledge of the Protozoa, parasitic worms, land and fresh-water snails, and, particularly, tracheate arthropods. Such a course of study "could be given in the zoological departments of the principal universities of our country without very much additional equipment or a very material addition to the numbers of the teaching staff. But in order that the student may have the opportunity of getting some training in the recognition of insect pests in the field, the work of the laboratory should be supplemented by some systematic teaching in connection with an institution of the nature of an agricultural college, in which access to growing crops may be facilitated."

THE question of the systematic position and feeding-habits of the African Jurassic genus Tritylodon, and its northern allies Plagiaulax and Ptilodus, is reopened by Dr. R. Broom in the October issue of the Proceedings of the Zoological Society. In the first place, the author has no doubt as to Tritylodon being a mammal, while as the only known specimen is from the Stormberg beds, it must be regarded as of Lower Jurassic, and not Triassic, age. As regards the affinities of the three genera, Dr. Broom refuses to admit that Mr. Gidley is justified in including them among the diprotodont marsupials, remarking that the dentition, both structurally and numerically, is of a different type, while the presence of a well-developed septo-maxillary in the African genus suggests monotreme rather than marsupial affinities. It is also pointed out that there is a considerable probability of diprotodonts having originated in Australia. "In the present state of our knowledge it seems wisest to leave the Multituberculata as a distinct independent group with no very near affinities with the living monotremes, marsupials, or eutherians." As regards the food of these mammals, the author points out that fruits were non-existent in Jurassic times, while if, as he considers probable, Tritylodon and its relatives were carnivorous, they must have fed mainly on reptiles, which would require a type of dentition different from that of mammal-eating species.

A NOTE on a fungal disease of the blue pine, *Pinus excelsa*, reported from the Simla forestry division, is contributed to the *Indian Forester* (October) by the assistant to the imperial mycologist at Pusa. The chief object of the note is to establish the observation of infection proceeding from diseased to healthy roots, for which good evidence is adduced. The fungus is reported to be *Trametes pini*, for which such marked fungal development in the root, and infection from root to root, has apparently not been previously recorded.

MESSRS. FLATTERS, MILBORNE AND MCKECHNIE, of Longsight, Manchester, are issuing a quarterly publication of fifteen pages entitled the *Micrologist*. Part ii., issued October 1, contains two excellent articles, one on mounting microscopical objects in fluid media in cells, the other (by Mr. H. E. Hurrell) on the polyzoa and the methods of collecting and mounting them. It is well printed and illustrated, and contains a beautiful plate of five reproductions of photomicrographs of starch, volvox, hydra, &c.

A USEFUL list of pteridophyta for the Transvaal province is communicated by Mr. J. Burtt-Davy to the *South African Journal of Science* (October) on behalf of the late Mr. V. G. Crawley and himself. To make the list serviceable to teachers and students, brief diagnoses are supplied for the classes and genera, while analytical keys and localities are given for the species. Among the true ferns, *Cyathea Dregei* and *Mohria caffrorum* are two remarkable common species; *Oleandra articulata*, *Todea barbara*, and *Marattia fraxinea* are said to be rare. With respect to the number of species, Asplenium, Pellæa, and Gymnogramme are conspicuous genera.

MR. W. N. LUBIMENKO publishes in the botanical section (series iii., parts i.–ii.) of *Travaux de la Société des Naturalistes de St. Pétersbourg* a long paper (in Russian) in which he presents the results of experiments directed towards ascertaining the relationship that exists between the amount of chlorophyll present in a leaf and the energy of photosynthesis. In the summary it is stated that the minimum intensity of light required to start photosynthesis depends on the amount of chlorophyll, being less as the amount of chlorophyll is greater; also that as the amount of chlorophyll increases the energy of photosynthesis increases up to a maximum, and then decreases. It is further suggested that certain experiments indicate that photosynthesis proceeds in two stages; first, CO_2 is decomposed and O is liberated, then certain photochemical reactions lead to the transport and incorporation of organic material.

A CORRESPONDENT sends us examples of a monstrous carnation in which the inflorescences have produced no true flowers, but a superabundance of bracts. This

peculiarity in carnations and certain species of Dianthus was observed many years ago (see "Vegetable Teratology," p. 371, by M. T. Masters). An example is illustrated in the *Botanical Magazine*, Tab. 1622, in which one bud has developed into a perfect double flower, and several others are exactly similar to those sent by our correspondent. Earlier than this, Linnæus had met with a similar malformation, and given it the name of *imbricatus*. The distorted flower buds so nearly resemble ears of wheat that they are known as "wheat ear" carnations. It is not known what causes the suppression of the other parts of the flower and the increase in the number of bracts, but Masters pointed out that the condition is met with frequently in a species of Mœsa, in *Plantago major*, and in *Gentiana Amarella*.

HITHERTO agricultural chemists have concentrated attention mainly on those constituents of the soil that are essential to the production of plant food, but recently attempts have been made to ascertain the effect of the non-essential or the rarer constituents. The investigations at Woburn are well known. Mr. Failyer, of the United States Department of Agriculture Bureau of Soils, has published (Bulletin 72) a number of analyses showing that barium is present in most soils in the United States, especially in soils derived from rocks containing barite deposits or from the Rocky Mountains. The quantity sometimes rose near to 0·1 per cent. Felspar is also a source of barium. It appears probable that the soil moisture, which plays a part in the nutrition of plants, contains barium salts, and cases are on record where barium has occurred in the plant ash. Its presence there would be injurious to animals, and may perhaps be the cause of some of the unexpected results occasionally produced by vegetation.

M. AUG. CHEVALIER, in a letter on his explorations in Upper Dahomey, published in the last number of *La Géographie* (October 15), mentions a curious phenomenon which he observed with respect to the Ouémé River. In its middle course, last May, he found during his stay of fifteen days that the stream ran continuously in a reversed direction, toward the head of the river. The gradient of its bed in this part is very small, and the upper reaches are completely dry during several months of the year, as is the case with most of the rivers of the central African plateau. The rainy season sets in earlier in the downstream part of the country and fills the empty channel, which then runs for a time both ways until equilibrium is established, after which the normal direction of flow is maintained. Similar abnormalities have been previously observed in some of the water-channels of the Kalahari desert in south-central Africa.

IN NATURE of October 20 (p. 503) reference was made to an article in the *Times* on the Norwegian expedition to Spitsbergen, which contained a somewhat detailed account of the discovery of a volcano of recent age in a branch of Wood Bay. It appears, however, that there is still some doubt about the age of the volcanic phenomena. The latest number of *La Géographie* (xxii., No. 4, October 15) includes a note on the results of the expedition by M. Charles Rabot, based on an article in the Christiania *Aftenpost*, sent to him by Captain Isachsen, the leader of the expedition, as the only official communication which has yet been published. On this authority the following reference is made in *La Géographie* to the discovery:—"Finally, round a branch of Wood Bay, Mr. Hoel [one of the geologists] has made the very unexpected discovery of an ancient volcanic development (*appareil*). Contrary to what has been announced from Spitsbergen correspondence published in Christiania journals, it does not date the actual epoch, and for a long time has not been the seat of manifestations. At present, upon the shores of Bock Bay the internal activity manifests itself only by the presence of thermal springs, of which the temperature does not exceed 28·5°." The scepticism respecting the earlier newspaper accounts of the volcano, alluded to in our previous note, was therefore not altogether unjustified. The full particulars of the discovery will be examined with keen interest by geologists and geographers.

THE Bureau of Science, Department of the Interior, Manilla, has issued the annual report on the mineral resources of the Philippine Islands for the year 1909. It is thoroughly characteristic of American methods that the United States Government should have straightway set about fostering the development of the mineral industry of their first colony. The success that has attended this attempt is clearly enough indicated in the present report. The main product up to the present has been gold, the output of which for the year 1909 is valued at about 49,600*l*.; it shows an increase of 14 per cent. over that of 1908, in which year the output was about three times that of the year previous. Even more important from the point of view of general industrial development and civilisation is the increase in the production of coal; the total quantity raised in 1909 was 30,336 tons, an increase of 155 per cent. over the previous year, and more than seven times as great as the production in 1907. The entire production now comes from two mines on the island of Batan, one at the extreme east and the other at the extreme west of the island. The seams now worked are from 3 feet 4 inches to 5 feet 8 inches in thickness. The coal appears to be of Tertiary age; it is classed as subbituminous, is low in ash, and has given satisfactory results in raising steam. From the scientific point of view the chief interest of the report centres in a very brief sketch of the geology and geological history of the Philippine Islands.

THE Meteorological Committee has issued a useful contribution to the study of the north-east and south-east trade winds of the Atlantic Ocean (Publication No. 203), comprising (1) an investigation by Commander Hepworth with the view of tracing any effect of the variations of those winds upon the temperature of the water in the North Atlantic; (2) a *résumé* of the meteorological data available for St. Helena, by Mr. J. S. Dines; and (3) a calculation, by Mr. E. Gold, of the relation between the periodic variations of wind velocity and of atmospheric pressure, with the application of the general theorem to the case of St. Helena. In NATURE of December 21, 1905, Dr. Shaw directed attention to an apparent connection between the circulation of the atmosphere, as represented by the south-east trade wind, and the meteorological consequences in other parts of the world, and the present work may be considered as an attempt to identify that connection, to trace the links in the chain of cause and effect, and also to supply information available for meteorologists interested in the subject. In a very lucid preface summarising some of the results Dr. Shaw points out that the marine discussion of the south-east trade wind shows hardly any seasonal variation (possibly due to the peculiarities of the Beaufort wind-scale), while the results for the north-east trade show a marked variation very nearly complementary to that at St. Helena, where the anemometer record exhibits a regular mean variation (irrespective of direction) between about 14 miles per hour in May and 21 miles per hour in September. Dr. Shaw points out that Mr. Gold's solution, on dynamical prin-

ciples, of the origin of the diurnal variations of the trade wind over the South Atlantic gives results which are hopeful, but not final.

THE well-known observatory on Mount Vesuvius was founded in the days of the Kingdom of Two Sicilies, and was taken over by the Government at the time of the unification of Italy. The work that it has done under the direction of Prof. Palmieri, and latterly Matteucci, is well known; but in a plea put forward in the *Atti dei Lincei*, xix., 3, Dr. Carlo dei Stefani states that the institution has been hampered by the want of a more substantial subsidy from the State, and he further directs attention to the desirability of establishing a much more extensive institution for the study of Vesuvius in all its aspects. It is pointed out that since the observatory was founded every branch of science has advanced enormously, that the study of volcanoes plays an important part in geology and geophysics, and that Vesuvius, from its situation as well as from our intimate knowledge of its past history, offers exceptional facilities for systematic study. In such an institution the departments of geology, mineralogy, chemistry, and physics should all be represented on the staff.

THE geometry of the triangle occupies a somewhat unique position in mathematics, leading as it does to a large number of results which appear to be capable of being added to almost without limit, which do not require the employment of advanced methods for their study, and have the further interesting peculiarity—perhaps not altogether a disadvantage—that they can be studied without afterthoughts as to probable utilitarian applications. We have received two papers on this subject. One is by Mr. W. Gallatly (London: Francis Hodgson, price 2*s.* 6*d.*), dealing with Lemoine and Brocard points, angular and tripolar coordinates, pedal and antipedal triangles, the medial triangle, Simson's line, the orthopole, and orthogonal projection. The second, by Mr. W. H. Salmon, is a note reprinted from the *Quarterly Journal of Pure and Applied Mathematics*, dealing with the Omega and Omega-prime lines and the γ line. These lines are defined by the property that if O be any point in the plane of a triangle, and the lines OA, OB, OC be rotated through a constant angle, they will, for certain angles of rotation, meet the sides taken in order in three points lying on a straight line, these lines being the lines in question.

PROF. L. PALAZZO has sent us a copy of his "Misure Magnetiche fatte in Sardegna nel 1892," extracted from vol. xxiv. of the *Annali* of the Italian Meteorological Service. This volume belongs to the year 1902, but the chronological order has not been observed in the publications of the Italian Meteorological Service—some of which are much in arrears—so that an account is only now published of the magnetic survey of Sardinia made by Prof. Palazzo in 1892. Sixteen stations were occupied, the observations at which are described in minute detail, the results being embodied in a chart. No really large local disturbances were detected, but some minor disturbances were noticed, especially towards the north-west of the island. Besides a full description of the observational methods and reductions, there are descriptions, with plates, of apparatus for determining the temperature and induction coefficients of collimator magnets, with which very consistent results seem to have been obtained.

IN the May number of the International Bulletin of the Academy of Sciences of Cracow Prof. Smoluchowski, of the University of Lemberg, gives an account of some measurements he has recently made of the heat conductivities of fine powders, and the influence of the size of the grains and the state of the gas between them on the conductivity. His apparatus is in principle identical with that used by Kundt and Warburg in their measurements of the heat conductivities of gases. It consists of a thermometer the bulb of which is surrounded by a tube nearly concentric with it, the space between the bulb and tube being filled with the powder and connected to a Gaede pump, so that it can be filled with a gas or evacuated. Whatever the nature of the powder, the conductivity through the gas between the grains is found to diminish rapidly as the pressure of the gas is reduced, and for granular, as distinguished from spongy, powders its dependence on the pressure may be calculated by the aid of the kinetic theory of gases if the surface resistance, which depends on the mean free path of the molecules of the gas, is taken into account at the low pressures.

COPIES have reached us of the volumes of magnetic data recorded during 1905 and 1906 at the observatories of the U.S. Coast and Geodetic Survey. There are five of these observatories, viz. at Cheltenham, Baldwin, Sitka, Honolulu, and Vieques (Porto Rico). The Cheltenham volume is dated 1909, the others 1910. Thus the delay in publication seems hardly accounted for by the inclusion of two years' data in the same volume. The procedure followed and the mode of presenting the data are closely alike at all the stations. Full particulars are given of all the hourly readings and of the daily maxima and minima, but only the ten quietest days of each month are employed for deducing the diurnal inequalities. Each volume contains a table of the principal magnetic disturbances, and some of the curves showing them are reproduced on a reduced scale. Except at Cheltenham, the times shown on the curves are G.M.T., thus facilitating intercomparison, but the times of commencement, &c., given in the text are in local mean time. The stations are now all provided with a complete outfit of Eschenhagen magnetographs, including vertical force instruments. The troubles experienced—discontinuities in the trace, changes of scale value, drift of trace across the sheet, and general instability—are described in some detail, and though most prominent in the vertical force instruments, seem by no means confined to them. Even the declination instrument gave serious trouble at Baldwin, leading to considerable loss of trace. One cannot but experience a doubt whether a more stable and less sensitive type of instrument would not have been preferable, especially at the less accessible stations. In addition to other troubles, Sitka suffered from an outbreak of dry rot, which necessitated a large amount of internal structural alteration in the magnetograph room. This led, however, practically to no loss of trace, the magnetographs being accommodated during the alterations in a temporary building. In addition to magnetic data, there are particulars of the seismic movements recorded by seismographs, mostly of the Bosch-Omori pattern.

A LIST of observing stations and particulars of the apparatus employed in connection with the *Michael Sars* North Atlantic Deep Sea Expedition, 1910, has just been received. An article by Dr. Johan Hjort describing the work of the expedition is given in another part of the present issue.

MESSRS. HENRY SOTHERAN AND CO., 140 Strand and 43 Piccadilly, London, have issued a new classified catalogue (No. 709) of second-hand books on geology,

mineralogy, mining, and metallurgy, including the library of the late Prof. Hilary Bauerman, with a supplement of sets of periodicals and publications of the learned societies.

THE Cambridge University Press has undertaken the publication of a work entitled "Principia Mathematica," by Dr. A. N. Whitehead, F.R.S., and the Hon. B. Russell, F.R.S.; the aim of the work is to show the dependence of mathematics upon logic by deducing from purely logical premises the elementary propositions of various branches of mathematics. The first volume, on mathematical logic and prolegomena to cardinal arithmetic, will be published very shortly. The second volume, concerning the principles of arithmetic, is in the press. In the third volume the authors have dealt with measurement and the principles of geometry.

WE have received the first part of vol. xviii. of the Journal of the Royal Institution of Cornwall. The proceedings at the annual and spring meetings of 1909 are given at length. The annual excursion of 1909 is described, and the address of the president, Dr. Richard Pearce, at the spring meeting in 1909 is printed *in extenso*. Among papers read at the meetings during 1909 may be mentioned:—King Arthur's Hall on Bodmin Moor and some Irish circles, by Mr. A. L. Lewis; the fauna of St. Ives Bay for 1908, by Mr. R. Vallentin; and the invertebrate fauna of Cornwall—Hymenoptera Entomophaga and Hymenoptera Aculeata, by Mr. W. A. Rollaston. The volume also contains meteorological tables for Cornwall for 1909.

OUR ASTRONOMICAL COLUMN.

FIREBALL ON NOVEMBER 2.—A brilliant fireball was observed on Wednesday, November 2, 7.46 p.m. It passed from east to west over the English Channel, and fell from heights of 84 to 26 miles. As seen from Cornwall and from the north of France, as well as from ships in the Channel, the meteor was a splendid object, yielding a brilliant light, as though the moon had broken out from clouds. The stream of aërolites from which the phenomenon was directed has its radiant point in Aries, and further observations are desirable.

ROTATION OF THE MOON.—A correspondent has been puzzled by the perennial perplexity of non-mathematicians as to how the moon can be said to rotate when she always presents the same face to the earth. The answer, of course, is that as we prove the rotation of the earth by the fact that any meridian, such as that of Greenwich, completes its circuit with respect to any fixed star in the course of a *sidereal* day, so also the similar consideration shows that the moon rotates on her axis in 27⅓ days, during which time she aiso completes her circuit about the earth with respect to the stars.

The moon's equator is not quite circular, since her figure may be considered as possessing a solidified tidal inequality of shape. Laplace examined the mechanical results of this condition of affairs, and showed that the moon would oscillate slightly about a mean position relatively to the earth. This is called the physical libration of the moon, and in consequence of its existence we see slightly more than half of the moon's surface.

It is probable that the moon once rotated more rapidly on her axis, and that her rotation was reduced by tidal friction to its present magnitude. The transition from a slow rotation to a libration would present a problem of considerable mathematical difficulty. We can, however, see what would be the several stages through which the changes would pass. There would first be unequal speed in the several parts of the rotation; this inequality would increase until at two moments in one rotation that rotation would nearly cease; then there would occur an actual stoppage, and the direction of motion would reverse itself for half a rotation, constituting a very large libration; finally, the amplitude of libration would diminish to its actual insignificant magnitude.

EPHEMERIS FOR HALLEY'S COMET.—Dr. Ebell publishes a continuation of his ephemeris for Halley's comet in No. 4450 of the *Astronomische Nachrichten*. The ephemeris covers, in four-day steps, the period November 5 to December 31, and shows that the comet is now travelling in a south-westerly direction through Corvus; its magnitude is about 15·5.

SELENIUM PHOTOMETER MEASURES OF THE BRIGHTNESS OF HALLEY'S COMET.—Observing at the Illinois University Observatory, Mr. Joel Stebbins measured the brightness of Halley's comet with his selenium photometer on fifteen occasions during May, and now publishes the results in No. 2, vol. xxxii., of the *Astrophysical Journal*. The selenium cell was attached to the 12-inch refractor, and, through a diaphragm, light from a circle 7 minutes of arc in diameter was admitted to it; Mr. Stebbins suggests that eye-estimates of the comet's brightness never included a larger area. The cell is known to be especially sensitive near the red end of the spectrum, and it is supposed that, unless the spectrum of the comet was very peculiar, the systematic error of these observations would be less than visual comparisons of a luminous surface with a point source of light, such as a star; extra-focal images of stars were used in the comparison, and in the morning observations the brightness of the sky was measured and taken into account in adopting final values for the comet's brightness. The range of the latter is shown by the following values, given in magnitudes:—May 3, 2·0; May 11, 0·6; June 1, 3·6. The second value, 0·6, is vitiated by bad observing conditions, but Mr. Stebbins states that the comet became brighter than the first magnitude, although it never reached magnitude 0·0.

THE APPARENT DIAMETER OF JUPITER.—An earlier discussion of the observations of an occultation by Jupiter, made at the Zô-sè Observatory on May 21, 1908, led to the conclusion that the apparent diameter of the planet, as generally adopted, should be diminished; the occulted star was BD, +19° 2095.

In No. 4450 of the *Astronomische Nachrichten* Father Chevalier, director of the Zô-sè Observatory, suggests that the observational results were not sufficiently certain to have such an important conclusion based upon them.

Attempting to determine more trustworthy data, he measured a photograph of the planet taken on May 19, and determined the corrections to the tabular place. Then applying these differences he found the position for May 21. This gave the position-angle of the star as 149° 23′ and its distance from the centre of Jupiter as 18·7″, a value greater than the semi-diameter of the planet. It is difficult to reconcile this result with the data for the occultation, and Father Chevalier urges that the observations made at other observatories should be closely examined and discussed from this point of view. A number of discussions such as he now publishes would possibly elucidate the matter.

CURVED PHOTOGRAPHIC PLATES.—In No. 161 of the Harvard College Observatory Circulars Prof. E. C. Pickering describes some interesting experiments made for ascertaining the practical efficiency of curved plates in celestial photography.

With the 16-inch Metcalf telescope employed, the difference in focus between the edge and the centre of the plate is only 0·8 mm., but the experiments show that the bending of the plates to the focal curve is advantageous, while there is little likelihood of counterbalancing disadvantages.

Several methods were tried, such as holding the ordinary photographic plate against a properly curved concave surface by means of mucilage, &c., but it was found that the most successful method was to have the space between the plate air-tight, and then to exhaust it by means of a pump. Reproductions of actual photographs illustrate the gain in definition over the whole plate.

THE "MICHAEL SARS" NORTH ATLANTIC DEEP-SEA EXPEDITION, 1910.

IN the month of August last year, Sir John Murray approached me with the liberal offer of defraying the expenses of a deep-sea expedition to the Atlantic Ocean, provided the Norwegian Government were willing to lend their research-vessel, *Michael Sars*, for the purpose. Sir John Murray wished to ascertain whether the appliances and instruments used by the *Michael Sars* for her work in the Norwegian Seas would yield new information in the Atlantic. It was, besides, considered desirable to examine parts of the Atlantic that had previously been only very slightly explored. The Norwegian Government at once signified its willingness to accept this proposal, and I accordingly employed the past winter in making preparations for the expedition, assisted by the captain of the vessel, Mr. Thor Iversen, Prof. H. H. Gran, who agreed to lead the investigation of phytoplankton, and Mr. Helland Hansen, who took charge of the hydrographical researches. For my own part, I decided to cooperate with Mr. E. Koefoed, and to devote myself especially to zooplankton and the study of the bottom-fauna.

The expedition left Bergen at the end of March, arrived at Plymouth—where it was joined by Sir John Murray—and then followed the coasts of Europe and Africa down to Cape Bogador, carrying out special investigations in the Bay of Biscay, the Bay of Cadiz, and the waters between the Canary Islands and Africa—thirty-four stations in all. It next undertook a section into the Sargasso Sea, and after touching at the Azores, proceeded right across the Atlantic to St. John's, Newfoundland (forty stations). From there a section was taken to the south coast of Ireland (twenty-two stations), and, finally, we concluded our investigations by examining the waters between Scotland and Rockall and between Scotland and the Faroes—that is to say, north and south of the Wyville Thomson ridge—so as to study the influence exerted by the Atlantic Ocean upon the Norwegian Sea. The route of the expedition will be seen on the accompanying sketch (Fig. 1).

During this cruise we endeavoured, so far as time permitted, to undertake hydrographical and plankton investigations simultaneously, and we further carried out a considerable number of hauls with the trawl.

The large number of observations and specimens thus secured can, naturally, not be fittingly described before being systematically studied, and it is accordingly only possible as yet to furnish information regarding their nature and extent.

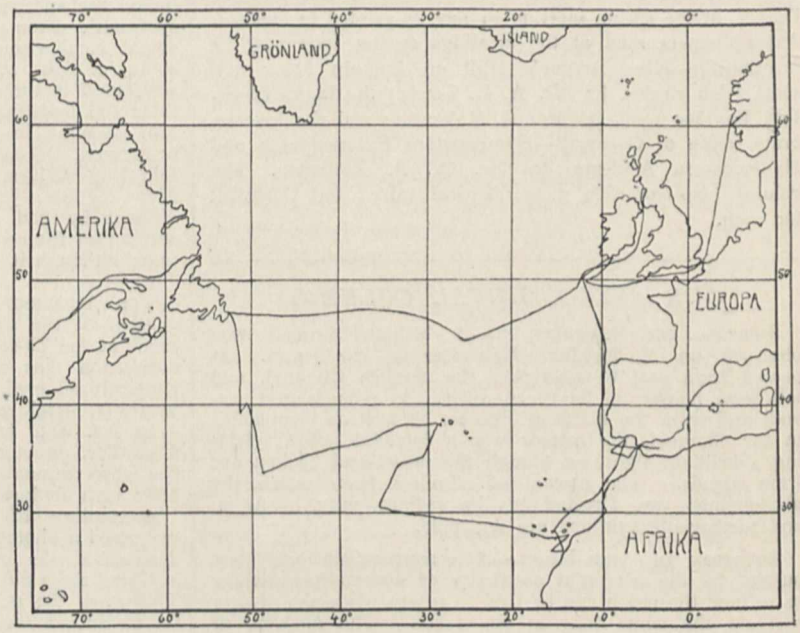

FIG. 1.

HYDROGRAPHICAL INVESTIGATIONS.

Hydrographical investigations have been carried out at about 110 stations. The temperature readings were taken with Richter's reversing thermometer and Nansen's thermometer, while the water-samples were collected by means of Ekman's water-bottle and the Petterson-Nansen isolated water-bottle. At most of the stations the temperatures have been recorded by two thermometers simultaneously at each depth, no fewer than 519 simultaneous readings being taken with the same two thermometers. The corrected temperatures gave an average difference of 0·01° Centigrade.

The difference between the two thermometers was:—

In 168 cases	.....	0·00°
In 231 ,,	.....	0·01°
In 84 ,,	.....	0·02°
In 36 ,,	.....	0·03° or over.

A fair number of simultaneous observations have been made with the reversing thermometer and Nansen's thermometer in the isolated water-bottle, with the view of observing the adiabatic effect by means of the difference in pressure. Besides the temperature readings, we have taken water-samples from all depths to determine the salinity and specific gravity, and we have endeavoured to get an exactitude in the determinations of salinity of 0·01–0·02 per mille, and in the density *in situ* an exactitude of 1–2 in the fifth place of decimals. On these lines the investigations have been carried out along the whole route of the expedition. We have, further, procured about 100 large water-samples from different stations and depths, for the purpose of determining the quantitative occurrence of nitrogenous substances, particularly ammonia.

The determinations from the deepest layers (down to 4950 metres) have given very uniform results, with a temperature of 2·48 C. It has been found that there is a very faint increase of temperature near the bottom at great depths, due, possibly, to the conduction of heat from the interior of the earth or a radium effect. In the upper layers conditions have varied considerably at times, especially in the neighbourhood of the Gulf Stream area and in the western portion of the North Atlantic. Here our investigations furnish apparently a number of new and interesting results, which, however, it is impossible to do more than allude to before the water-samples have been thoroughly examined.

Surface temperatures have been recorded every hour during nearly the whole cruise, while every two hours a water-sample has been taken from the surface with particulars of the different meteorological conditions (wind, barometer, temperature of the air, humidity, and cloudiness). Altogether we have about 2500 water-samples and about 3000 temperature readings.

Several series of direct-current measurements have been made with Ekman's propeller current measurer. In the Straits of Gibraltar the current was so strong that we encountered no small difficulty in regard to anchoring. However, we succeeded in the course of a day in obtaining altogether seventy good measurements from eight different depths between the surface and the bottom. There were considerable tidal fluctuations both in the west-going surface current and in the deep east-going current; simultaneously with the fluctuations in the strength of the current the boundary between the two streams shifted upwards and downwards, as clearly appears from repeated series of temperatures and water-samples. The boundary lay at a depth between 50 and 100 fathoms below the surface. Velocities of four knots or

more were on several occasions recorded in both the surface current and the undercurrent; in the majority of cases, however, the velocity varied between 1 and 2½ knots.

On the slope south of the Azores the *Michael Sars* was anchored in 500 fathoms. Here about ninety current-measurements were made at different depths. In the deep sea between the Azores and the Canary Islands a series

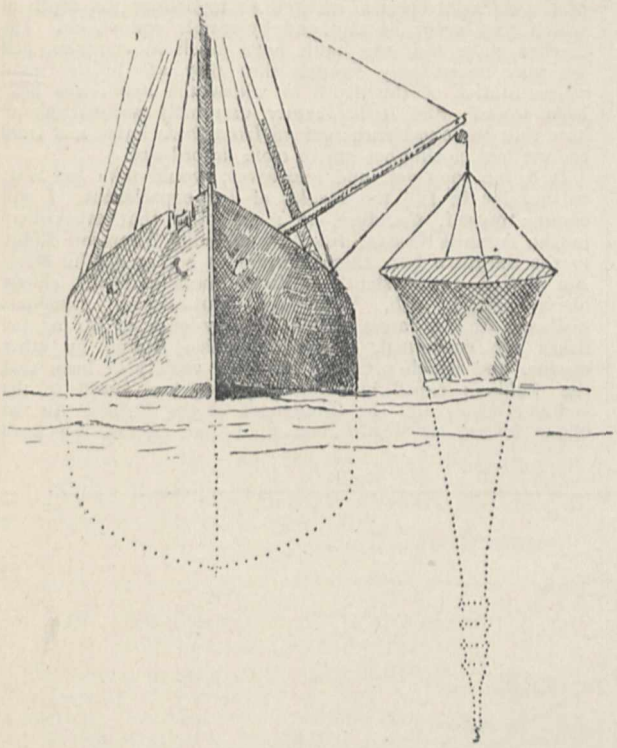

FIG. 2.

was taken right down to 2000 metres, from the vessel while under slow, steady drift, with one of the large tow-nets out as a drift-anchor. These measurements also show considerable fluctuations, which are apparently connected with tides. Similar investigations with modern methods have never been undertaken before either in deep water or in the Straits of Gibraltar.

A number of measurements of light were also made in the ocean south and west of the Azores. Mr. Helland Hansen has constructed a new photometer which worked well; he determined the quantity of light by the aid of panchromatic plates with and without gelatine colour filters. The investigations showed a great influence of light rays at 100 metres, red being the weaker, and blue and ultra-violet rays the strongest; at 500 metres blue and ultra-violet rays were still found, and even at 1000 metres the influence of the ultra-violet rays was clearly evident. No trace of light could be noticed on the plates at 1700 metres, after an exposure of two hours at noon with a clear sky.

PHYTOPLANKTON.

Vertical hauls have been undertaken at various depths, at fully forty stations, with a fine-meshed Nansen closing-net, our object being to collect material for studying the vertical and horizontal distribution of peridinæ and diatoms in the Atlantic Ocean. We specially aimed at obtaining material for comparing the plankton of the coast-banks with plankton from purely oceanic waters, as also for comparing subtropical and boreal conditions of existence. The coast-banks off Ireland, Cadiz Bay, the west coast of Africa, and the Newfoundland banks have a characteristic flora which is sharply marked off from the oceanic flora, rich in species but poor in individuals, which is met with in the central parts of the Atlantic Ocean, especially the Sargasso Sea south of the Azores.

Largely owing to Lohmann's interesting researches in the Mediterranean, we arranged to devote a considerable part of our work to the study of those organisms, especially Coccolithophoridæ and the naked flagellates, which pass through even the finest silk net. These organisms have been partly collected by filtering sea-water through sand filters and partly by employing a large centrifuge driven by a small steam winch. Altogether we have employed the centrifuge in the case of about sixty of these water-samples; and, by means of a suitable contrivance, Prof. Gran was able to examine these samples on board in their living state, both in regard to quality and quantity.

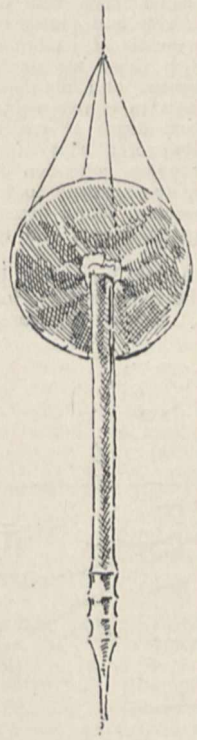

FIG. 3.

Examination showed a large number of new forms, partly belonging to quite new types, which will be described by Prof. Gran. In the central oceanic parts of the Atlantic Ocean these small organisms were found to occur in numerous forms and in such large quantities that they exceed in volume the plants obtained through the medium of the silk nets. In the neighbourhood of the European coast-banks the number of species was far smaller, but the quantity of individuals was particularly large. Thus we secured in a single sample more than 200,000 individuals per litre of one species alone. On the coast-banks off Newfoundland and off Ireland the peridinæ far exceeded in volume the Coccolithophoridæ.

Altogether the samples from the more northerly waters show a greater quantity of plants than the subtropical portion of the ocean. The material will likewise furnish information with regard to the distribution of phytoplankton in relation to depth. In the more northerly waters its range is limited to a thinner, less deep-reaching layer than in the more southern portion of the area of investigations.

ZOOPLANKTON.

For the study of smaller plankton animals, of the size of copepods, for instance, we employ a vertical closing-net, one metre in diameter, with rather coarser silk. With this we took samples at various depths and at many stations.

However, I perceived from the very first that an appli-

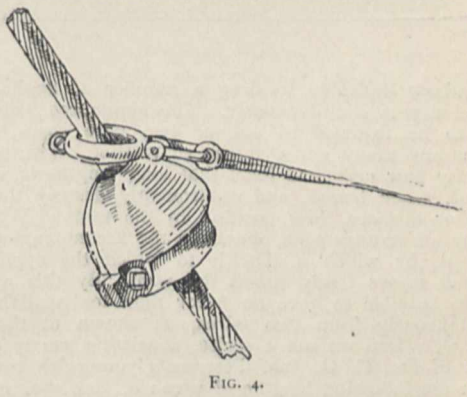

FIG. 4.

ance of this sort would not be able to afford us much information regarding the occurrence of the larger pelagic animals, such, for instance, as cephalopods, decapod crustaceans, and deep-sea fishes. Both the *Challenger* and *Valdevia* expeditions employed, as will be remembered, a big tow-net, with which they made many vertical hauls from great depths to the surface of the sea. By this means they caught a certain amount, though by no means a

particularly large quantity, of fish in proportion to the number of hauls; and they naturally obtained but little information regarding such questions as the depth at which the animals live, and their vertical wanderings by night and day. These questions seemed to me to be of special interest at the present juncture, and accordingly an essential part of the work of our expedition was directed towards their solution. We first constructed some large nets of 3·25 metres diameter, partly of coarser silk and partly of prawn-net, arranged to close on the principle of Nansen's closing net (see Figs. 2 and 3). With these we made several successful hauls at various depths, and obtained sufficient catches of the commonest forms to enable us to determine more approximately the actual depth at which they occur. Nevertheless, we soon discovered that even these large nets yielded merely an incomplete collection of the fauna, since many species occur far too sparsely to be caught with vertical hauls. It was therefore found necessary to employ large horizontal-fishing appliances and to make hauls of considerable length.

Such hauls would, however, take an unduly long time, if they were to be carried out singly at the same station, for hours in succession, at different depths. It was, therefore, particularly desirable to drag a number of appliances at several depths simultaneously. The appliances had in this case to be fastened to one or two wire ropes, as one cannot tow many wires at the same time. The technical difficulty now presented itself that long lengths of wire get twisted, when towed, and consequently destroy the appliances or displace their position in the water. We solved this by an arrangement, shown in the accompanying figure (Fig. 4), by which a shackle to which the appliance is fastened moves freely round the wire. By this means it became possible to have no fewer than ten appliances out simultaneously from two wires, as shown in the figure (Fig. 5). Here we see a series, consisting partly of nets, partly of Dr. C. G. Joh. Petersen's young-fish trawls, in use at the following lengths of wire: 0, 100, 200, 300, 600, 1000, 1500, 2000, 2500, 3000 metres. The total number of these towing stations exceeded thirty.

The material obtained in this way was very large indeed. From the same station hundreds of pelagic deep-sea fishes and litres of large decapods, medusæ, &c., were secured. All the same, the hauls showed that the material was not by any means too large, since right up to the very last haul we continued to capture a few species of pelagic fishes that had not occurred in any of the previous hauls. The largest net, in particular, worked splendidly. We have thus discovered quite a number of species of pelagic deep-sea fish not previously described.

As there were so many stations, and we fished in widely differing waters and at all hours of the day and night, a comparison of these catches with each other will afford much information concerning the geographical distribution of the different species, as well as regarding the depth at which they occur by day and by night, and so on. The catches show that the hauls have much in common, and we may accordingly assume that they are in the main representative of the depth in which the appliances have been towed; and it is further extremely satisfactory to note that the experiences gained from these hauls and from the vertical closing-net are in close accordance.

It is too soon yet, and, moreover, would take too long, to describe in full the results of our experiences. I will confine myself, therefore, to mentioning that everywhere in the Atlantic Ocean, from the Wyville Thomson Ridge to the Sargasso Sea, there appears to be, at depths below 400 metres, a consistently uniform fauna of small, chiefly black pelagic fish, large red crustaceans, numerous medusæ, &c., a fauna which, in any case so far as the fishes are concerned, is probably also shared by other oceans, and which presents the same variety of form that the *Valdivia* expedition, for instance, has found in the Indian Ocean, and the *Challenger* in the Pacific. In the upper layers, at depths less than 400 metres, we have discovered numerous younger stages of fish that are not as yet determined, mostly of transparent, colourless form, such as Leptocephali, to take merely one example.

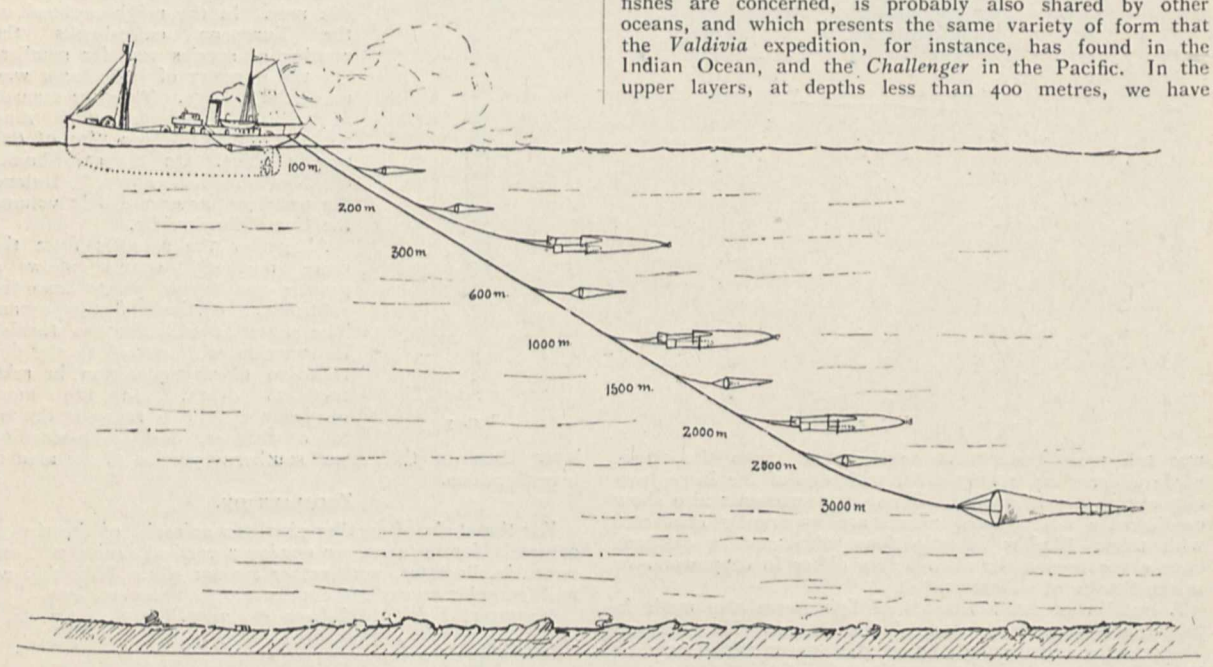

FIG. 5.

TRAWLINGS.

During previous expeditions in the Atlantic Ocean a great number of hauls have been undertaken either with the dredge or with small trawls. There was, therefore, no pressing necessity for the *Michael Sars* to investigate the bottom-fauna of the Atlantic, more particularly as hauls of this nature require a considerable expenditure of time, and could therefore with difficulty be combined with our exacting programme of hydrographical and plankton investigations. It was of interest, on the other hand, to try whether a large-sized model of the ordinary otter-trawl (with 50 feet of head-rope) would yield new results. During my previous researches I had succeeded to my satisfaction, and had secured very good catches, by making use of a trawl of this kind at depths down to 1000 fathoms. It was, in my opinion, especially desirable to employ this appliance along the Continental slope from the Wyville Thomson ridge southwards to the tropical coast of Africa, so as to ascertain the composition of the fauna on this long stretch at depths varying from 500 to 1600 fathoms.

Besides, I considered it of the utmost interest to attempt some hauls far out from the coast-banks on an oceanic deep plain with depths descending to 3000 fathoms. Altogether we have carried out twenty-two hauls at various depths with this large trawl.

It will be seen that our trawl had a greater capacity than any of the appliances previously employed, and that it can therefore, without doubt, be recommended for investigations of the deep-water fish-fauna. This is especially the case where it is requisite to have many individuals for examination. For invertebrate organisms, on the other hand, smaller and more handy appliances may be preferable.

Essentially new types of fishes the trawl cannot be said to have taken. But the material we possess furnishes a good picture, especially of the uniform fish-fauna to be met with along the slopes of the coast-banks of Europe and Africa from the Wyville Thomson ridge down to Cape Bogador, and it also shows clearly the sharp transition from the southern to the northern side of the Wyville Thomson ridge, which the *Triton*, the *Knight Errant*, and my own investigations, amongst others, had previously demonstrated.

The hauls at great depths (about 5000 metres) were no doubt few, perhaps too few; but they accorded with each other and with the hauls made by previous expeditions, more especially those of the *Challenger*, *Travailleur*, and *Talisman*, in indicating that the actual eastern deep-ocean plain of the Atlantic is especially poor in all kinds of higher organisms and particularly in fish. It might, by some naturalists, be regarded as a desert region. A fuller discussion of our observations must, however, be reserved for a more comprehensive publication.

JOHAN HJORT.

THE ASSOCIATION OF TEACHERS IN TECHNICAL INSTITUTIONS.

THE annual meeting of the Association of Teachers in Technical Institutions was held at the Northern Polytechnic, London, on Saturday, November 5. In moving the adoption of the annual report of the council, Mr. J. Wilson (Battersea Polytechnic), the retiring president, stated that any further extensive progress in the general technical and scientific education of this country depends upon the adoption of certain educational reforms, for most of which public opinion is now ripe. These reforms may be briefly summarised as follows:—(1) elementary education to be more practical or constructive; (2) compulsory attendance at day or evening (preferably day) continuation schools, with a limitation of the hours of labour of adolescents; (3) the institution of "technical-secondary" schools; (4) the linking of the elementary school through the continuation and secondary school to the technical school; (5) the increased provision of scholarships, with adequate maintenance grants, so that the qualified day and evening technical student may receive the highest possible technical and scientific training. These suggested reforms are all quite practical, and their adoption would entail but relatively little strain upon the financial resources of this country, while the commercial and educational results would be of incalculable benefit.

Attention was directed to the promise held out in the Prefatory Memorandum to the recent Board of Education regulations for technical schools, that the Board would take action, in the near future, with respect to certain of the more pressing of the educational reforms just referred to. A significant statement in the memorandum, relating to the payment of grants for technical instruction to institutions of university rank, together with the recent formation of a "University Branch" at the Board of Education, emphasises the modern tendency towards bringing the English universities within the purview and influence of the national educational authorities The hope was expressed that this would result in the opening wider of the doors of the university to the community, and a closer connection of the universities with all phases of educational effort in this country.

The recent regulations of the Board of Education respecting the registering of the attendance of day and evening students at technical institutions were criticised adversely, inasmuch as by considerably increasing the time and attention to be devoted by the teacher to the merely mechanical work of registration, they inevitably detract from the efficiency of the teaching as a whole.

In discussing the first volume of the minutes of evidence submitted to the Royal Commission on University Education in London, Mr. Wilson stated that in this evidence there appears vague and unjust criticism of the higher work of the London polytechnics, generally based upon want of knowledge of the work these institutions are now doing.

The president of the association for 1910–11 is Mr. Barker North, of the chemistry and dyeing department, Bradford Technical College.

METEOROLOGICAL RELATIONSHIPS.

PROF. H. HILDEBRAND HILDEBRANDSSON is continuing his important series of papers on the centres of action of the atmosphere, and the fourth communication, recently received, is entitled "Sur la Compensation entre les types des Saisons simultanés en différentes régions de la Terre" (*Kungl. Svenska Vetenskapsakademiens Handlingar*, Band 45, No. 11). In his third paper he suggested that the principal cause of the different types of seasons depended very probably on the condition of the ice in the polar seas, and the evidence he brought forward was such as to show that this view had very much in its favour. In the present communication he makes a closer study of these compensations between the types of simultaneous seasons in both winter and summer seasons, and extends his researches to North America. He further directs attention to some analogous results which he finds exist in the southern hemisphere. Thus he finds both in winter and in summer that there occurs an opposition between the north and south of both Europe and of North America, and also probably between the sub-polar regions and sub-tropical regions of the southern hemisphere. There is also, in general, an opposition between the north of Europe and Siberia.

Special attention is directed to some regions where this opposite nature of seasons is in some years less pronounced, and Prof. Hildebrandsson points out that these districts are intermediate between the main centres of typical action, and are therefore dependent on the intensity of the latter. This communication is accompanied by several plates of curves, and these should be closely studied in connection with the text. There is little doubt that these researches will in time open up a field for the future forecasting of seasons, but it is important to bear in mind that so intimate are the meteorological associations between very widely separated regions on the earth, it behoves the investigator to take a very broad view of the subject, and not confine himself to one small portion of the earth's surface.

Mr. E. T. Quayle, of the Australian Commonwealth Meteorological Bureau, has recently (Bulletin No. 5, March) published the results of his investigations in relation to the possibility of forecasting the approximate rainfall for northern Victoria. At the outset he states that it has long been his conviction that ordinary statistical methods must prove inadequate, and that they do not enable the essential differences between the weather of successive years to be grasped. In his study of the storm systems as they have affected Victoria he has made a classification of them, and on this he bases his method of forecasting. The storms which affect Victoria and bring the rain belong to two main systems, one called "Antarctics," which originate in the southern seas, and the other called "Monsoonals," which are of tropical origin. The first-named he divides into two classes:—(*a*) Antarctics, when their centres are too far south to be identified; and (*b*) Antarctic cyclones, when their centres can be located inland or over Bass Strait. The monsoonal low depressions he divides into three groups:—(*a*) monsoonal troughs; (*b*) monsoonal dips; and (*c*) monsoonal cyclones.

By the use of isobaric charts the number of occurrences of each type of disturbance was taken out for each month for the years 1888 to 1909. As the northern districts of Victoria receive most rain chiefly from monsoonal de-

pressions or the fronts of well-developed Antarctics, a typical rainfall curve of the northern areas was constructed. Thus for each half-year the low- and high-pressure systems passing Victoria were counted, and alongside the numbers thus obtained were placed the figures for the rainfall over the northern areas and the mean air pressure and temperature for Melbourne. The comparison brought out the result that an excess in the number of summer monsoonal disturbances was followed by an excess in the winter rainfall in seventeen cases out of twenty-two.

Mr. Quayle then evolves a rough rule for predicting the approximate winter rainfall over northern Victoria, giving the weights of two, one and one to the number of monsoonal disturbances, mean pressure, and mean temperature, respectively, for the preceding summer. Noting the coincidences of sign only in the values he evolves for the calculated winter rain, he finds that they are in agreement with those for the actual departures from normal of the winter rains nineteen times out of twenty-two, and in serious agreement in two cases only. It is unfortunate that, owing to lack of daily isobaric charts, the period could not have been extended over more years; nevertheless, the system may be used tentatively, and the results will be watched with interest.

THE LATITUDE OF ATHENS.[1]

IN the volume referred to below M. Eginitis describes the varied activities that exercise the staff of the National Observatory of Athens and of the smaller institutions that his zeal has called into existence and made to yield results useful to science, both as regards seismology and meteorology. It seems not a little strange to find well-remembered names like Thebes, Sparta, Naxas, Samos, and many others famous in the past, figuring in this list, and playing a new *rôle* by contributing climatic observations made on approved lines with modern instruments. Of the last mentioned of these stations, that on the island of Samos, the author remarks, "malheureusement, elle a été complètement détruite, le jour du bombardement de cette île, en 1908, par la flotte turque," recalling a struggle which seems more in keeping with its ancient history than its effort to accumulate meteorological observations.

But the real serious piece of work here described is the attempt to determine the latitude of Athens, a problem that interested Ptolemy, who recorded the value 37° 15′, placing the city some 45 kilometres south of its true site, even when allowance for all known sources of error is made, a larger error than is usual in similar determinations in that age. But error seems to cling to this unfortunate coordinate, for M. Eginitis informs us that the latitude for the Pantheon given in the "Connaissance des Temps" is about 6″ too small. In striving for the nicest accuracy, the director has found the problem to be one of extreme difficulty. He has employed two methods and two instruments, and the results do not coincide. He has employed the Horrebow-Talcott process, carried out by means of an instrument originally intended for a meridian circle, but by removing the microscopes and adding a level, adapted to that particular form of observation. Later, through the generosity of M. Syngros, he was supplied with a modern and excellent meridian circle by Gautier, the construction of which was supervised by M. Lœwy. This instrument was used for determining the zenith distances of both circumpolar stars and stars of known declination, the zero being derived from nadir observations only.

The interest in the discussion consists in the different values obtained after reversing the instrument. The difference is constant and rather larger than has been noted elsewhere. Like the R-D term in similar inquiries, it refuses to yield a satisfactory explanation, however ingeniously solicited. There is no attempt to determine the actual variation of latitude, though the observations extend over a considerable period, nor, as we think, is sufficient attention paid to the possible effect of a "magnitude equation." The inquiry is of a purely instrumental character, and is directed mainly to the legitimacy of employing an arithmetic mean of the values obtained in the two positions of the instrument. If this conclusion is warranted and offers the only possible means of correctly determining the latitude, M. Eginitis is justified in insisting upon the necessity of reversion and of providing for the operation in the construction of the instrument. But as the director promises further experiments and a more rigorous attempt to eliminate all possible sources of error, it will be desirable to pause before offering any criticism or accepting the result as final.

[1] Annales de l'Observatoire National d'Athènes, publié par Demétrius Eginitis, Directeur de l'Observatoire. Tome v. Pp. ii+592. (Athens, 1910.)

EDUCATION IN TECHNICAL OPTICS.

THE reawakening of the British optical industry which began with the first years of this century brought with it a demand for the provision of special technical education in optics. The Northampton Polytechnic Institute, from its situation in Clerkenwell, where much of the London optical industry is centred, was particularly suited as a centre for such work, and optical classes were begun there as a branch of work in general physics. The optical trade, however, regarded these classes as being of little value, and in 1902 a new syllabus was adopted and a special department of technical optics was instituted. Since that time this department, under Mr. S. D. Chalmers, has developed very considerably and done much useful work for both day and evening students, but the scope and value of this work has been continually hampered and further development has been completely blocked by want of proper space and equipment. This unsatisfactory state of affairs has been fully realised, and the governors of the Northampton Institute have acquired the necessary land on a site opposite the institute, and have had plans prepared for a complete "Opto-technical Institute"; for the erection and equipment of the building they are, however, dependent on a grant from the London County Council.

The County Council or its predecessors in authority, the School Board, has been repeatedly approached in this matter. A deputation from the Optical Society in 1902 led to a grant which resulted in the establishment of the optics department at the institute; for a time this was supplemented by a grant from the Company of Spectacle Makers, but this has subsequently been replaced by a trade fund, collected principally by the efforts of Mr. J. Aitchison and administered by the Optical Society. In 1905 the Optical Convention sent a deputation to the London Education Committee; this deputation was headed by Dr. R. T. Glazebrook, and included a large number of influential men connected with the science or industry of optics, but, although favourably received, no practical steps resulted for five years.

Now, however, there appears to be a definite prospect that this want of our optical industry may soon be met in an adequate manner. This is indicated by a circular letter issued a few weeks ago by the L.C.C. Education Officer to members of the optical trade in London. In this letter the members of the trade are asked to state their views as to the need for an Opto-technical Institute in London, and to indicate to what extent they or their employés would take advantage of any facilities provided, and what benefits they would expect to derive from such teaching. The letter concluded by inquiring whether, in the opinion of the trade, an expenditure of about 30,000*l.* for a building for such a purpose would be justified, and the general scheme of the new institute as proposed by the Northampton Institute is indicated. This comprises a series of large teaching laboratories and lecture-rooms for instruction in all branches of optics, lens-working and general instrument design and construction being provided for, as well as the theoretical and experimental branches of the subject. The new institute would accommodate 300 to 400 day and evening students, complete day courses as well as evening classes being contemplated.

Fortunately there is every reason to believe that the optical trade will respond to this circular letter in a manner which will fully justify the London County Council in proceeding at once with a scheme which is really of

national importance. An opening meeting of opticians and those interested in optics was called by Mr. J. Aitchison at Anderton's Hotel in Fleet Street on October 17, and an attendance of 300 enthusiastically and unanimously affirmed their approval of the London County Council scheme. This was probably the largest, and certainly the most unanimous, optical meeting ever held in London; all the speakers emphasised the need for close cooperation between science and industry in the optical more than in most other industries, and the consequent need of the best educational facilities for masters and workmen. It is clearly recognised—not in this country alone—that the British optical industry has made and is making a very great effort to regain lost ground; such names as Grubb and Hilger show that there is even now British leadership in some fields of optics. With the help of such schemes as that of the London County Council these fields might well be extended.

THE CRYSTALLOGRAPHY OF HÆMOGLOBINS.[1]

CRYSTALS of oxyhæmoglobin differing greatly in character are figured in every text-book of physiology; but in the absence of specially skilled study by a crystallographer it has always seemed possible hitherto that the differences observed might be dependent on polymorphism, differences in water of crystallisation, effects of environment, or on chemical change, and that hæmoglobin, from whatever source obtained, was essentially one and the same substance. Hüfner's observation that all hæmoglobin solutions giving the same extinction coefficients in the spectrophotometer showed the same capacity for oxygen appeared to support such a view, although it could also be interpreted as showing merely, what was already probable on other grounds, that the hæmatin portion of the molecule was identical in all cases.

Profs. Reichert and Brown, regarding crystalline character, when interpreted with care and knowledge, as a trustworthy criterion of identity or non-identity, have prepared crystals of oxyhæmoglobin and its near allies from some two hundred species of animals, and subjected them to minute crystallographic analysis. Their observations show beyond doubt that hæmoglobin exists in almost innumerable varieties, each of which is more or less characteristic of the species from which it was obtained. In view of the ease with which oxyhæmoglobin undergoes chemical change, the demonstrated impossibility of purifying it by recrystallisation without the occurrence of such change, the effects of admixture with other substances on crystal form, and the difficulties of crystallographic interpretation, it is inevitable that some reserve should be felt in accepting all their conclusions in detail, but the main facts presented can hardly be interpreted otherwise than in the way suggested by the authors.

It is, however, much to be regretted that they have not described the spectroscopic characters of the crystals studied in each case, since the omission of this information leaves it open to doubt whether the material examined was always what it was taken for. In the absence of spectroscopic evidence, their statement that the blood of the horse, python, and many primates, including man, contains in the same individual two different kinds of oxyhæmoglobin, while that of the baboon and some other animals contains as many as three, carries no conviction. Scepticism on this point appears, indeed, to be very much in place in view of the extraordinary statement in the last chapter that "metoxyhæmoglobin," the substance ordinarily known as methæmoglobin, the neutral or acid solutions of which show a four-banded spectrum, becomes converted to oxyhæmoglobin by treatment with ammonia. It is almost impossible to resist the conclusion that the authors are unfamiliar with the spectrum of alkaline-methæmoglobin, and the suspicion that the crystals described as a second kind of oxyhæmoglobin may have consisted of the former substance.

Another interesting statement concerning which ampler justification would have been very welcome is that the blood of the shad during the breeding-season, and that of the bear during hibernation, is especially rich in "metoxyhæmoglobin."

The first two chapters deal very completely with the general properties, and distribution in the animal kingdom, of hæmoglobin, hæmocyanin, and the colourless respiratory substances termed achroglobulins; they contain also some very useful comparisons of the chemical and morphological characters of the blood of different animals, and full references to the literature. The third chapter is devoted to a special consideration of the physical and chemical properties of hæmoglobin, and it is no fault of the authors that Barcroft's important work on this subject had not appeared in time for its inclusion. The rest of the monograph contains an admirable critical account of the work of previous investigators, and a full description of the methods, results, and conclusions of the authors, illustrated by 600 very successful photomicrographs and numerous figures in the text.

The results obtained are of general biological interest, not only as showing that the differences already proved to exist between the corresponding serum-proteins of different animals are equally manifest between their hæmoglobins, but also as throwing light on phylogenetic relations, since the crystals from closely allied species often exhibit close similarities. They are also of great interest to the crystallographer by reason of the extensive isomorphous series brought to light, and some important observations on mimetic twinning of crystals.

[1] "The Differentiation and Specificity of Corresponding Proteins and other Vital Substances in Relation to Biological Classification and Organic Evolution and the Crystallography of Hæmoglobins." By Prof. E. T. Reichert and Prof. A. P. Brown. Pp. xix+338+100 plates. (Washington, D.C.: Carnegie Institution, 1909.)

PROBLEMS OF WHEAT GROWING.

THE October number of *Science Progress* contains an important article on "Wheat-growing and its Present-day Problems," by Dr. E. J. Russell, of the Rothamsted Experimental Station. The article is based very largely upon a discussion which took place at the Winnipeg meeting of the British Association, at a joint meeting of the Botanical, Chemical, and Agricultural Sections. The work of the Rothamsted station has long ago made familiar the main facts in reference to the fertilisation of wheat-fields under normal conditions, but the recent discovery of the use of phosphatic manures in order to secure earlier ripening may prove to be an important factor in extending the northern limit of the wheat-belt; in the same way, it is suggested, the use of late-ripening varieties manured with potassium salts may be of value in extending the southern limit; phosphates have also proved of value in securing rapid root development in the dry soils of Australia, where it is of great importance that the plant should secure access to the subsoil water as quickly as possible. Reference is also made to the recent experiments of Dr. Saunders and others on the breeding of wheat in order to develop "strength," heavy cropping power, early maturity, and resistance to rust and drought. The work to be done here is very extensive, as different localities demand widely different types, owing both to economic and to physical differences. Even in a given locality the results obtained vary greatly according to the conditions, a "strong" wheat often giving a crop of weak piebald wheat when grown on newly broken land, whilst on old land the crop may be superior in quality to that used as seed, a difference that is perhaps due to the great decrease in the proportion of water in the older land during the period of growth of the crop. It is pointed out that continuous cropping with wheat appears to break down the fertility of the soil by bacterial changes, which result in disintegrating the nitrogen, rather than by chemical exhaustion; the soil recovers, however, when planted with clover and similar crops, which act as agents for the fixation of nitrogen; as this seems to fit in with the natural development of farming in a new country, the temporary loss of fertility is of less importance than might appear at first sight to be the case.

BOTANY AT THE BRITISH ASSOCIATION.

The President's Address.

IN accordance with the custom that is growing up of arranging for a minimum of clashing between the various presidential addresses, Prof. Trail delivered his address (which was printed in full in NATURE of October 6) at 12 noon on Thursday, September 1. The address dealt with the subject of field botany, and the president particularly urged the need for the preparation of a really great national flora. As a direct outcome of the address, a committee was subsequently appointed, with Dr. Trail as chairman, to consider what steps should be taken towards organising and preparing the materials for such a flora.

As regards the rest of the proceedings, the outstanding features of the Sheffield meeting were the sittings devoted respectively to physiology, cytology, and morphology. Judged by the keenness of the discussions and the numbers attending the section, the meeting must be pronounced to have been distinctly better than the average. It will be convenient to deal first with the subject of physiology.

Physiology.

On Monday morning, September 5, there was a joint sitting of the botanists, chemists, and physiologists in the meeting-room of Section K, the subject being the biochemistry of respiration. A report of this discussion will be found in the account of the proceedings of Section I (p. 26), so it is unnecessary here to do more than mention the botanical contributions to the discussion. Dr. F. F. Blackman, who opened the subject, by way of introduction outlined our present knowledge of the respiration of plants in respect to:—(1) the nature of the reaction (or reactions) which constitutes respiration; (2) the physical chemistry of the respiration reaction; and (3) the influence of protoplasm upon the progress of the reaction. Mr. D. Thoday dealt with the effect of chloroform on the respiration of plants.

Tuesday morning, and to some extent Wednesday, were also devoted to physiological papers. Mr. S. Mangham read an interesting paper on the paths of translocation of sugars from green leaves. Using Senft's method of testing for sugars by the precipitation of osazones, the author was able to obtain definite evidence that the sieve-tubes (and not the parenchymatous vein sheaths) provide the main paths for the translocation of free sugars from the lamina of the leaf. He was thus able to confirm Czapek's theory, which had been disputed by Haberlandt and others. Mr. D. Thoday followed, and discussed assimilation and translocation under natural conditions. His experiments show that in detached leaves the increase of dry weight, due to assimilation, is surprisingly small in bright diffuse light as compared with bright sunlight. Leaves still attached to the plant show a smaller rate of increase than detached leaves; this is probably largely due to translocation. Dr. F. Darwin demonstrated a new method of observing in living leaves, while still attached to the plant, the degree to which the stomatal apertures are open or closed. The instrument (which he calls a *porometer*) consists of a small glass chamber cemented on to the stomatal surface of a leaf, and connected with a suction tube and manometer. By diminishing the air-pressure in the chamber a flow of air through the stomata is induced, the rate of flow indicating the condition of the stomatal apertures. Dr. Darwin then discussed some actual results obtained by the porometer. On comparing the readings of the latter with the loss of weight by transpiration, it was found that the two curves rise and fall together, but the transpiration readings have a much smaller range than those of the porometer. This is perhaps what might have been expected, taking into account Dr. Horace Brown's work on diffusion.

Miss N. Darwin and Dr. F. F. Blackman contributed a paper on germination conditions and the vitality of seeds. If the vitality of seeds is lowered by exposure to, *e.g.*, high temperatures, they do not germinate well, and become more sensitive to any unfavourable modification of the environment. Failure to germinate when too little water is present is due to purely physical causes, while the injurious effects of excess of water are due to the water acting as an oxygen excluder. Mr. A. S. Horne next discussed the absorption of water by various leguminous seeds. Prof. Bottomley showed that the Cyanophyceæ endophytic in the apogeotropic roots of cycads and in the cavities of Azolla and Anthoceros are invariably accompanied by nitrogen-fixing bacteria. He suggested that this may really be a symbiotic association of the algæ and the bacteria.

Ecology.

In contrast to the Winnipeg meeting, ecology was represented this year by only two papers. Mr. J. H. Priestley gave an account of the distribution of halophytes on the Severn shore. In this district the halophytes exhibit three well-marked zones:—(1) the low-lying Salicornia zone; (2) the Sclerochloa and Aster zone; and (3) the rarely submerged *Juncus Gerardi* and *Festuca rubra* zone. Apparent anomalies of distribution are probably referable to differences of drainage and salinity. Mr. M. Wilson discussed plant distribution in the woods of north-east Kent.

Cytological Papers, &c.

Friday morning was occupied with papers dealing with cytology and heredity, the first two being taken jointly with Section D (Zoology). In a paper entitled "The New Force, Mitokinetism," Prof. Marcus Hartog further developed his views on the formation of the spindle and other structures observed during karyokinesis. Discussing the various theories put forward, Prof. Hartog contended that neither diffusion currents on one hand, nor electrolytic or electrostatic force or magnetism on the other, are sufficient to account for the formation of the mitotic spindle. As an alternative the author postulates the existence of a new force, which he terms "mitokinetism," and which, so far, is unknown outside the living cell. Dr. E. Hindle followed with an account of artificial parthenogenesis in the eggs of a sea-urchin (*Strongylocentrotus purpuratus*). The author described the process of artificial fertilisation in these eggs by treatment with a monobasic fatty acid, and subsequently with hypertonic salt solution. The cytological changes undergone were carefully described, including the formation of an artificial fertilisation membrane and the various nuclear changes. Under suitable conditions free-swimming larvæ were produced. These, though their dividing nuclei contained only the reduced number of chromosomes, were identical in form and behaviour with those developed from normally fertilised eggs. This concluded the joint sitting of Sections D and K, and the remaining papers were communicated to Section K alone.

The next two papers dealt with the behaviour of the chromosomes during mitosis, and particularly with respect to the stage at which longitudinal fission is initiated. Prof. Farmer and Miss Digby found in Galtonia that during the archesporial divisions the longitudinal fission begins by a condensation of the chromatin on the edges of the chromosomes during the telophase of the preceding division, and the duplicate character can thus be detected very early. Similarly, in the heterotype division of mitosis, the longitudinal fission is prepared for, as in the somatic mitoses, during the telophase of the last archesporial division. Dr. Fraser and Mr. Snell obtained very similar results in *Vicia faba*. They found that the chromosomes which are separated from each other in any given division are the product of a longitudinal fission which is initiated in the preceding telophase. This was stated to be the case in both the sporophyte and gametophyte generations, the resting chromosomes in both cases exhibiting a double structure. Prof. V. H. Blackman, in a very interesting short paper, described the vermiform male nuclei of Lilium. The author brought forward evidence that, although purely nuclear in structure and possessing no cilia, these structures are capable of active movement. It seems probable that the activity of these nuclei, and not the streaming movements of the surrounding cytoplasm, is responsible for their entrance into the ovum and passage to the polar nuclei.

The remaining two papers taken on Friday dealt with problems of heredity. Mr. R. P. Gregory offered some further observations on inheritance in *Primula sinensis*,

and Prof. F. E. Weiss described some experiments on the inheritance of colour in the pimpernel. The latter author crossed *Anagallis arvensis* and *A. coerulea* (the red and blue pimpernels). The red colour proved to be dominant, while in the f_2 generation there was complete segregation into red and blue forms. This is another interesting case of a recessive blue in the Primulaceæ.

Fungi.

The fungal papers were taken on Thursday morning before the president's address. Prof. Buller discussed the function and fate of the cystidia of Coprinus. The author confirmed Brefeld's view that the cystidia act as props to keep the gills from touching each other. He pointed out that this is necessary to allow for the free escape of the ripe spores. The cystidia themselves disappear by a process of autodigestion just before the basidia in their immediate neighbourhood are ready to discharge their spores. In the discussion on this paper Mr. Wager suggested that the cystidium must be regarded as having been phylogenetically derived from the basidium. Mr. A. E. Lechmere read an interesting paper on the methods of asexual reproduction in a species of Saprolegnia. In hanging-drop cultures great variation was found in the behaviour of the zoospores, the method of discharge, and the shape of the sporocyst. Variations of form, &c., supposed to be characteristic of distinct genera of the Saprolegnieæ were found within the limits of this single species. Prof. V. H. Blackman described a form of nuclear division intermediate between mitosis and amitosis in *Coleosporium Tussilaginis*. A spindle is formed on which granular chromatin collects, and is then drawn apart towards the poles. The chromatin is not aggregated into definite chromosomes. Mr. Harold Wager, in a paper on chromosome reduction in the Hymenomycetes, maintained that normally only two nuclei (each containing four chromosomes) fuse in the basidium. During the division of the fusion nucleus the spireme breaks up into eight chromosomes, reduction being brought about in a simple manner by the distribution of the chromosomes to the two daughter nuclei. Mr. F. T. Brooks described his investigations into the cause of the silver-leaf disease of fruit trees. These experiments are still proceeding, but, although not absolutely proved, the available evidence points, as previously suggested by Percival and Pickering, to *Stereum purpureum* as the probable cause of the disease.

Morphological and other Papers.

Although only an afternoon session (on Monday) was available for morphology, the papers proved so attractive that the section sat for nearly three and a half hours. Prof. F. O. Bower led off with two papers. The first was a short note on *Ophioglossum palmatum*. The divided character of the leaf-trace supports the conclusion, previously arrived at from its external morphology, that *O. palmatum* is one of the more extreme and specialised types of the Ophioglossaceæ. The second paper, on two synthetic genera of Filicales, dealt with some very interesting problems of phylogeny. The two genera in question are Plagiogyria (formerly included in Lomaria) and Lophosoria (usually grouped with Alsophila). The author not only put forward strong reasons why these respective genera should be kept separate, but suggested that both are probably important intermediate synthetic forms. Thus he regards Plagiogyria as a transitional form related on the one hand to the Gleicheniaceæ and the Schizæaceæ, and on the other to the whole series of Pterideæ. Similarly in the case of Lophosoria, a probable sequence may be traced from forms also having affinities with the Gleicheniaceæ through Lophosoria to Alsophila and other Cyatheaceæ.

Dr. Kidston and Prof. Gwynne-Vaughan described the structure of the "false stems" of the fossil genus Tempskya. This plant had an extraordinary habit. Its erect "stem," which grew to a height of 9 or more feet, really consisted of an aggregate of branching stems embedded in a compact mass of their own adventitious roots. The individual stems were slender, and possessed a dorsi-ventral symmetry. The authors think that in this case the erect habit had been only recently acquired, the particular method adopted being one which could be evolved with great rapidity. They further suggest that the erect habit of modern tree-ferns may be a secondary character derived from Tempskya-like forms, in which the original axis has developed at the expense of the lateral branches. Dr. M. C. Stopes read a paper in which she further described the fossil flower *Cretovarium japonicum*, dealing especially with the structure of the ovary. Mrs. Thoday, in a communication on the morphology of the ovule of *Gnetum africanum*, instituted a comparison between this and the ovules of Welwitschia and Lagenostoma. She regards the ovule of Gnetum as probably more primitive than that of Welwitschia on account of its radial structure, the presence in the young ovule of a well-developed pollen chamber, and the small development of the free portion of the nucellus. Prof. F. W. Oliver next discussed the pollen chambers of various fossil seeds. He showed that in certain seeds (*e.g.* Conostoma spp.) the structure of the nucellar apex is much more complex than in forms such as Lagenostoma, &c. In these more complicated forms a second pollen chamber was excavated below the primary one (which alone is found in Lagenostoma), the latter becoming merely vestigial. In the light of this discovery it seems possible that the nucellar beak of Trigonocarpus, Ginkgo, &c., may represent a vestigial primary pollen chamber, which had been functionally replaced by a more deeply seated cavity.

Prof. W. H. Lang concluded the afternoon's sitting with a very interesting account of the morphology of the stock of Isoetes. He produced evidence that the stock grows regularly in two opposite directions. Leaves are produced at the upper end, the stem apex being situated at the base of a deep depression. Similarly, the roots are borne in regular sequence on a downwardly growing region. In this case, too, the apex is at the bottom of a deep depression, but the growing point is obscured by the congenital union of the sides of the depression. The young roots are finally freed by the gradual and partial separation of the united lobes of the stock. Although greatly modified, the axis of Isoetes is strictly comparable with that of Lepidodendron or Pleuromeia.

The Semi-popular Lecture

this year was given by Prof. F. O. Bower, the subject being "Sand-dunes and Golf Links." The lecture, which was greatly appreciated, dealt chiefly with the part played by vegetation in the formation and fixing of sand-dunes. Perhaps the prominence given to this part of the subject caused some mild disappointment to the golfers present, who wished for practical hints on the keeping of greens. Prof. Bower showed a number of beautiful photographs, amongst the most interesting being some of shifting dunes.

ENGINEERING AND CIVILISATION.[1]

IN order rightly to appreciate the share taken by our profession in bringing about the present state of civilisation, a comparison should be made between the conditions prevailing, say, in the Greek states during the fifth and fourth centuries before Christ and those existing now in the twentieth century after Christ.

In indicating the state of knowledge at that period of Greek history, it is enough to remind you that it was the age of Themistocles, Aristides, and Pericles, the statesmen; of Æschylus, Sophocles, Euripides, and Aristophanes, the dramatists; of Phidias, Scopas, and Praxiteles, the sculptors; of Apollodorus, Zeuxis, and Apelles, the painters; of Ictinus, the chief designer of the Parthenon, and Dinocrates, who rebuilt the temple of Diana at Ephesus and laid out the city of Alexandria, the architects; of Herodotus, Thucydides, and Xenophon, the historians; of Socrates, Plato, and Aristotle, the philosophers.

Can we say that there have been many since that time who are worthy to be mentioned as equals of the men I have just named? The fact alone that we use the adjective "classical" to indicate perfection in literature and art shows what a standing had been attained more than 2000 years ago, and in many respects we feel down

[1] From the Presidential Address delivered at the Institution of Civil Engineers on November 1, by Mr. Alexander Siemens.

to the present time the direct influence of Greek and Roman learning.

In his "Organon" Aristotle expounded the logic of deductive reasoning in such a complete form that even the terms which he was the first to establish are in use at the present time, and both Kant and Hegel acknowledged that from the time of Aristotle logic had made no progress. But the schoolmen did not realise that the "Organon" was merely an "instrument" setting out the theory of reasoning; they neglected altogether the teaching of Aristotle, that in every branch of science or art the only means of obtaining premises on which logical deductions can be based is by experience and observation of facts. He says in the "Prior Analytics," I., xxx., 3:—"When the facts in each branch are brought together it will be the province of the logician to set out the demonstrations in a manner clear and fit for use."

This principle of bringing together facts was absolutely neglected in mediæval times by the later schoolmen, even when, during the thirteenth century, the complete works of Aristotle, translated into Latin, had become known to them, although at first the Church authorities would not allow any lectures to be delivered on them in the universities.

A reaction against Scholasticism, or Obscurantism as it is sometimes called, set in during the fifteenth century; it was strongly supported by the Reformation, but it is the merit of Sir Francis Bacon to have directed the course of the further studies of mankind into the right channel by showing that the object of all science is to recover man's sovereignty over nature, or, as he expresses it, "to extend more widely the limits of the power and of the greatness of man" ("Novum Organum," I., 116).

For this purpose, Bacon asserts, it is necessary to study nature by inductive investigation after observing and collecting facts, but, in contrast to the deductive reasoning adopted by the schoolmen, he lays down that "the induction that is to be available for the discovery and demonstration of sciences and arts must analyse nature by proper rejections and exclusions, and then, after a sufficient number of negatives, come to a conclusion on the affirmative instances, which has not yet been done save only by Plato . . . and this induction must be used not only to discover axioms, but also in the formation of notions" ("Novum Organum," I., 105).

Although it cannot be said that the Baconian method has been followed in its entirety during the subsequent development of science, its fundamental ideas, viz. the need for rejecting rash generalisation and the necessity for critical analysis of experience, serve as the sound basis of the modern method of framing hypotheses and verifying them by observation and experiment.

In literature and art or in philosophy we cannot boast of being greatly superior to the ancients, but, so far as engineering problems are concerned, we have enormously advanced, thanks to the practical application of scientific theories.

Comparing generally the conditions of life then and now, we may sum up the difference by claiming that our progress is due principally:—(1) to the improvement of the means of communication; (2) to the saving of manual labour by the introduction of mechanical power; which main features have caused a general lowering of the cost of "obtainables."

When Hertz discovered the property of electric sparks to start waves of the æther which can be detected at a distance, nobody anticipated that Marconi and others would succeed in developing these small beginnings to the system of wireless telegraphy, of which nowadays so many applications are in constant use.

Again, the polyphase motors and generators of electricity had their beginning in the researches of Prof. Ferraris, who demonstrated that three alternate currents can be combined in such a manner that the sum of the three currents at any moment is equal to zero, and that by their aid a revolving magnetic field is produced.

When we seek to recognise true progress in the material conditions under which we are living, it is not unreasonable to expect that any further advance will be made on the same lines as differentiate our present civilisation from that of the ancients, and that "lowering the cost of obtainables," based upon improvement of communications and upon the saving of manual labour, will furnish a trustworthy test whether a change suggested to be made in our material surroundings is worth adopting or is merely an alternative without any prospect of being generally accepted.

The development of the manufacture of glow-lamps is a striking example of the advantage of labour-saving machinery; at first the lamps were made by a few skilled workers at a high cost, so that they could not be sold for less than twenty-five shillings each. This excessive cost naturally restricted their sale; but the efforts of the manufacturers to devise labour-saving machinery were not relaxed until the selling price of glow-lamps had diminished to its present level, when they are sold by the million. Can anybody doubt that the introduction of labour-saving machinery into this industry, far from diminishing opportunities for employment, has not only benefited the skilled workers, but has opened new avenues for profitable employment to the so-called unskilled labour.

Nor is the advantage limited to this particular industry; the possibility of obtaining cheap glow-lamps has increased the sale of dynamos, steam and gas engines, cables and fittings, giving employment to thousands of workmen. Similar consequences have followed the introduction of labour-saving machinery into other branches of manufacture.

In their own interest inventors should appreciate more than they have done in the past that progress is not the result of flashes of genius that illuminate suddenly a hitherto unknown subject, but that it can only be gained by plodding work and careful study directed by an infinite capacity for taking pains.

This requirement is expressed very tersely by Aristotle in his definitions of science and of art, which, unfortunately, have been lost sight of in the course of ages, so that they cannot be used any longer. They are, however, so appropriate to our subject that I do not hesitate to repeat them.

Aristotle says:—Science is the trained faculty of demonstrating necessary conclusions from necessary premises, and these conclusions are independent of the producer.

Art is the trained faculty of producing, involving sound reasoning; it has to do with the genesis, the production of things, and the result depends on the producer.

From these definitions it follows that every profession requires to have its "science" which teaches the "sound reasoning" on which its "art" is based, and for both "science" and "art" training is a necessary condition for success.

They indicate, to my mind, for our profession in particular, that the college teaching should occupy itself principally, though not exclusively, with "science," viz. the natural laws which are "independent of the producer," leaving the "art" of engineering to be developed by practical work either in the field, in the drawing office, or in the workshop.

So far as the "science" of any industry is concerned, all civilised countries have access to the results of the latest researches which are published without loss of time in the technical journals, and the "art" of each industry devotes itself everywhere to the problem of lowering the cost of production in order to widen the circle of possible customers.

Viewing the question of international competition from this aspect, it can only be regarded as an extension of the competition at home, and, applying the same reasoning, the question naturally arises whether it would be desirable to have international standards or not. Looked at from the point of view of the consumer, it certainly appears to be very convenient to be able to obtain supplies from a number of different sources with the certainty of their being interchangeable, or at least equivalent.

In fact, the same reasons that have led to the establishment of the Engineering Standards Committee in this country hold good for international dealings, so that we may look forward to the time when international standard specifications will be accepted all over the world. A beginning was made when the British Association introduced in 1861 the C.G.S. system of electrical units, which, since that time, have been adopted internationally, and a further step was taken at the St. Louis Exhibition of

1904, when the International Electro-technical Commission was called into being.

It is a very significant circumstance that it has been found necessary for this commission to associate itself in some branches of its activity with the Engineering Standards Committee, and it is not unreasonable to expect that such joint international action will gradually extend beyond the field of electricity.

FORESTRY EDUCATION: ITS IMPORTANCE AND REQUIREMENTS.[1]

I PROPOSE to deal to-day with a brief exposition of the points on which the system of forestry education is based. It will be of interest, I think, first to glance briefly at the training to be obtained at some of the European forestry schools, and the facilities provided for giving it. We will then consider some of the things the student in forestry must know, and in this connection glance briefly at a few of the duties which confront the forest officer in the course of his ordinary work in India, concluding, finally, with a review of the present position of the university as regards forestry training and the steps which require to be taken to enable us to send out the class of British forester which is already required in many of our colonies, and for which we trust there will soon be a demand in the British Isles.

A few years ago, whilst on furlough from India, I made a tour of some of the forestry colleges and schools of Europe, my object being to study the lines upon which the Continental system of education was based and the methods they adopted to combine a proper proportion of practical work with the theoretical instruction given in the class-room. In the course of my tour I visited Eberswalde, Tharandt, Aschaffenburg, and Munich Forestry Schools in Germany, the Imperial Forestry Institute at St. Petersburg, the Agricultural and Forestry Institute at Vienna, and the fine French Forest School at Nancy. That tour was an education in itself. Briefly, I may sum up the results of my observations as to the essentials for the tuition of forestry thus:—(1) a strong teaching staff; (2) good museums; (3) a forest garden and forest educational woods.

(1) *The Instructional Staff.*—The study of forestry so depends on a number of cognate subjects, such as botany, chemistry, geology, zoology, surveying, and forest engineering, &c., that it is essential that the student should be given first-class courses in these matters. Excellent courses are given in all the Continental colleges. There remains the subject of forestry itself, comprising the various branches of silviculture, forest management, forest valuation, forest protection, forest utilisation, the law of the forests, and procedure and accounts. To lecture on these various branches, the best Continental colleges retain the services of at least three men, professors and assistants, many of the former having world-wide reputations in their various branches. These men are also often responsible for their own departments of work in the school forest garden and instructional forests. Their work, as we shall see, falls under two heads. They deliver courses of lectures in the lecture hall, and they conduct the students on the excursions made into the woods to illustrate these lectures, and personally supervise every piece of practical work laid down for the student to do. Since the minimum time in which a student can finish the forestry course is two years, the professor requires at least one assistant to conduct a part of the lectures, for the junior and senior students are both necessarily attending courses at the same time, and one lot may be in the woods whilst the other is in the lecture hall. At the well-known Forestry School at Munich, the home of a number of famous foresters, the various branches of forestry science are in charge of three professors: Prof. Mayer takes silviculture, forest utilisation, protection, and foreign forestry; Prof. Endres, forest policy, administration, valuation, and finance; whilst Prof. Schüffer lectures in forest management and working plans, estimation of increment, and yield. Each of the professors is responsible for the excursions, laboratory and practical work, of their various courses.

(2) *Good Museums.*—The educational value of a good museum is fully recognised. It need not be enlarged upon here. Forestry is peculiarly a science the tuition of which on the one side and assimilation on the other is dependent upon two essentials, a thoroughly efficient system of practical work, and up-to-date, well-planned museums exhibiting in a simple and efficient manner the various details connected with forest work.

So important is the museum as an adjunct to the efficient teaching of forestry that we find in all the Continental forestry colleges that considerable sums of money have been spent on this part of the equipment alone, and yet in some instances, although with treble the space available here in Edinburgh, the cry was often that more room was required. Where all is so good it is difficult to particularise, but as examples of efficiency in this respect I will instance the museums at the Forestry School of Nancy in France, the Imperial Forestry Institute in St. Petersburg, and the Forestry College at the University of Munich. The latter, so far as its building accommodation and museums are concerned, forms the nearest parallel to the position of Edinburgh University, and it will be of interest to glance briefly at the accommodation provided.

The Forestry College at Munich forms part of the University of the town and State, and considerable sums of money were spent a few years ago with the object of bringing it thoroughly up-to-date. The buildings devoted to forestry instruction are two in number, both situated in the grounds of the University.

The new building, which was opened about the year 1900, is the most perfect institution of its kind that man could have devised. The whole of the inside fittings are of wood, highly polished parquet flooring being used throughout, whilst the rooms are handsomely panelled with various kinds of woods. The chemical, mineralogical, meteorological laboratories, &c., are in the basement; forest surveying, mathematics, and forest-wood museums on the first floor; and forest implements, forest products, and models and diseases of woods on the next floor. Each of these branches or departments of science has its own museums, one or two rooms as are required, its own large lecture hall, with professors' and assistants' rooms, laboratories where required, packer's room, &c.

The space devoted to forestry pure and simple is ample, no fewer than five large rooms and halls being devoted to the exhibition of the collections alone, those of each branch being exhibited alone.

This brief description will show that there is little fault to be found with the arrangements and space devoted to this wonderfully efficient forestry college. With such equipment there is every incentive to professor and student alike, not only to work, but to undertake research work in the various branches of forestry. In the Bavarian University the State pays for the upkeep of the major portion of the Forestry Department, and in return the Government reaps the advantages derived from the very important research work and experimental work in which its professors, many with great European reputations, spend all their spare time.

(3) *The Forest Garden and Educational Woods.*—We come now to our third essential to the proper teaching of forestry, the forest garden and educational woods. It may be said at once that the subject of forestry cannot be taught by the professor or assimilated by the student unless efficient instructional woods are available to which the student can be taken during the lecture course, as well as during the practical course, to be shown eye object-lessons of what he is told. He should be shown in the woods what he is told in the lecture-room, and taught to observe for himself—that first and most important of the lessons of a forester. These first principles of the education of a forestry student are well understood on the Continent, and are adequately provided for.

I will give two instances out of many. The German Forestry Academy of Tharandt is situated not far from Dresden, in Saxony. The school is provided with a forest garden and demonstration forest, forming a compact block in its immediate vicinity. The forest garden is situated on a hill-side immediately behind the school. The hill-

[1] From the inaugural lecture delivered at the University of Edinburgh on October 12, by Mr. E. P. Stebbing, Head of the Forestry Department of the University.

side is terraced into beds, which contain some 1800 different species of trees, shrubs, perennials, and annuals of various kinds, both indigenous and exotic. This garden serves as a forestry and botanical garden, and is an exceptionally fine one, covering an area of about 18 hectares. There is a forest nursery in the garden managed on most up-to-date lines.

The school demonstration forests adjoin the forest garden, and are kept up entirely for educational and demonstration purposes. They are situated in a hilly area presenting ever-varying conditions, aspects, and variations in soil, thus allowing of a variety of object-lessons with different species and mixtures being presented to the student. For example, these woods contain spruce and beech with birch in mixture; spruce and silver fir, or the two latter with birch. Or again, there are woods of spruce, beech, Scotch pine, silver fir, larch, maple, birch with maple and various mixtures, ash (pure, about thirty years old), alder (in wet valleys), oak, and a little Æsculus. There are some most interesting mixtures to be seen doing remarkably well, and forming an ideal of what demonstration woods should be. The steep slopes of the hill-sides are worked under different sylvicultural systems to the area of tableland above, where the woods are clear-cut and naturally regenerated or sown or planted. Exotics are being largely introduced, and thousands of plants are sent out annually from the forest garden and nursery in the demonstration area into the forests all over Saxony. Fencing of young planted areas and other ways of protecting young plants from deer, &c., are to be seen in practice in the woods. Time will not permit of my dwelling upon this excellent educational demonstration area; but from his earliest course in the lecture-room the student is taken out week by week into the forest garden or woods, and with his own hands learns how to trench, sow, plant, thin, and fell and measure up his woods; is taught to distinguish the different species of tree, and how they differ in their requirements of soil, light, moisture, &c.; is shown on what the foundations of sylviculture depend; and is gradually led, step by step and stage by stage, to understand and grasp both the theory and practice of the various branches of the lore of the woods comprised in forestry.

I should like to give another instance of this educational forest. The Imperial Institute of Forestry at St. Petersburg is probably the largest forestry college in Europe. The students number 500, all training for the controlling staff. In addition, there are thirty-three lower-grade schools containing fifteen students apiece, from which the ranks of the forest rangers and upper guards are filled. Attached to the institute at St. Petersburg are two educational forests, the one 14 versts (9 miles) from the capital, the other, and larger, 60 versts (40 miles) away. At each of them buildings are maintained for housing the professors and students during their visits. Portions of every summer are spent by the students in these woods occupied in practical work. The woods are entirely under the management of the director of the college, as is the case at Tharandt, and are managed on similar lines, and solely for demonstration purposes. The directors at both these places, as also the forestry professors (and this applies to many of the Continental colleges), are all practical men who have themselves been through the mill of executive work, have themselves held charge of large areas of woods worked entirely on a commercial basis, and are therefore in a position to see that the instruction given to the students is such as will return full value to the State or proprietor who employs the men leaving their institutions.

This is a point which I think worthy of the most serious consideration in this country. Too great stress cannot be laid on what are, after all, actual facts. The excellent and remunerative results of forestry in Europe, which we also wish to arrive at in the British Isles, are solely the result of the study of higher forestry both in the woods and in the laboratory. Practical foresters can only be successful in proportion to the knowledge they themselves possess or which is imparted to them by those who know. We can learn from other countries a great deal, but the application of what we learn must depend on ourselves and must be carried out by ourselves.

We have now seen what the Continental forestry colleges consider the essentials to the proper tuition of forestry as a science, and have shown how the student is gradually led, not only to assimilate the theoretical portions of the study in the lecture-room, but to take with him what he has absorbed there and apply it practically in the woods. We have seen that these practical object-lessons must begin with the student's first lectures, that he must be taken into the woods at the beginning and be shown, step by step, that what he is being told in the lecture-room is not so much matter to be studied for an examination and to be subsequently forgotten when his text-books and note-books are thrown aside after the "pass" has been gained. It has been said of the forester that he is always at school, from the moment he first enters the lecture-room to commence his first course to the end of his life; and those of us who are foresters know this to be true. Our text-books and lecture notes remain our trusted friends to the end, and as we grow older and have had a more extensive practice and experience in forestry we grow more diffident about expressing definite opinions and laying down the law on the subject of the life-histories of our friends the trees. For the tree is very much like the human being. He has his wants and requirements, his fancies for particular aspects and localities, for certain soils and degrees of light, moisture, heat, and shade.

All these the forester must know and study, and even then his fastidious friend will often discover something he dislikes, and refuses to grow. The forester has to set to work to find out what this something is, and meanwhile all he has done is a failure—a failure, that is, unless he is a thoroughly trained scientific man. As such he will turn his failures to account, for he will place them on record so that he and others like him may set to work to get at the reasons for the failure of a crop which, so far as human forethought was capable of doing, had been given every chance. How much sound practical knowledge and observations have been lost to the foresters all over the world by this regrettable neglect to place upon record their failures. Almost more valuable are they to record than the successes; to the forester far more valuable. This is one of the spots upon which the scientific forester can place a finger in the British Isles. Had one a full, or even a partial, record of all the failures of the past, how much simpler would be the task at present facing the nation of getting its forestry house in order.

Scotland is more favourably situated and in a better position as regards woods of a high educational value than any other portion of the British Isles for undertaking this necessary research work. There are woods in Scotland, many of them known by repute, others less well known, in which the student on his practical course can learn a great deal and in which work of high importance to afforestation in the British Isles can be carried on. Edinburgh is very favourably situated for participating in this pioneer work, and has every intention of taking her share in it.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—To-day, November 10, Graces will be offered to the Senate proposing that the offer of the Worshipful Company of Drapers to erect a new physiological laboratory at Cambridge be gratefully accepted, subject to the conditions set forth in the letter, dated February 11, 1910, from the clerk to the company; that a syndicate be appointed to discuss details with the company; and that the Vice-Chancellor be authorised to convey to the court of assistants of the company the grateful thanks of the university for their munificent benefaction. Further, that the Vice-Chancellor, Dr. Mason, Master of Pembroke College; Mr. Shipley, Master of Christ's College; Dr. Langley, professor of physiology; Dr. W. M. Fletcher, and K. Lucas, of Trinity College, be the syndicate appointed under the above-mentioned Grace.

Applications for the tenure of the Benn W. Levy studentship in bio-chemistry should be sent to Mr. F. G. Hopkins, Trinity College, on or before Wednesday, November 30, 1910. Applicants should state their university standing and previous scientific experience, mentioning if they are in receipt of any other endowment for research. The studentship is open to members of the University of Cambridge who have been admitted to a degree, or to members of

Girton or Newnham Colleges who have acquitted themselves so as to have deserved honours and have fulfilled the conditions respecting length of residence which members of the university are required to fulfil before being admitted to a degree. The annual value of the studentship is 100*l*. The student, during his or her tenure of the studentship, shall prosecute original research in bio-chemistry, and shall not engage in such other work as in the opinion of those entrusted with the administration of the fund would seriously interfere with his or her original inquiries. The appointment will be for one or two years, at the option of the managers.

Notice is given that a prize of 50*l*. out of the Gordon-Wigan fund will be awarded at the end of the Easter term, 1911, for a research in chemistry, of sufficient merit, carried out in the University of Cambridge. Candidates for the prize must have taken Part I. of a Tripos examination, and be under the standing of M.A. The research may be in any branch of chemistry. The dissertation, with the details of the research, must be sent to the professor of chemistry not later than June 10, 1911.

The local examinations and lectures syndicate is about to appoint an assistant secretary for examinations. The person appointed will be expected to enter on his duties not later than January 1, 1911. The appointment will be made in the first instance for the period ending March 31, 1912, at a stipend of 400*l*. a year. The post will after that date be held during the pleasure of the syndicate, and the stipend will be raised by annual increments of 25*l*. to 500*l*. Graduates of the university who desire to offer themselves as candidates are requested to send their names to Dr. Keynes, Syndicate Buildings, so as to reach him not later than 9 a.m. on Monday, November 21.

The Vice-Chancellor gives notice, on behalf of the Board of Geographical Studies, that Mr. R. T. Günther has consented to deliver a lecture in Cambridge on Friday, November 11, at 5 p.m., on "Earth Movements of the Italian Coast." The lecture will be given in the Sedgwick Museum, and will be illustrated by lantern slides. Members of the University and others are invited.

The Regius professor of physic gives notice that Prof. Osler has consented to deliver a lecture on November 17, at 5 p.m., in the large theatre of the medical schools, on "Medical Education in France."

OXFORD.—The congregation of the University of Oxford had before it on November 8 the first of the important series of statutes framed by the Hebdomadal Council, in pursuance of the comprehensive scheme of reform initiated by the Chancellor, Viscount Curzon. The adoption of the statute, which deals with the constitution and powers of the boards of faculties, including that of mathematics and natural science, was advocated by the President of Magdalen, the Master of University College, and Prof. Geldart. Its provisions were sharply criticised by the Warden of All Souls and the Master of Balliol, and its rejection was recommended by Prof. Holland and the President of Corpus. The preamble was carried in a full house by a majority of rather more than two to one; but there is no doubt that strong efforts will be made to modify the effects of the statute by amendment, especially those of its provisions which deal with the composition of the electorate and with the control exercised by the University and colleges respectively over the subjects and methods of instruction.

The tenancy of the well-known house in Broad Street, long the residence of Sir Henry Acland, has lately been acquired for the Oxford School of Geography. When the necessary arrangements have been completed, the house will contain a library, reading-room, and collections of maps, views, and models. Part of the premises will be fitted up for the use of the Beit lecturer in colonial history (Mr. W. L. Grant), and accommodation will be provided for purposes of general geographical instruction and research. The whole will be under the direction of Prof. A. J. Herbertson. This much-needed development of the facilities for geographical studies in the University has been made possible by the generosity of Mr. Bailey, of Johannesburg, who has given 500*l*. towards the adaptation of the house, and has promised 250*l*. a year for five years towards its maintenance.

Mr. O. G. S. Crawford, of Keble College, has been appointed junior demonstrator in geography for one year.

Mr. G. C. Robson, formerly exhibitioner of New College, has been elected to the vacant Naples biological scholarship lately held by Mr. J. S. Huxley, of Balliol College.

Mr. Selwyn Image, of New College, who has recently delivered his inaugural lecture as Slade professor of fine art, is a well-known student of the microlepidoptera, and is at present a member of the council of the Entomological Society of London. The seal of the society, which is a work of great artistic merit, was designed by the new Slade professor.

To encourage further interest in the subject of oceanography, it has been decided to invite the members of Dr. Bruce's class in geography at the summer school at St. Andrews this year to write essays on certain aspects of oceanography, and to submit them at the end of next spring. The essays are to be on one or other of the following subjects:—(*a*) on the effects of wind, temperature, and salinity on the circulation of the ocean, or (*b*) on the question of continental connections. The competition is only open to members of Dr. Bruce's class, and the essays must be lodged with the director of studies on the last day of April, 1911. Two prizes will be awarded, viz. two sets of the report on "The Scientific Result of the Voyage of the s.y. *Scotia* during the Years 1902, 1903, 1904." The two successful essays will be published either by the Scottish Oceanographical Laboratory or in the *Scottish Geographical Magazine*.

THE *Electrical Review* in its issue of October 21 directs attention to the great falling off in attendance at the evening classes of our technical schools which occurs during the course of each winter session. It contrasts the eagerness of the prospective student in consulting the teachers as to his course, in buying the text-books, and in making all his arrangements for strenuous work during the forthcoming winter evenings, with his tired and weary look and his vain attempt to follow the explanations given by his class teacher three months later. For this change, sheer fatigue and inability to stand the strain of perpetual day and evening work are responsible, and the *Review* charges the evening-school authorities with attempting too much and demanding attendance on the part of students for four or five evenings per week. It points out that undue strain can only be prevented by a reduction of the evenings of attendance to two, or in exceptional cases to three, per week, and urges the authorities to take this step as a means of improving both day and evening work of the students who attend their evening classes.

THE DUKE OF CONNAUGHT on November 5 laid the foundation-stone of the new University Hall of the Cape University. The council of the University presented an address, in which the hope was expressed that the union now accomplished in South Africa would lead to the conversion of the present Cape University into a teaching university for the whole of South Africa, by incorporating existing institutions of higher education as constituent colleges, and by creating chairs for those subjects for which no single college could provide. In replying, the Duke of Connaught said he trusted that the funds necessary to convert the Cape University into a great teaching university would be forthcoming. At a university luncheon held on the same day, Mr. Malan, Union Minister of Education, announced that Mr. Otto Beit had agreed to divert the sum of 200,000*l*., bequeathed by the late Mr. Alfred Beit for the foundation of a university at Johannesburg, to the creation of a great teaching university at Groote Schuur, the estate of the late Mr. Cecil Rhodes outside Cape Town. It was also announced that Sir Julius Wernher has promised to make up the amount to a total of 500,000*l*.

A NEW engineering laboratory was opened at the Darlington Technical College on October 20 by the Hon. C. A. Parsons, F.R.S. During the course of his address Mr. Parsons said that in the early part of last century engineering was principally guided by traditional rule and trade knowledge, handed down from father to son and from master to apprentice. Engineering has gradually assumed a more important place, its field of operations has become wider and more complex, and it has become

imperative to institute, instead of the old and primitive methods, systematic technical training for young men. There is probably no field of work in modern times where so great an amount of well-ordered experimental investigation has been undertaken as in engineering. Referring to the advantages of engineering workshops, Mr. Parsons said that knowledge, more especially of the practical kind, must be acquired when a man is receptive, and at such an age when ideas and impressions become so ingrained as to constitute intuitive and guiding principles in after life. In the engineering laboratory students are brought face to face with materials and machinery for dealing with and discovering principles; they gradually acquire a familiarity with practical engineering and the power to think in engineering materials, and to form a mental picture when it is necessary to design a new or improve an old machine or to design new methods of work. Such a training fits a student to go out into the world with mind and eyes alert, ready to acquire more knowledge, and fit to command success in most branches of engineering. By the help of good technical training a much larger proportion of men of high standard are produced than formerly—men of knowledge capable of taking the lead and commanding, and able and willing to deal fairly with their subordinates.

THE executive council of the County Councils' Association has made a series of recommendations with regard to rural education. They follow the main lines of the proposals of the Departmental Committee on Agricultural Education, which reported two years ago. Among other plans, the council encourages the formation of separate agricultural committees appointed by the county education committees. Another proposal is to appoint, in consultation with the agricultural college with which the county may be associated, a resident agricultural instructor and adviser at a salary of not less than 500*l*. per annum, who shall be under the control of the county council. The duties of this officer will be to give courses of lectures during the winter months; to supervise experiments and demonstration plots; to visit farms, small holdings, or allotments, and advise as to the appearance of disease in crops, insect pests, and on other matters; to meet bodies of farmers at local exhibitions and shows for the purpose of discussion; to organise classes for instruction in farm labour subjects and prize competitions in connection with such subjects as hedging, ditching, and thatching; and to advise the committee as to the establishment of permanent centres for agricultural instruction. It is also suggested that each county should organise, with the aid of the agricultural adviser, developments of a semi-educational character in connection with cooperative small holdings, instruction in pig-breeding, the establishment of poultry societies for improving breed and management, the provision of instruction in bee-keeping, the establishment of demonstration small holdings, the provision of a central county garden with demonstration and experimental centres for horticulture, and the provision of a demonstration farm of 100 to 300 acres, which might be used later as the nucleus of a farm institute. The association estimates that 2000*l*. per annum will be needed as a commencement, and suggests that an application should be made for a grant of this amount. The association has adopted the view of the Departmental Committee that "agricultural education is of such vital importance to the United Kingdom that no effort should be spared in making the provision for it as full and complete as possible," and that a complete system of technical agricultural education is "the natural corollary to the vast sums spent on elementary education in the rural parts of the country."

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, November 3.—Sir Archibald Geikie, K.C.B., president, in the chair.—Sir D. **Bruce** and others: (1) Trypanosome diseases of domestic animals in Uganda. II.—*Trypanosoma brucei* (Plimmer and Bradford). (2) Trypanosome diseases of domestic animals in Uganda. III.—*Trypanosoma vivax* (Ziemann).—H. G. **Plimmer**, W. B. **Fry**, and H. S. **Ranken**: Further results of the experimental treatment of trypanosomiasis: being a progress report to a committee of the Royal Society. This paper gives detailed results of the continuation of the work which has been going on under the direction of a subcommittee of the Royal Society. The general results have confirmed an opinion which the authors have before expressed, viz. that antimony is a more powerful trypanocide than arsenic, and that such compounds as they have tried have not shown such severe toxic effects as some arsenic compounds have. But there are unpleasant effects produced (varying according to the animal used) by antimony, such as sloughing and necrosis at the seat of injection and severe pain, so they have devoted considerable time to the study of new methods and new forms of antimony. Finding that in dogs the subcutaneous and intramuscular administration caused pain and sloughing of the tissues, intravenous injections of the salts were tried. The elimination of the antimony was so rapid, however, that, beyond prolonging life, little good effect was produced; so that eventually the injection of the metal itself, in state of finest division (devised and prepared for them by Dr. R. H. Aders Plimmer, of University College), was tried. This is taken up by the leucocytes, and is gradually transformed into some soluble compound, and their idea was that perchance it might be carried to parts of the body not easily accessible to other methods of administration. The results so far have been, on the whole, more satisfactory than those of any other means they have tried, but the technique in many animals is difficult, and there have been difficulties in the preparation of the antimony. Although putting a metal into the circulation sounds impossible, they have not had any case of plugging of capillaries in rats, guinea-pigs, rabbits, dogs, goats, or horses. It of course acts much more slowly than the salts, and takes from two to three times as long to clear the peripheral circulation of trypanosomes as subcutaneous injection of a salt does. But the excretion is also much slower, so that the blood and organs are in much longer contact with antimony than when a salt is administered. If carefully administered no irritation of the tissues is produced, and the vessel walls are not affected. Animals appear to be more susceptible to overdosage than with the salts; and it is curious that an animal with trypanosomes in the blood can bear well a dose which is fatal to a healthy animal. It has also been used intraperitoneally successfully in rats and rabbits. A number of experiments have been made with silver salts, with negative results in every case. A number of experiments have been made with two new compounds (one an arsenic-camphor compound, one an organic antimony compound) kindly sent to them by Dr. Morgan, of the Imperial College of Science, with negative results.—Dr. J. W. W. **Stephens** and Dr. H. B. **Fantham**: The peculiar morphology of a trypanosome from a case of sleeping sickness, and the possibility of its being a new species (*Trypanosoma rhodesiense*). The main points of the paper may be thus summarised:—(1) This trypanosome was first observed by one of the authors (J. W. W. S.) in February in the blood of a rat infected from a case of sleeping sickness. (2) The patient, W. A., infected in Rhodesia, had never been in *Glossina palpalis* areas, though he had been in areas infested with *G. morsitans* and *G. fusca*. (3) The trypanosome shows long forms and short stout or stumpy forms with hardly any free flagellum, *but it is unique in that about 6 per cent. of the forms have the nucleus at the posterior* (non-flagellar) end *near the blepharoplast, and in some cases actually posterior to it.* (4) Such forms have not been described before in any known strain of *T. gambiense*. (5) Prolonged search has been made for them in the stock laboratory strain of *T. gambiense*, but they have not been found. (6) They are not due to the drying of the blood films, because they can be seen by *intra vitam* staining, and because dried films of the ordinary *T. gambiense* strain do not show them. (7) They are not degenerate, as division forms of them occur. (8) They are not due to drug treatment, because the original animals were inoculated before treatment was begun. (9) These forms still persist in rats, guinea-pigs, rabbits, and monkeys. (10) On morphological grounds the authors believe they are dealing with a new species of human trypanosome also causing sleeping sickness, for which they propose the name *T. rhodesiense*.—Dr. F. W. **Mott**: Note upon the

examination, with negative results, of the central nervous system in a case of cured human trypanosomiasis. A Sikh belonging to the 4th K.A.R. (aged thirty at death) was found to be suffering from trypanosomiasis in June, 1905, and received treatment with inorganic arsenic. The drug was given intermittently for eighteen months or more, and pushed until toxic symptoms of neuritis and mental dullness rendered further energetic treatment impossible; trypanosomes were then no longer obtained by puncture of the glands. Unfortunately, there is no note of lumbar puncture having been performed until a few months before death. Sir David Bruce, in December, 1908, saw this man, and stated that he appeared to be in excellent health. A year later he was seen by Captains Hamerton and Bateman, who reported no symptoms of sleeping sickness. They made a very careful investigation of the blood, both by microscopic examination and by experimental injection into monkeys; the results were negative. In June lumbar puncture was performed, and 17 c.c. of fluid withdrawn; the centrifuged fluid showed no lymphocytosis or trypanosomes; injection of the fluid into a monkey was followed by negative results. The patient was attacked with pneumonia in August, and died three days after admission to the hospital. *Post mortem* the brain was found quite normal in appearance, and there was no excess of fluid. *Histological Examination.*—Sections were prepared of portions of the cerebrum, cerebellum, and medulla oblongata by all the methods which the author had previously adopted for the examination of sleeping-sickness cases. He found no trace of the characteristic meningeal and perivascular infiltration nor of gliosis. It may therefore be asserted that this case proves that human trypanosomiasis is curable, but it does not prove that sleeping sickness is curable, for the author contends that the diagnosis of "sleeping sickness" can only be made when there is a proof that the trypanosomes had invaded the sub-arachnoid space. The tissues were forwarded to the author by C. A. Wiggins, the acting principal medical officer of Uganda.—Miss M. P. **Fitzgerald**: The origin of the hydrochloric acid in the gastric tubules.—Dr. A. **Harden** and R. V. **Norris**: The fermentation of galactose by yeast and yeast juice (preliminary communication).—W. M. **Thornton**: The opposite electrification produced by animal and vegetable life.—R. **Kirkpatrick**: A remarkable pharetronid sponge from Christmas Island.

Challenger Society, October 26.—Dr. A. E. Shipley in the chair.—Mr. **Earland** exhibited and made remarks upon *Pilulina jeffreysii*, a rare species of Foraminifera dredged west of St. Kilda by the *Goldseeker*, which had only been recorded once since its discovery by the *Porcupine* in 1869.—Mr. Tate **Regan** discussed the evolution of the flat-fishes, which he regarded as asymmetrical perches; from some form not unlike Psettodes, indifferently dextral or sinistral, had arisen two well-marked groups, and each of these had split into two series, a sinistral and a dextral. Parker's researches on the optic nerves had made it clear that reversal to the asymmetry of opposite sign was secondary in the Pleuronectidæ.

PARIS.

Academy of Sciences, October 31.—M. Émile Picard in the chair.—The president announced the loss by death of M. Gernez.—Henri **Douvillé**: Some cases of adaptation. The origin of man. A discussion of some modifications produced in various species by change in the conditions of life, including changes which may possibly have been produced in the anthropoid apes by lower temperature, reduced rainfall, and consequent destruction of forests.—M. **Coggia**: Observations of the new Cerulli planet (KU) 1910, made at the Observatory of Marseilles with the Eichens equatorial of 26 cm. aperture. Observations are given for October 21 and 22, and also the positions of the comparison star.—H. **Larose**: The extinction of the discontinuities by reflection at the extremities of a telegraphic line. In a previous paper the expressions for the potential and current on a telegraphic line of indefinite length were given; the case of a line of limited length is worked out in the present communication.—G. A. **Hemsalech**: The influence of the magnetic field on the duration of the lines of the spectrum emitted by luminous vapours in the electric spark. In a magnetic field the durations of nearly all the lines are diminished, and the intensity of the action on the different lines appears to be selective. Nearly all the lines diminish in intensity except in the immediate neighbourhood of the electrode.—Georges **Claude**: The preparation of argon. Compressed oxygen prepared by the fractional distillation of liquid air is now an article of commerce. If the proportion of oxygen is more than 95 per cent., as is always the case in practice, the chief impurity is argon, the volatility of which is intermediate between that of oxygen and that of nitrogen. Since the oxygen is very readily absorbed, such a mixture forms an advantageous starting point for the preparation of argon.—L. **Gay**: The osmotic equilibrium of two fluid phases.—M. **David**: A method of analysis of fatty bodies by the separation of the solid fatty acids from the liquid acids. This method is based on the fact that, at a temperature of 13° to 14° C., the ammoniacal salts of the solid fatty acids are absolutely insoluble in a large excess of ammonia, whilst the ammoniacal salts of the liquid acids are completely soluble. Results are given of the application of the method to the separation of stearic or palmitic acid from oleic acid.—G. **Darzens** and H. **Rost**: The synthesis of ketones in the tetrahydroaromatic series. Cyclohexene is treated with an acyl chloride in presence of aluminium chloride, and the product of the reaction heated with an excess of diethylaniline. The physical properties of four ketones prepared by this method are described.—Em. **Bourquelot** and M. **Bridel**: A new sugar, verbascose, extracted from the root of *Verbascum Thapsus*. The mode of extraction employed is given in detail. The new sugar is analogous to stachyose, of which it would appear to be an isomer and from which it differs by its higher melting point and its greater rotatory power; it gives levulose, glucose, and galactose on hydrolysis.—G. **Friedel** and F. **Grandjean**: Liquids with focal conics. Liquids of the group of ethyl azoxybenzoate are characterised by the existence of groups of focal conics in their mass or at their surface.—P. A. **Dangeard**: Two lower organisms met with in the Roscoff laboratory.—A. **Imbert**: The influence exerted by pain on the form of ergographic diagrams of fatigue.—H. **Truc** and C. **Fleig**: The experimental and chemical ocular action of bitumen dust and vapour. Bitumen dust can rapidly produce various lesions of the eye in man. The condition of the eye before exposure is an important predisposing cause, and the action of sunlight is also prejudicial. The lesions resulting from the action of bitumen vapour upon the eye are comparatively slight.—M. **Urbain**, Cl. **Scal**, and A. **Feige**: The sterilisation of water on the large scale by ultra-violet light. The water is caused to circulate spirally round a source of light in such a manner that with a flow of 20 cubic metres per hour the water is exposed for three minutes to the rays. With this device complete sterilisation of water has been obtained with an expenditure of twenty watts per cubic metre.—Ch. **Gravier**: The duration of life in the Madrapores.—Henry **Pénau**: The cytology of *Endomices albicans*.—Y. **Deprat**: The geographical distribution of the different layers recognised in Yun-nan (Geological expedition, 1909–10).—Julius **Schuster**: The geological age of the Pithecanthropus of the pluvial period in Java. From a study of the fossil plants collected from the Quaternary deposits of Lasem, Java, the author is able to confirm his earlier estimate of the age of Pithecanthropus. If with Penck the age of *Homo heidelbergensis* be taken as 300,000 years, Pithecanthropus lived at least 400,000 years ago.—Louis **Gentil**: Geological sketch of the massif of Kebdana (Eastern Morocco).—E. A. **Martel**: The chasms of the Pyrenees. A short description of seven groups of subterranean fissures, eighty-four in all, together with a discussion of their effect on the water supply of the district.

DIARY OF SOCIETIES.

THURSDAY, NOVEMBER 10.

ROYAL SOCIETY, at 4.30.—The Tidal Observations of the British Antarctic Expedition, 1907: Sir George Darwin, K.C.B., F.R.S.—Conduction of Heat through Rarefied Gases: F. Soddy F.R.S., and A. J. Berry.—The Chemical Physics involved in the Precipitation of Free Carbon from the Alloys of the Iron Carbon System: W. H. Hatfield.—A Spectroscopic Investigation of the Nature of the Carriers of Positive Electricity from

heated Aluminium Phosphate: Dr. F. Horton.—On the Determination of the Tension of a recently-formed Water surface: N. Bohr.—Aërial Plane Waves of Finite Amplitude: Lord Rayleigh, O.M., F.R.S.—Observations on the Anomalous Behaviour of Delicate Balances, and an Account of Devices for increasing Accuracy in Weighings: I. J. Manley.—On the Improbability of a Random Distribution of the Stars in Space: Prof. F. W. Dyson, F.R.S.—The Conditions necessary for Discontinuous Motion in Gases: G. I. Taylor.—(1) On the Radium Content of Basalt; (2) Measurements of the Rate at which Helium is produced in Thorianite and Pitch-blende, with a Minimum Estimate of their Antiquity: The Hon. R. J. Strutt, F.R.S.

MATHEMATICAL SOCIETY, at 5.30.—Annual General Meeting.—The Relation of Mathematics to Experimental Science (Presidential Address): Sir W. D. Niven.—Properties of Logarithmico-exponential Functions: G. H. Hardy.—The Double Six of Lines: G. T. Bennett.—On Semi-integrals and Oscillating Successions of Functions: Dr. W. H. Young.—On the Existence of a Differential Coefficient: Dr. W. H. Young and Mrs. Young.—The Analytical Extension of Riemann's Zeta-function: F. Tavani.—The Geometrical Representation of non-real Points in space of Two and Three Dimensions: T. W. Chaundy.—The Extension of Tauber's Theorem: J. E. Littlewood.—A Note on the Property of being a Differential Coefficient: Dr. W. H. Young.—The Stability of Rotating Shafts: F. B. Pidduck.—A Class of Orthogonal Surfaces: J. E. Campbell.—On Non-integral Orders of Summability of Series and Integrals: S. Chapman.—Optical Geometry of Motion: A. A. Robb.—Lineo-linear Transformations, specially in Two Variables: Dr. A. R. Forsyth.—On the Conditions that a Trigonometrical Series should have the Fourier Form: Dr. W. H. Young.—Notes on Terminating Hypergeometric Series: Dr. W. F. Sheppard.—The Transformation of a particular type of Electromagnetic Field and its Physical Interpretation: H. Bateman.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—Inaugural Address of the President: S. Z. de Ferranti.

SOCIETY OF DYERS AND COLOURISTS, at 8.—A Comparison between the Action of Dyeing, Tanning, and Vulcanisation: W. P. Dreaper.

FRIDAY, NOVEMBER 11.

ROYAL ASTRONOMICAL SOCIETY, at 5.—On the Formulæ for comparison of Observed Phenomena of Jupiter's Satellites with Theory: W. de Sitter.—Photographs of Halley's Comet taken with the Astrographic Telescope at the Cordoba Observatory: C. D. Perrine.—Third note on the number of Faint Stars with large Proper Motions: H. H. Turner.—(1) Mean Areas and Heliographic Latitudes of Sun-spots in 1907, 1908, and 1909; (2) Observations of Minor Planets in 1909; (3) Observations of Jupiter's Eighth Satellite in 1910: Royal Observatory, Greenwich.—*Probable Papers*: Preliminary Comparison with Observation of the Tables of the Four great Satellites of Jupiter: R. A. Sampson.—(1) The Systematic Motions of the Stars of Boss's "Preliminary General Catalogue"; (2) Note on a Moving Cluster of Helium Stars in Perseus: A. S. Eddington.

MALACOLOGICAL SOCIETY, at 8.—On the names used by Bolten and Da Costa for genera of Venerdiæ: A. J. Jukes-Browne, F.R.S.—On New Melaniidæ from Goram and Kei Islands, Malay Archipelago: H. B. Preston.—On the Anatomy of the British Species of the Genus Psammobia: H. H. Bloomer.—Note on *Triton tesselatus*: Major A. J. Peile.

PHYSICAL SOCIETY, at 8.—On the supposed Propagation of Equatorial Magnetic Disturbances with Velocities of the Order of 100 miles per second: Dr. Chree, F.R.S.—On Cusped Waves of Light and the Theory of the Rainbow: Prof. W. B. Morton.—Exhibition of a Brightness Photometer: J. S. Dow.

TUESDAY, NOVEMBER 15.

ROYAL ANTHROPOLOGICAL INSTITUTE, at 8.15.—The Castes of Eastern Bengal (Epidiascope): Sir H. H. Risley, K.C.I.E., C.S.I.

ZOOLOGICAL SOCIETY, at 8.30.—On the Inheritance of the Webfoot Character in Pigeons: J. Lewis Bonhote.—Notes on the little-known Lizard *Lacerta jacksoni* Blgr., with special reference to its Cranial Characters: Edward Degen.—On *Lacerta peloponnesiaca* Bibr.: G. A. Boulenger, F.R.S.—Remarks on Two Species of Fishes of the Genus Gobius, from Observations made at Roscoff: Edward G. Boulenger.

ROYAL STATISTICAL SOCIETY, at 5.—Presidential Address on a Statistical Survey of the Problems of Pauperism: Lord George Hamilton, G.C.S.I.

MINERALOGICAL SOCIETY, at 5.30.—Anniversary Meeting.—Further Notes on Wood-tin: J. H. Collins.—On the Alteration of the Felspar of Granites to China-clay: J. M. Coon.—On Wiltshireite, a new Mineral from the Binnenthal: Prof. W. J. Lewis.—A new Locality of Phenakite in Cornwall: A. Russell.

JUNIOR INSTITUTION OF ENGINEERS, at 7.30.—Presidential Address on the Influence of Pure Science in Engineering: Sir J. J. Thomson, F.R.S.

INSTITUTION OF CIVIL ENGINEERS, at 8.—*Further discussion*: The London County Council Holborn to Strand Improvement, and Tramway-Subway: G. W. Humphreys.

WEDNESDAY, NOVEMBER 16.

ROYAL METEOROLOGICAL SOCIETY, at 7.30.—Results of the Hourly Balloon Ascents made from Manchester, March 18th–19th, 1910: Miss Margaret White.—Registering Balloon Ascents, December 6th to 11th, 1909, and August 8th to 13th, 1910: W. H. Dines, F.R.S.—Pilot Balloon Observations in Barbados, December 6th to 11th, 1909: Charles J. P. Cave.—Report on Balloon Experiments at Blackpool: Capt. C. H. Ley.—Registering Balloon Ascents at Liverpool, June 21st to 23rd, 1910: W. Marriott.

ROYAL MICROSCOPICAL SOCIETY, at 8.—Specimens of British Mycetozoa: A. E. Hilton.

ENTOMOLOGICAL SOCIETY, at 8.

THURSDAY, NOVEMBER 17.

ROYAL SOCIETY, at 4.30.—*Probable Papers*: On the Effect of Gravity upon the Movements and Aggregation of *Euglena viridis* Ehrb. and other Micro-organisms: Harold Wager, F.R.S.—The Influence of Bacterial Endotoxins on Phagocytosis (including a new method for the Differentiation of Bacteria). (Second Report): L. S. Dudgeon, P. N. Panton, and H. A. F. Nilson.—On the State of Aggregation of Matter. Part I. On the Action of Salts in Heterogeneous Systems, and on the Nature of the Globulins. Part II. On the Action of Formaldehyde on Witte's Peptone. Part III. On the Solubility of Phenol and certain Crystalline Substances in Salt Solutions: Dr. S. B. Schryver.—The Proteolytic Enzyme of Drosera: Miss Jean White.—A Method for Isolating and Growing the Leprosy Bacillus of Man: F. W. Twort.—The Oxidation of Phenol by certain Bacteria in Pure Culture: G. J. Fowler, E. Ardern, and W. T. Lockett.

LINNEAN SOCIETY, at 8.—(1) Theoretical Origin of *Plantago maritima* and *P. alpina*, from *P. coronopus*; (2) Supplementary Observations on the Theory of Monocotyledons being derived from Aquatic Dicotyledons: Rev. George Henslow.

ROYAL GEOGRAPHICAL SOCIETY, at 5.—Research Meeting. Origin of the Present Geography of Northern Nigeria: Dr. J. D. Falconer.

FRIDAY, NOVEMBER 18.

INSTITUTION OF MECHANICAL ENGINEERS, at 8.—The Development of Road Locomotion in Recent Years: L. A. Legros.

CONTENTS.