THURSDAY, DECEMBER 4, 1913.

ANTARCTIC METEOROLOGY.

National Antarctic Expedition, 1901–1904. *Meteorology*. Part ii. Comprising Daily Synchronous Charts October 1, 1901, to March 31, 1904. Prepared in the Meteorological Office, under the superintendence of M. W. Campbell Hepworth, C.B. Pp. 26+charts. (London: The Royal Society, 1913.) Price 21*s*.

THIS work completes the series of meteorological investigations which were begun after the return of the National Antarctic Expedition in the year 1904. While the first volume, which appeared in the year 1908, dealt with the meteorological observations of the *Discovery* station and of the sledge journeys carried out from there, the second volume now published gives the results of the International Meteorological Cooperation, which existed from 1901 to 1904, in order to discuss, in a summarised form, the weather conditions of the higher southern latitudes during that period of investigation. For this purpose it was from the first arranged, at the instigation of the German authorities, to construct daily synoptic weather charts of the higher southern latitudes for the period October 1, 1901—March 31, 1903. The data for these charts were to be supplied by the land stations on the southern continents, and by ships of all nationalities which were during that time further south than 30° S. latitude. These were requested to take observations daily at the time of Greenwich noon, relating to air-pressure, temperature of the air and sea, amount and motion of clouds, precipitation, and other noteworthy phenomena.

As the ship *Discovery* remained fixed in the ice a second year, it was agreed to extend the International Cooperation for another year, viz., to March 31, 1904. The data thus obtained, which covered a period of two and a half years, were, after the termination of the cooperation, collected at the Meteorological Office in London, and at the Bureau of the German South Polar Expedition in Berlin, and at both places the plan of constructing weather charts was then further considered. The result of the English discussion, prepared under the superintendence of Commander Hepworth, is contained in the volume now under review. The German discussion, which was handed over by the leader of the German South Polar Expedition, Dr. von Drygalski, to myself and Mr. Mecking, is under publication. A first part, which dealt with the monthly isobaric charts from October, 1901, to March, 1904, and the climatic conditions of Cape Horn, was published in the summer of 1911. The continuation in the course of next year will include the daily synchronous weather charts, together with their discussion.

In the work under review the weather charts of the south polar region are drawn on the polar projection on the scale of about 1 : 130 millions for the period in question. Of the elements relating to the weather only wind-direction and force, air-pressure (without correction for gravity), air-temperature at individual stations, and at the ships' positions, are given; not sea-temperature, cloud, and hydrometeors, which are probably omitted for want of space. With the aid of air-pressure and wind observations, isobars are drawn, but are apparently limited essentially to simultaneous observations at Greenwich noon only, without regard to changes of weather from day to day. Consequently the run of the isobars on the charts between positions of far-distant ships is practically disconnected and uncertain. By the addition of the regular four-hourly ships' observations a much better basis for drawing the isobars might have been obtained; this will be done in the German publication.

It is also noticeable that the isobars between neighbouring places of observation are not brought into harmony and connection, which in many cases might have been easy, and would appear to be necessary. Compare, for instance, the isobars of November 4, 1902, southward of Australia and eastward of South America. In these circumstances one could not, in most cases, accurately locate "High" and "Low" on the charts and identify them from day to day. It therefore seems hazardous to use the charts for systematic investigations relating to the velocity of translation of anti-cyclones and cyclones. In the brief text which accompanies the charts, the author has restricted himself to noting the amount of progression of nine depressions only, which could be identified on the charts after about every eight days. From these he has drawn the following conclusion:—"If the centres of the respective cyclonic depressions have been correctly located, the average daily rate at which they progressed was nearly 300 nautical miles."

As regards anticyclones the case was only more favourable in the area of the Australian and South American continents. But there is no detailed information in the text as to what new results could be deduced from the charts in question; generally speaking only the older investigations of Hepworth, Russell, Lockyer, and Rawson are referred to, and the general remark made that the views of the first-named are confirmed by the new publication. Commander Hepworth especially ob-

jects to Russell's deduction that the southern sub-tropical anticyclones have a daily west-east movement of 460 nautical miles; this figure is thought to be much too high, and not confirmed by ships' observations. It would appear more likely that the depressions travelled quickly, and determined the alternation of weather conditions on the south border of the sub-tropical anticyclones, the movements of which, according to the weather charts, are shown to be erratic and slow.

The average paths followed by the depressions are, so far as possible, deduced from the daily charts and entered on unpublished charts. Unfortunately, only general information on the results of this investigation is contained in the text to the atlas. The following are the principal conclusions:—

"The average path of all central areas of depressions charted for the entire period, October, 1901, to March, 1904, is found to have been in about the 52nd parallel. Between the meridians of 20° E. and 150° E., that is to say, over the South Indian division of the Southern Ocean, it was between the 49th and 50th parallels; and between 150° E. and 70° W., the South Pacific division, in about the 55th. . . During the summer months the 53rd was the average parallel along which the centres travelled eastward in the Indian division, and they followed a path between the 56th and 57th in that of the Pacific. During autumn and winter the paths were confined to zones between 48° S. and 49° S. in the South Indian division, and between 55° and 56° S. in the Pacific."

For the south-western Atlantic Ocean it is shown that the paths of the depressions eastward of 56° W. take the direction towards E., S.E., or N.E. In autumn and winter the paths in all parts of the Southern Ocean are more scattered than in spring and summer. But, in my opinion, these statements of the mean geographical latitude of the tracks require an essential limitation. It is plainly not a question of the paths of the *centres* of the depressions as there stated. Moreover, in the circumstances, the determination of these centres in the Southern Ocean was really not possible, as the range of the area of weather charts in the Indian and Pacific Ocean does not extend far enough to the south. In the Indian Ocean vessels rarely go beyond 50°, or in the Pacific Ocean beyond 55° S.

On the charts, so far as these latitudes, the isobars in low-pressure regions usually show no closed form; on the contrary, they are open towards the south, a sign that the centres of the depressions usually lie more southerly than those latitudes. In fact, it is already known from the observations of the South Polar expeditions that the zone of west winds has its southerly limit beyond 60°, and consequently the mean paths of the depressions are also to be looked for in this high latitude. The writer has determined this latitude as 63° S. for the meridian of the *Gauss* station (90° E.). South of Cape Horn, 62° S. may be assumed, while eastwards in the Weddell Sea the depressions draw still more to the southward. The latitudes above indicated, therefore, only refer to those northerly offshoots of the depressions which extend to the regions represented by synoptic charts, and which often have the character of secondary depressions. As a matter of fact, therefore, those figures furnish no answer to the important question as to where the depressions of the southern temperate zone are to be looked for. On this point only the discussion of the results of the synchronous South Polar Expeditions, in conjunction with the weather charts, can give information.

In the text accompanying the charts the results of the expeditions are only referred to briefly. The author there restricts himself essentially to some general remarks on the character of the easterly winds at the south polar stations. He rightly holds them to be of cyclonic origin, which agrees with the writer's views in the discussion of the wind observations at the *Gauss* station (1905), and subsequently stated in more detail. And the warm, stormy, south-easterly winds at the *Discovery* station are also indicated as cyclonic air-currents, which bring their warmth and moisture with them from low latitudes. The occurrence of corresponding storm periods at the Kerguelen and *Gauss* station is shown in twelve cases, proving that a connection exists between them, as had also been remarked by the writer. The publication of hourly observations at both stations in the German South Polar work allows the comparison to be still more thoroughly and forcibly demonstrated.

In the discussion of the weather conditions of the Weddell Sea, the important investigations of Mossman and Mecking were certainly worthy of being mentioned. The explanatory text of the work now in question contains in the smallest space only general facts about those conditions which have long been known and fully established by the investigators named.

In addition to the daily weather charts there are monthly charts of air-pressure and air-temperature for the period in question (October, 1901—March, 1904), and opposite to these are placed the normal charts for comparison. From these some general conclusions are drawn upon the deviations of the individual seasons and years, but without detailed comparison; and a precise account of the method on which these monthly

charts are drawn is not given in the text. The monthly isobaric charts published by the German South Polar Expedition, and partly discussed in detail, are not referred to.

The daily weather charts are also utilised in determining the frequency of winds and storms in the different 10° zones of latitude; these are given in tabular form, but no conclusions are drawn from them.

In the preface to the volume the president of the Royal Society, Sir Archibald Geikie, makes some very useful corrections to volume i. of the Meteorology of the National Antarctic Expedition. These refer specially to the question whether on the sledge journeys of the *Discovery* expedition the wind-directions were noted by true or magnetic bearings. W. MEINARDUS.

THE GROUP-ORIGIN OF SPECIES.

Gruppenweise Artbildung, unter spezieller Berücksichtigung der Gattung Oenothera. By Prof. Hugo de Vries. Pp. viii + 365 + 22 coloured plates. Figs. 121. (Berlin: Gebrüder Borntraeger, 1913.) Price 22 marks.

IT may be said at once that the facts in this volume represent perhaps the most compendious and extensive experimental treatment of hereditary phenomena which has yet been accomplished in one limited group of organisms, and as such it deserves careful study by all students of genetics. The book is an outgrowth and further development of the views expressed by de Vries in "Die Mutationstheorie" (1901–03). Those views were, as is well known, founded chiefly upon the author's experiments with Oenothera, the mutation theory of sudden germinal changes being also based to some extent upon his conception of intracellular pangenesis.

The present volume, therefore, marks not only an important advance in our knowledge of the hereditary behaviour in the evening primroses, but also coordinates, and develops to a remarkable degree the views of the author on the general subject of heredity and its relation to mutation. The strength of this present work lies in the fact that the new empirical results all receive their interpretation in terms of the earlier theory. And it must be said that the enormous mass of experimental data with Oenothera has been coordinated and rendered intelligible in a striking way by the application of the author's earlier conceptions.

De Vries adheres to the view that characters which are independently inherited must be represented by separate structures (pangens) in the cell, and one of the basic conceptions of the book is that these pangens are not simply present or absent from the cell, but may exist in one of three conditions: (1) active, (2) inactive, or (3) labile. On this basis the whole explanation, not only of several different types of hereditary behaviour in wild species and mutants, but also of the mutation phenomena themselves, is worked out. A theory which can bring into harmonious relation such a vast body of evidence is of much service, even though its validity may not be final.

Since the phenomena of heredity occupy such an important part of the book, a few of the general results of crossing may be mentioned. By series of interspecific crosses it is shown that various wild species, including *O. biennis* L., *O. muricata* L., and *O. cruciata* Nutt., carry entirely different characters in their male and female germ cells. Such species are called heterogamous. The pollen grains usually carry a type corresponding nearly with the external characters of the species, while the egg cells may carry a very different type. Other species of Oenothera, such as *O. Hookeri, O. strigosa,* and *O. Lamarckiana*, are, like most wild species, isogamous, *i.e.*, bearing the same qualities in their eggs and pollen grains. In heterogamous species the reciprocal crosses are, of course, unlike.

In the subsequent crosses, several distinct types of hereditary behaviour are recognised, *e.g.* (1) twin hybrids—two types unlike either parent, and which subsequently breed true or split, being produced in the F_1; (2) the formation of intermediate hybrids, which remain constant; (3) splitting in F_1 into the two parent types, which afterwards breed true; (4) Mendelian splitting, in F_2. The mutations from *O. Lamarckiana* are thus classified according to the type of behaviour they exhibit.

These types of behaviour again are discussed in terms of pangens. Why, for instance, does *O. Lamarckiana* × *O.* mut. *nanella* give dwarfs in the F_1, while in *O.* mut. *rubrinervis* × *O.* mut. *nanella* dwarfs first appear in F_2? This is because the former cross represents a labile × inactive pangen, while in the latter we have the active × inactive condition. In this way many of the hereditary peculiarities of the Oenotheras are "explained" by the same theory which explains the mutations themselves. It is considered that a mutation consists in the change of a pangen from one condition to another, and sometimes in the formation of new pangens. These conceptions are largely in harmony with the cytological facts.

Aside from these theoretical matters, one of the most important contributions of the work is to show by many instances that new and constant races frequently result from crossing—races the characters of which, moreover, are not Mendel-

ian recombinations, but in which many of the characters have been modified. The most prominent achievements of the book appear to be in showing (1) that mutation as a process is not to be confounded with the mere recombinations of unit-characters, and (2) that various types of hereditary behaviour exist, only occasional characters showing the Mendelian type of segregation.

R. R. G.

THE NEW PSYCHOLOGY.

(1) *Man and His Future.* Part ii., The Anglo-Saxon: His Part and His Place. By Lieut. Col. William Sedgwick. Pp. 217. (London: Francis Griffiths, 1913.) Price 6*s.* net.

(2) *The Fate of Empires: being an Inquiry into the Stability of Civilisation.* By Dr. A. J. Hubbard. Pp. xx+220. (London: Longmans, Green and Co., 1913.) Price 6*s.* 6*d.* net.

(3) *The Science of Human Behaviour: Biological and Psychological Foundations.* By Dr. Maurice Parmelee. Pp. xvii+443. (New York: The Macmillan Company; London: Macmillan and Co., Ltd.) Price 8*s.* 6*d.* net.

(4) *Die Neue Tierpsychologie.* By Georges Bohn. Autorisierte deutsche Ubersetzung von Dr. Rose Thesing. Pp. viii+183. (Leipzig: Veit and Co., 1912.) Price 3 marks.

IT may be stated as a truism that every new development of science modifies opinion as to the meaning and destiny of man himself. Well-intentioned sentimentalists, like the late Henry Drummond, try to "reconcile" science and religion by a metaphorical interpretation of both. Such attempts illustrate the popular instinct for unification, which is itself a part of religion and the kernel of metaphysical philosophy. Such a volume as Lieut.-Colonel Sedgwick's "Man and his Future" (1) is thus a sociological phenomenon, illustrating the vitality and variation of popular philosophy. The Anglo-Saxon, he says, has instituted the Age of Machines and Instruments; by means of these he is beginning to separate the component bricks of the universe (Clerk Maxwell's metaphor)—the atoms. Man is therefore on the eve of a great development, which is the integration of the whole universe (Herbert Spencer's metaphor)—whatever that may mean—by the employment of the forces of attraction against those of repulsion. The former and the men using them are, says this author, guided by Christ; the latter by Satan. A pre-occupation with the periodic theory of Mendeléeff and his school is the basis of these lucubrations.

On a higher but equally metaphorical plane is Dr. Hubbard's "The Fate of Empires" (2). This work, both in substance and in style, is an echo of Kidd's "Social Evolution." The author is struck by the simultaneity in civilisation of socialistic phenomena and a declining birthrate. First-hand acquaintance with the intensive population and the family instinct (*hiao*) of China has inspired an investigation into the causes of the fall of Greece and Rome. The cure of the fate of empires is religious motive, which, says our author, is the final social impulse, superseding reason, as reason superseded instinct. But, as has been done before, he confuses "reason" with the acquisitive instinct.

The scientific student of man and his meaning, fate, or place in the universe may be thoroughly recommended to Dr. Parmelee's study of his behaviour, or, rather, introduction to the subject (3). The work of men like Jennings, Loeb, and Bohn has revolutionised animal psychology, and is now influencing human. "Animal Behaviour" has inspired "Human Behaviour." Dr. Parmelee gives a clear and up-to-date account of the facts of tropism, sense of difference (*Unterschiedsempfindlichkeit* of Loeb, *sensibilité différentielle* of Georges Bohn), "instinct," and the associational intelligence. His judgment is discriminating, and the general student could not have a better introduction to comparative psychology in its application to man and society. His anthropological discussion is confined to the impulses behind the social "instinct." Preceding this is a good account of animal "societies."

The scope of the book may be illustrated by the following:—

"In all study of behaviour it is necessary to begin with the structural form upon which is based the action-system which determines the behaviour. . . . Then were studied the direct reactions of the lower animals to external forces. But when the nervous system developed, these reactions became more or less indirect, so that we find new types of behaviour appearing. The fundamental type of behaviour determined by the nervous system is the reflex action. These actions become in course of time combined into complex forms, which are usually called instincts. . . . There has been a tendency on the part of many writers . . . to regard instinct as a form of behaviour which is not mechanically determined. The attempt has therefore been made in this book to render the conception of instinct more precise. . . . Intelligent behaviour . . . marks a new stage . . . determined by individual experience."

Consciousness and mind are then discussed, Sherrington's work being largely used.

The second of Bohn's classic handbooks to modern animal psychology has now (4), like his "La Naissance de l'Intelligence," been translated into German. "La Nouvelle Psychologie animale"

was published two years ago, and the two together are already standard introductions to the modern developments of the study of mind. He prefixes as a motto the words of Giard—"L'idée de science est intimement liée à celle de mécanisme et de déterminisme." But, as students are aware, the point of view is not a temperamental or sentimental aversion from the "finalists"; it merely represents the extraordinary precision which the new methods have introduced into what was once the vaguest and most fantastic of studies. Both account and criticism are excellent, as of selection of movements, the theory of trial and error, the incompleteness of adaptation.

The analysis of some special "instincts," viz., feigning death, return to rest, the search for food, mimicry, social "instincts," is a valuable part of the book. Equally valuable and especially interesting is the discussion of methods, such as the *Dressurmethode* (the training of animals), *Vexierkasten* (puzzle boxes), labyrinths, &c. One of the newest is that of Pawlow, to which is devoted the largest section. The chief work of the great Russian physiologists, Pawlow, Zéliony, and Orbéli, is based on their remarkable tests of psychical saliva-reaction, as yet not so well known in England as they deserve.

A. E. CRAWLEY.

POPULAR BOTANICAL PUBLICATIONS.

(1) *Plant Life.* By Prof. J. Bretland Farmer. Pp. viii+255. (London: Williams and Norgate, n. d.) Price 1*s.* net.

(2) *Toadstools and Mushrooms of the Countryside.* By Edward Step. Pp. xvi+143+136 plates. (London: Hutchinson and Co., 1913.) Price 5*s.* net.

(3) *Wild Flower Preservation.* By May Coley. Pp. 181+29 plates. (London: T. Fisher Unwin, n. d.) Price 3*s.* 6*d.* net.

(1) IN this welcome addition to the well-known "Home University Library," Prof. Farmer has produced a work which, owing to its freshness of treatment of various problems of plant life, will be useful to students of botany, besides fulfilling admirably the object of the series of which it forms part—namely, the popularising of knowledge and the creation as well as the satisfaction of a desire among general readers for really authoritative and accurate, though simplified, treatises on various branches of knowledge, published at a popular price. The keynote of the book is the presentation of the main features of plant form from the viewpoint of function, and the author has touched upon various matters not usually discussed in works of this limited size, instead of simply going over ground already covered in numerous books of this scope.

Of the twenty chapters into which the book is divided, the first five deal mainly with the lower green algæ, and it would be difficult to devise a better starting-point than that afforded by these simple types, which serve as an admirable introduction to the study of the fundamental facts of plant life. Following an account of the work of the green leaf and the root, in which emphasis is rightly laid on the manner in which the whole conformation of the plant is dominated by the leaf or other equivalent green surface, there is an admirable chapter on mechanical problems and their solution. A large section is then devoted to the adaptations shown by climbing and aquatic plants and epiphytes, as well as the relations of plants in general to water supply. Subsequent chapters deal with fungi, fungal and flowering-plant parasites, various cases of symbiosis, vegetative and sexual reproduction, and finally the nucleus and the process of fertilisation. An appendix gives a short but well-chosen bibliography.

(2) Mr. Step's handy guide to the larger fungi is a marvel of cheapness, the excellent photographic illustrations being alone well worth the price of the book. The cap-fungi lend themselves so well to "popular" treatment, owing to the absence of technical terminology in their description, that it is perhaps a matter for surprise that a work of this kind has not been published earlier, and there can be little doubt that the author's reputation for the production of readable accounts of our native plants, illustrated by skilful photographs, will ensure for the present work a wide sale. Mr. Step has purposely refrained from dealing with the classification of the plants dealt with, but the book would certainly have been rendered more useful if he had supplied a simplified key for enabling the beginner to identify the species described and depicted in the book.

(3) One is inclined to look askance at a book the main object of the author of which appears to be the advocacy of extensive collecting and drying of wild flowers, root and all, rather than the other aspect of "wild flower preservation" concerning which much has been written recently by those who deplore the raids made upon our native flora by collectors of various kinds. To be quite fair, it must be admitted that the author does deprecate greedy and destructive gathering, and that her book is written in a pleasant and enthusiastic style which to a large extent disarms criticism; while her suggestions on the keeping of records in a note-book, &c., are likely to prove

useful to young botanists. In fact, this work would be all that is desirable for the attraction of new adherents to nature study if the author were either to omit entirely the portions dealing with the preparation of herbarium specimens, or to exhort the reader to keep on the safe side of "wild flower preservation" by refraining from digging up any except the very commonest plants; after all, the roots of plants are so uniform in morphology that the collector, young or old, would lose little by letting them remain in the soil and contenting himself with taking samples from the upper portions of the plants—if it is considered necessary to make a herbarium collection at all.

F. C.

OUR BOOKSHELF.

A Medley of Weather Lore. Collected by M. E. S. Wright. Pp. 144. (Bournemouth: H. G. Commin, 1913.) Price 2*s.* 6*d.* net.

"OF the making of many books there is no end," and the natural result is that some books remind us that better books have already been written which tell us what the new ones have to tell. There is scarcely a weather proverb in the present book which is not given in Inward's "Weather Lore," a book with which the author claims no acquaintance; there are a number of beautiful quotations which make one long for summer when summer is not here; and there are, in addition, a few sayings, such as "If boys be beaten with an elder stick it hinders their growth," whose association with the weather is remote Perhaps they are essential to a "Medley."

And yet the book has a charm; I saw it picked up and read with the greatest pleasure by a visitor to a meteorological library; I myself have renewed my acquaintance with old friends scattered through its pages, and wondered at the generations of experience which went to the production of such sayings as:—

> Maayres taails an' mackerel sky,
> Not long wet nor not long dry.

or,

> In the middle of May comes the tail of the winter.

Some of the sayings quoted are frankly untrue, and ought, I suppose, to be omitted on that account. Such are:—

> There is never a Saturday in the year
> But what the sun it doth appear.

or,

> No weather is ill
> If the wind be still.

but perhaps this latter is intended for use by seasick folk.

Possibly the appearance of the book may stimulate some meteorologist to select the better-known and representative sayings from the large numbers available, and to bring the light of modern physical and meteorological knowledge to bear upon them. A short article of this character was published two years ago by Prof. Humphreys in the *Popular Science Monthly*; it might with advantage be consulted by anyone interested in the subject.

E. G.

Weltsprache und Wissenschaft. By Prof. L. Couturat, Prof. O. Jespersen, Prof. R. Lorenz, Prof. W. Ostwald, and Prof. L. von Pfaundler. Zweite Auflage. Pp. vi+154. (Jena: Gustav Fischer, 1913.) Price 2 marks.

THE displacement of Latin by the national languages in scientific publications since medieval times is one of the few phenomena at variance with the general tendency to internationalise the means of intellectual communication, such as we find it in musical and algebraic notation, the Morse alphabet, the metric system, and the flag-signalling code. The reaction against this separatist tendency in language is found in the three main attempts to devise an international auxiliary language, viz. Schleyer's "Volapük" (1879), Zamenhof's "Esperanto" (1887), and the "Ido" of the International Delegation of Academies (1908).

The present work is a powerful plea for the adoption of the last, and it must be acknowledged that a very strong case is made out in favour of this improved form of Esperanto, in which most of the beauty and flexibility of Zamenhof's masterpiece is retained, and the changes are directed towards facilitating the printing and improving the logical structure of the auxiliary language. It is interesting to note that biological and mathematical vocabularies for Ido, English, German, French, and Italian are already published, and that some twenty journals are devoted to the new international idiom.

Physics: an Elementary Text-book for University Classes. By Dr. C. G. Knott. Pp. vi+370. (London: W. and R. Chambers, Ltd., 1913.) Price 7*s.* 6*d.*

THE first edition of Dr. Knott's text-book of physics was reviewed in the issue of NATURE for April 15, 1897 (vol. lv., p. 557). Since its first appearance radium has been discovered, and the demand for a new edition of his work has provided Dr. Knott with the opportunity to add a new chapter on the electron theory and radioactivity, to indicate recent advances in other lines of physical research, and to amplify and revise the book as a whole.

How to Enter the Civil Service: a Practical Guide to State Employment for Men and Women. By Ernest A. Carr. New edition. (London: Alexander Moring, Ltd., 1913.) Price 2*s.* 6*d.* net.

THIS useful compendium provides the essential facts as to the conditions of entry to the Civil Service, the various appointments, the subjects of examination, and the prospects of persons entering the service of the State. Specimen examination papers and hints to students are provided also. The present edition will be found to be fully up-to-date and to provide an account of present conditions.

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.]*

Synthesis by Means of Ferments.

THE short article on the synthesis of glucosides by means of ferments in NATURE for November 6 (p. 304) contains the statement, "hitherto it has not been proved that enzymes have anything but an analytical action." "Prof. Bourquelot . . . has, however, obtained results which justify the conclusion that the decomposing action continues up to a certain point only, and that at this point synthetic action begins." Prof. Bourquelot's discovery is by no means new, because in 1898 Dr. Croft Hill, in a paper on reversible zymolysis in the Transactions of the Chemical Society for 1898 (vol. lxxiii., part 2, p. 634) not only showed that the products of fermentation arrested the action of the enzyme which caused it, but also that if these products reached a certain concentration, the enzyme instead of producing further hydrolysis began to reverse its action into a synthetic one, and built up instead of breaking down. These experiments were further extended and described in the Transactions of the Chemical Society for 1903 (vol. lxxxiii., part 1, p. 578), where he also gives an account of experiments made by other authors, and concludes (p. 597) with the words: "These observations, together with my own more recent results, make it increasingly more probable that the view I put forward in 1898 is a correct one, namely that all ferment actions are reversible." LAUDER BRUNTON.

10 Stratford Place, Cavendish Square.

Amœbocytes in Calcareous Sponges.

I THINK there can be little doubt that the Amœbæ referred to by Mr. Orton in NATURE of November 27 are not independent organisms, but constituents of the sponge from which he obtained them. I have been working for some time past at the problem of the origin of the germ cells in the common *Grantia compressa*, and have often found the flagellate chambers of the sponge crowded with amœboid cells, which can sometimes be seen actually squeezing themselves through the layer of collared cells. According to my observations, these amœbocytes are immature germ cells—oogonia and spermatogonia—and they can often be seen undergoing mitosis in the chambers. A similar phenomena has been described in Sycon by Jörgensen. Possibly the amœboid cells squeezed out from the gastral cavity of Sycon by Mr. Orton were either of the same nature or else metamorphosed collared cells. The latter are very readily detached from their proper position in the sponge, and may then put out pseudopodia and come to resemble Amœbæ, as has long been known.

As it is likely to be some time before my results can be ready for publication, I may take this opportunity of mentioning that I find that in *Grantia compressa* the amœboid germ cells arise in the first instance from the metamorphosis of collared cells, and not, as is sometimes stated, from primitive amœbocytes, or archæocytes.

I spent a fortnight in April, 1912, at the Plymouth Laboratory in the investigation of these problems, and in collecting and preserving the material necessary for continuing the work. I have now an almost complete series of stages of the oogenesis, the most interesting feature of which is perhaps the feeding of the growing ova by nurse cells, the latter being phagocytes which capture other cells and stuff them into the ova. I have also a number of stages of spermatogenesis. The sponge (*G. compressa*) is hermaphrodite, and sperm morulæ are to be found (in April), enclosed in cover-cells, wedged in between the collared cells in the lining of the flagellate chambers. Haeckel described and figured the sperm morulæ in this situation in various calcareous sponges so far back as 1872, but his results do not seem to have been generally accepted.

The character of the nucleus, to which Mr. Orton refers as a means of distinguishing his supposed Amœbæ from sponge cells, varies greatly according to circumstances, and cannot be regarded as conclusive.

ARTHUR DENDY.

University of London, King's College,
November 27.

Intra-atomic Charge.

THAT the intra-atomic charge of an element is determined by its place in the periodic table rather than by its atomic weight, as concluded by A. van der Broek (NATURE, November 27, p. 372), is strongly supported by the recent generalisation as to the radio-elements and the periodic law. The successive expulsion of one α and two β particles in three radio-active changes in any order brings the intra-atomic charge of the element back to its initial value, and the element back to its original place in the table, though its atomic mass is reduced by four units. We have recently obtained something like a direct proof of van der Broek's view that the intra-atomic charge of the nucleus of an atom is not a purely positive charge, as on Rutherford's tentative theory, but is the difference between a positive and a smaller negative charge.

Fajans, in his paper on the periodic law generalisation (*Physikal. Zeitsch.*, 1913, vol. xiv., p. 131), directed attention to the fact that the changes of chemical nature consequent upon the expulsion of α and β particles are precisely of the same kind as in ordinary electrochemical changes of valency. He drew from this the conclusion that radio-active changes must occur in the same region of atomic structure as ordinary chemical changes, rather than with a distinct inner region of structure, or "nucleus," as hitherto supposed. In my paper on the same generalisation, published immediately after that of Fajans (*Chem. News*, February 28), I laid stress on the absolute identity of chemical properties of different elements occupying the same place in the periodic table.

A simple deduction from this view supplied me with a means of testing the correctness of Fajans's conclusion that radio-changes and chemical changes are concerned with the same region of atomic structure. On my view his conclusion would involve nothing else than that, for example, uranium in its tetravalent uranous compounds must be chemically identical with and non-separable from thorium compounds. For uranium X, formed from uranium I by expulsion of an α particle, is chemically identical with thorium, as also is ionium formed in the same way from uranium II. Uranium X loses two β particles and passes back into uranium II, chemically identical with uranium. Uranous salts also lose two electrons and pass into the more common hexavalent uranyl compounds. If these electrons come from the same region of the atom uranous salts should be chemically non-separable from thorium salts. But they are not.

There is a strong resemblance in chemical character between uranous and thorium salts, and I asked Mr. Fleck to examine whether they could be separated by chemical methods when mixed, the uranium being kept unchanged throughout in the uranous or tetravalent condition. Mr. Fleck will publish the experi-

ments separately, and I am indebted to him for the result that the two classes of compounds can readily be separated by fractionation methods.

This, I think, amounts to a proof that the electrons expelled as β rays come from a nucleus not capable of supplying electrons to or withdrawing them from the ring, though this ring is capable of gaining or losing electrons from the exterior during ordinary electrochemical changes of valency.

I regard van der Broek's view, that the number representing the net positive charge of the nucleus is the number of the place which the element occupies in the periodic table when all the possible places from hydrogen to uranium are arranged in sequence, as practically proved so far as the relative value of the charge for the members of the end of the sequence, from thallium to uranium, is concerned. We are left uncertain as to the absolute value of the charge, because of the doubt regarding the exact number of rare-earth elements that exist. If we assume that all of these are known, the value for the positive charge of the nucleus of the uranium atom is about 90. Whereas if we make the more doubtful assumption that the periodic table runs regularly, as regards numbers of places, through the rare-earth group, and that between barium and radium, for example, two complete long periods exist, the number is 96. In either case it is appreciably less than 120, the number were the charge equal to one-half the atomic weight, as it would be if the nucleus were made out of α particles only. Six nuclear electrons are known to exist in the uranium atom, which expels in its changes six β rays. Were the nucleus made up of α particles there must be thirty or twenty-four respectively nuclear electrons, compared with ninety-six or 102 respectively in the ring. If, as has been suggested, hydrogen is a second component of atomic structure, there must be more than this. But there can be no doubt that there must be some, and that the central charge of the atom on Rutherford's theory cannot be a pure positive charge, but must contain electrons, as van der Broek concludes.

So far as I personally am concerned, this has resulted in a great clarification of my ideas, and it may be helpful to others, though no doubt there is little originality in it. The same algebraic sum of the positive and negative charges in the nucleus, when the arithmetical sum is different, gives what I call "isotopes" or "isotopic elements," because they occupy the same place in the periodic table. They are chemically identical, and save only as regards the relatively few physical properties which depend upon atomic mass directly, physically identical also. Unit changes of this nuclear charge, so reckoned algebraically, give the successive places in the periodic table. For any one "place," or any one nuclear charge, more than one number of electrons in the outer-ring system may exist, and in such a case the element exhibits variable valency. But such changes of number, or of valency, concern only the ring and its external environment. There is no in- and out-going of electrons between ring and nucleus.

FREDERICK SODDY.

Physical Chemistry Laboratory,
University of Glasgow.

Philosophy of Vitalism.

IN NATURE of November 6 Prof. E. W. MacBride has made some critical remarks with regard to my proof of vitalism as discussed in the first of the four lectures which I had the honour to deliver before the University of London in October. Will you kindly permit me to explain in how far I feel unable to accept Prof. MacBride's criticism?

I fully agree with him that vitalism has nothing to do with the progress of zoology as a pure science in the narrower sense of the word. As I have said in my "Biologie als selbständige Grundwissenschaft" (second edition, 1911, p. 24): "The problem of the *method* of biology remains unaffected by the controversies between vitalism and mechanism."

But I cannot accept Prof. MacBride's opinion about the theoretical, or, if he would choose to say so, philosophical importance of the concept of *entelechy*. He believes "that at the best the conception of entelechy is of quite limited application." He speaks of the fact that, under special experimental conditions a lizard may regenerate two tails instead of one, that the egg of Ascidians (he might have added that of Ctenophores, a case well known to me from my own experiments) possesses a very limited faculty of regulation, &c. But, has it not been for the very reason of the *fact* that there are "limits of regulability" that I have invented a rather complicated theory of the possible relations between entelechy and matter (see my Gifford lectures, vol. ii., p. 178ff., and the second of my London lectures)? Thus it appears, so I hope, that I have never neglected the limited character of regulability and the dependence of the effects of what I call entelechy on matter. Entelechy is *not* omnipotent. But it seems to me that limitation does not mean non-existence.

For, on the other hand, there are very many cases (development of isolated blastomeres or parts of the blastula of Echinoderms, &c., into small but complete organisms, restitution of Clavellina, Tubularia, &c.) where entelechy acts, so to say, in quite a pure manner. And it is on *these* cases, of course, that the concept of entelechy was founded in the first place. Would not also a physicist whose aim it is to study the laws of the reflection of light, prefer for his experiments such materials, which do well reflect rays and do not show the phenomenon of absorption, or only in a very small degree? Logically, in fact, one single case of what I call harmonious equipotentiality would suffice to establish vitalism. But there are many cases.

Prof. MacBride does not attack my analysis of harmonious equipotentiality as such. And, in fact, the theory of organ-forming substances, which he advocates, cannot account at all for the differentiation of "harmonious-equipotential systems," though we might accept it, perhaps, if there were *only* eggs, such as those of Ascidians, Ctenophores, &c. Organ-forming substances have to be ordered or arranged during ontogeny; now this could only happen on the basis of a *machine*, if we believe that it happens on a physico-chemical foundation altogether. But just a "machine" is excluded by the phenomenon of harmonious equipotentiality.

Thus I believe that, even if we concede to Prof. MacBride that the conception of entelechy is "of quite limited application," we are entitled to say: In the theory of the harmonious-equipotential system the concept of entelechy *must necessarily be applied*.

HANS DRIESCH.

Heidelberg, November 12.

THE courteous reply of Prof. Driesch to my letter on vitalism which was published in NATURE of November 6 calls for only a few remarks from me. If Prof. Driesch and I were discussing questions of epistemology or of consciousness, questions in which as an amateur I have taken an interest for many years, it is possible that our points of view might not be so far apart; it would certainly be possible to arrange a *modus vivendi* between them. But for me the value of a conception in zoology is its fruitfulness

in connecting facts and in leading to the discovery of new facts; and my objection to the conception of *entelechy* is not that it is idealistic, but that it is barren.

Prof. Driesch now candidly admits that if he had only eggs like those of Ascidians and Ctenophores to deal with the theory of organ-forming substances might suffice, but that in order to account for what he calls a "harmonious-equipotential system," and for what I call an undifferentiated type of egg (or bud) an entelechy must be postulated. Now if the inversion of the two-celled stage in the development of the frog's egg will produce such a rearrangement of materials that *two* embryos and not *one* result, is it not just possible that the closing up of a fragment of a blastula of Echinus may lead, under the stress of forces which we may picture to ourselves as surface tension, &c., to such a rearrangement of materials as may issue in a perfect larva of reduced size instead of in a half larva? That organ-forming substances limited to special regions do exist in the later embryo of Echinus Prof. Driesch has himself shown in one of the most exquisite of his earlier researches. At any rate, if we adopt this hypothesis we shall be urged on to further researches as to the conditions of this rearrangement, whereas if we adopt the theory of an entelechy about the ideas or methods of working of which we know nothing, all future research is stopped.

The eggs of Asteroids and Echinoids show great resemblances in their earlier stages of development coupled with subsequent divergences. On Prof. Driesch's theory these divergences are due to differences in the indwelling types of entelechy, and no further explanation is possible. But when Prof. Driesch's friend and colleague, Prof. Herbst, shows that an Asteroid egg can be made to develop into something like the Echinoid blastula by immersing it in a solution of KCNS, then we are led to speculate as to the nature and origin of the chemical differences between these two types of egg, which cause the differences in their development.

Prof. Driesch refers to the case of the physicist who selects "pure material" for his experiments. I may reply by citing the case of the physiologist who in investigating nervous phenomena, chooses clearly differentiated nerve for his material, and would never dream of beginning by examining the phenomena of conduction in Amœba. I contend that eggs with organ-forming substances definitely localised are far "purer material" for the analysis of the forces of development than the undifferentiated eggs of Echinus. E. W. MACBRIDE.

Imperial College of Science, November 15.

The Kathode Spectrum of Helium.

A NUMBER of articles have recently appeared in scientific journals dealing with a spectrum frequently associated with the spectrum of helium and by some attributed to impurities in the helium. A few words relative to this interesting and very beautiful spectrum will, I think, clear up the question of the source of the spectrum.

If a helium tube be prepared with *disc* electrodes, carefully freed from impurities, and operated on a transformer or continuous current (*not* on an induction-coil discharge), the region about the kathode will be filled with a bright pink glow. The spectrum of this kathode glow is the spectrum in question. It is simply the kathode spectrum of pure helium. If care be taken to avoid stray light from the anode column it may be obtained quite free from the ordinary (anode) spectrum of helium. When the disruptive discharge from an induction coil is used to excite the tube or the tube is viewed end on through a cylindrical electrode, the two spectra appear mixed in various proportions.

During the writer's several years of work at the Bureau of Standards on the helium tube as a primary light standard, scores of helium tubes were prepared and operated as above described. It was noted that the kathode glow was pale and greyish until the last traces of impurities has disappeared, when it turned to a bright pink. In fact, the appearance of the kathode glow is an infallible criterion for the purity of the helium, a spectroscope being unnecessary. The kathode spectrum of helium, viewed with a large, high intensity spectroscope, will be recalled by many who have visited the bureau during the last four years. Goldstein's spectrogram reproduced in the *Physikalische Zeitschrift*, July 15, 1913, is a very good one considering the photographic difficulties.

It is well known that most gases exhibit two and a few three quite distinct spectra. These are the anode (primary) and kathode spectra, and the secondary spectrum obtained with a disruptive discharge. Nitrogen is a familiar example of a gas having all three spectra. Helium is one of the few gases and vapours the primary and secondary spectra of which are alike, but the anode and kathode spectra of which are quite different. P. G. NUTTING.

Rochester, N.Y., November 7.

Observation of the Separation of Spectral Lines by an Electric Field.

THE effect of the electric field upon spectral lines is a problem which has caused much discussion without being solved by experiment until to-day. Applying a very intense electric field in an incandescent gas, and using suitable optical arrangements, I succeeded in separating several spectral lines into components. These are polarised rectilinearly in relation to the axis of the electric field in the transversal effect (radius of vision normal to the electric field). With the dispersion used, the hydrogen lines $H\beta$ and $H\gamma$ are resolved by the electric field into five components. The three located in the middle are in electric oscillation normally to the electric field, the two outer ones parallel to it. My first paper on the new phenomenon will soon be published in the *Berichte der Berliner Akademie der Wissenschaften*.

J. STARK.

Aachen, Technischen Hochschule, November 21.

Phosphorescence of Mercury Vapour.

LAST July I published in the Proceedings of the Royal Society an account of a persistent fluorescence of mercury vapour produced by excitation of "2536" light, obtained from a quartz-mercury arc lamp. I have recently placed the fluorescent vapour in a strong magnetic field, and find that when the mercury lamp is cooled and consequently the "2536" line is sharp, the magnetic field increases the intensity of the fluorescence several times. If the lamp is allowed to warm up so that the "2536" line becomes broadened and reversed, the opposite effect is obtained, *i.e.* the phosphorescence decreases in intensity with the field. In this latter case the field strength that produces the greatest diminution in intensity increases with the temperature of the quartz-mercury lamp. The ordinary fluorescence produced by the light from the cadmium spark is not affected by the magnetic field. I am at present working with the idea of obtaining a satisfactory explanation of the persistent fluorescence and the various phenomena connected with it.

F. S. PHILLIPS.

Imperial College of Science and Technology, November 24.

A Remarkable Meteor on November 24.

I WAS much interested in seeing Dr. Rambaut's letter describing a brilliant meteor seen at Oxford on the evening of November 24. I was travelling along the London to Oxford road at the time, and when passing through Stokenchurch (seventeen miles from Oxford) was suddenly aware of a pale green light of sufficient intensity to be quite noticeable even when looking down at the road. On looking up I saw the meteor just as it disappeared. It presented the appearance of a luminous green ball of about one-quarter the sun's diameter, though this can only be regarded as quite an approximate estimate. My first impression was that the phenomenon was an unusual type of meteor, but on account of the brilliant green colour I immediately afterwards came to the conclusion that it must have been a rocket, and therefore did not unfortunately note the exact time or careful particulars as to the position. I should estimate that the meteor lay about N.N.E. when I saw it, but that the altitude was somewhat greater than the 17° given by Dr. Rambaut. The agreement in time and place was, however, sufficiently close to leave no doubt that it must have been the same phenomenon. The intensity of the illumination may be judged from the fact that the light was quite noticeable to one not looking up towards the sky at the time.

J. S. DINES.

Meteorological Office, South Farnborough Branch, December 1.

I REGRET to have to have to point out a mistake in my letter printed in NATURE for November 27 (p. 372). The altitude of the meteor should have been given as 27°, not 17°, as there stated.

As the error appears in my copy, I fear I must bear all blame for it.

ARTHUR A. RAMBAUT.

Radcliffe Observatory, Oxford, December 1.

THE BRITISH RADIUM STANDARD.

AN account of the preparation and testing of an international radium standard was given in the issue of this journal for April 4, 1912 (vol. lxxxix., p. 115). It will be remembered that a radium standard containing 21·99 milligrams of pure radium chloride was prepared by Mme. Curie for the International Committee. At a meeting in Paris the standard of Mme. Curie was compared with another independent standard prepared in Vienna by Professor Hönigschmidt, and the two were found to agree well within the limits of accuracy of measurements by the γ ray method. The preparation of Mme. Curie was accepted by the Committee as the International Standard, and was deposited in the Bureau du Poids et Mesures at Sèvres, near Paris. At the same time it was arranged that the Vienna preparation should be retained in Vienna as a secondary standard. Arrangements were made to allow Governments to obtain duplicates of the international standard. For this purpose the Austrian Government generously offered to provide the radium required at a considerable reduction in price. It was arranged that duplicate standards should be prepared and tested in Vienna in terms of their secondary standard, and then sent on to Paris to be tested again in terms of the international standard. In all six duplicate standards have now been prepared for different Governments, and the independent standardisations of the radium content in Vienna and Paris has been found to be in remarkably good agreement. The comparisons of the quantities of radium is made by means of the penetrating γ rays, and it is a striking testimony to the accuracy of this method that the independent measurements have agreed so closely, although widely differing experimental arrangements have been employed in the two places.

It will be remembered that Dr. Beilby, F.R.S., very generously defrayed to Mme. Curie the cost of the radium forming the international standard, and thus relieved the International Committee of the necessity of collecting special funds for this purpose. Immediately after the fixing of the international standard, arrangements were made in this country to obtain a duplicate standard to be placed in charge of the National Physical Laboratory at Teddington. Dr. Beilby again stepped in in a very generous manner and agreed to defray the expense of acquiring the British radium standard, which was delivered to the National Physical Laboratory a few months ago. The British radium standard does not differ much in radium content from the international standard, containing about 20 milligrams of pure radium chloride.

A circular has now been issued by the National Physical Laboratory, stating that they are prepared to standardise preparations of radium and mesothorium in terms of the international standard, and a detailed list of testing charges has been issued. In the beginning, the Laboratory has very wisely confined itself to undertaking the standardisation of strong preparations of radium and mesothorium only. The comparison with the British standard will be made by γ ray methods. Tests on radio-active minerals, radio-active waters and other materials of weak activity, will not be undertaken at the moment, though, no doubt, arrangements will be made as the new radio-active department progresses to undertake some work of this character in the future. The Laboratory sends out a certificate that the active material under examination shows a γ ray activity equivalent to a certain weight of metallic radium, but no guarantee is given of whether the activity is due to radium itself, for it is well known that it is not easy to distinguish without special tests between preparations of radium and mesothorium. Preparations of the latter are standardised by expressing their γ ray activity at the time of testing in terms of a definite weight of metallic radium in radio-active equilibrium. Both the Reichsanstalt and the National Physical Laboratory express the activity of their preparations in terms of metallic radium, and not in terms of bromide or chloride. This appears to me a very wise step, for it is obviously more definite and scientific to express the results in this form. It is also very desirable that all radium should be bought and sold in terms of metallic radium, thus avoiding the uncertainty that some-

times arises as to whether the preparation is being sold as anhydrous radium bromide or radium bromide with its water of crystallisation.

The radio-active department in the Reichsanstalt has now been in operation for more than a year, under the charge of Dr. Geiger, whose radio-active researches in the University of Manchester are well known. The creation of this department has been found to fill a much-needed want, and it is not too much to say that practically all the radium and mesothorium that is bought and sold in Germany requires to-day the certificate of the Reichsanstalt. The number of standardisations required have increased very rapidly, and several assistants have been added to the department in charge of this work alone. There can be no doubt that the institution of a radio-active department in the National Physical Laboratory will prove of great service to this country, not only for scientific, but also for commercial purposes. It is well known that the buying and selling of radium in the past has been a very uncertain and risky procedure, for in most cases the radium content has not been expressed in terms of any authorised standard. This difficulty is removed by the present arrangement, and we should strongly recommend that those who wish to buy radium or mesothorium, whether for scientific or for medical purposes, should do so conditional on the certificate of standardisation from the National Physical Laboratory.

It is understood that the work of testing and standardisation will be under the supervision of Dr. W. G. C. Kaye, of the National Physical Laboratory, whose pioneer work on the production and distribution of X-rays is well known to all physicists. The ability and skill in measurements which he has shown both in his work in the Cavendish Laboratory and in the National Physical Laboratory, afford the best of guarantees that the work of the new department will be carried out in a thoroughly satisfactory manner.

E. RUTHERFORD.

SIR ROBERT BALL, F.R.S.

ROBERT STAWELL BALL was born in Dublin on July 1, 1840, the eldest son of Dr. Robert Ball, director of the Natural History Museum in the University of Dublin and secretary of the Queen's University in Ireland. After attending school at Abbott's Grange, Chester, he entered Trinity College, Dublin, in 1857. He became a mathematical scholar in 1860, Lloyd exhibitioner the same year, and graduated in 1861 as gold medallist in mathematics, first gold medallist in experimental and natural sciences and University student in mathematics. Towards the end of 1865 he went to Parsonstown as tutor to the three younger sons of the third Earl of Rosse and observer with the great six-foot and three-foot telescopes. When Ball began to use the six-foot reflector in February, 1866, nearly all the larger and more interesting nebulæ had been frequently observed and carefully drawn, and he therefore chiefly devoted himself to work with the micrometer, a difficult task, since the telescope at that time had not yet been provided with a clock motion. He was the first observer with the instrument who corrected the measured position angles for the error due to the telescope not being equatorially mounted, but supported at the lower end on a universal joint. His observations were included in the "Observations of Nebulæ, 1848–78," published by the late Lord Rosse in 1879–80.

In the autumn of 1867, shortly before the death of the maker of the great telescope, Ball was appointed professor of applied mathematics and mechanism at the newly established Royal College of Science for Ireland, in Dublin. He was singularly well fitted for this post, as he was not only an excellent mathematician and had the power of elucidating even abstruse subjects in simple and clear language, but also possessed great skill in experimental work. In addition to his regular class work, he also sometimes gave evening lectures on mechanics in a more elementary form, and in 1871 he published his first popular book, "Experimental Mechanics," which was very well received and showed his great aptitude both as a popular lecturer and as a writer. It led to his being much sought after as a lecturer; and as lectures on mechanics required a large amount of apparatus, he preferred to lecture on popular astronomy, and by degrees he became the most successful lecturer on this subject, not only in this country, but in after years also in America.

In January, 1870, Ball read a paper before the Royal Irish Academy on the small oscillations of a rigid body about a fixed point under the action of any forces. Out of this investigation grew the long series of memoirs which he published on the theory of screws in the course of the next thirty-four years, nearly all in the Trans. Roy. Irish Academy. This remarkable extension of theoretical dynamics, perhaps the most important contribution to that science since the introduction of couples by Poinsot, combines Poinsot's force and couple into the single conception of a wrench on a screw, the latter being regarded merely as "a directed straight line with an associated linear magnitude called the pitch." The capabilities of the theory were gradually shown to be very great, as all the results of modern algebra and geometry appear to be applicable to it. Ball published a separate book on the subject in 1876, and in 1889 Dr. Gravelius wrote a text-book in German, founded on Ball's first eight memoirs. Finally, Ball's great "Treatise on the Theory of Screws" appeared at Cambridge in 1900, but even after that date several succeeding memoirs showed that the author of the theory continued to devote his mind to its extension.

The growing fame of Ball as a mathematician and the warm interest he was known to take in astronomy naturally led the Board of Trinity College to appoint him to the Andrews professorship of astronomy in the University of Dublin,

when it became vacant in 1874. Ball threw himself into his new duties at Dunsink Observatory with his usual energy, and decided to continue the investigations on the annual parallax of stars carried out by his predecessor, Brünnow, by means of micrometer observations. In addition to working on a few stars throughout the year in the usual way, he broke fresh ground by attempting to find stars with a large parallax by what he called "reconnoitring observations." He observed a great number of stars only twice, with an interval of six months, at the time of greatest parallactic displacement. In a very few cases the measures seemed to indicate that the star might be within a measurable distance from us, and he therefore took a regular series of observations of these stars. For two stars he found in this way parallaxes of a third of a second and half a second, which, however, were not subsequently confirmed, and the rapid rise of astronomical photography has led to the complete abandonment of visual observations in work on annual parallax. But Ball's experiment in search of stars with a large parallax is an interesting one all the same. For three or four years he devoted his whole time to this work, which he arranged and carried out in the most businesslike and methodical manner, often observing till 2 or 3 o'clock in the morning, and the results were published in Parts III. and V. of the Dunsink Observations, the latter of which appeared in 1884. After that time he seems to have done very little observing, probably on account of renewed trouble with one of his eyes, which had been accidentally injured in his youth, and later (in 1897) had to be removed.

In 1884 Ball was appointed scientific adviser to the Commissioners of Irish Lights, and in 1886 he was knighted by the Lord Lieutenant of Ireland. In February, 1892, he was elected Lowndean professor of astronomy and geometry and director of the Observatory at Cambridge, leaving Dunsink to take up the appointment in the following autumn. At Cambridge he continued as previously to divide his time between his official duties, his mathematical researches, and his activity as a popular lecturer and writer of popular astronomical books and articles. He was president of the Royal Astronomical Society in 1897–99. In 1908 he published his last book, "A Treatise on Spherical Astronomy," more intended for the use of college students than for practical astronomers, but written in his usual clear and concise style.

Sir Robert Ball died on November 25, after a long and lingering illness. His genial and hearty manner, his fund of wit and his enthusiasm for any subject which had taken hold of his mind, made him a favourite wherever he went. Anyone who has worked under him will not forget his readiness to allow his subordinates to carry out any special work in their own way and to reap therefrom whatever credit they could.

J. L. E. D.

THE ANNIVERSARY MEETING OF THE ROYAL SOCIETY.

THE anniversary meeting of the Royal Society was held on Monday, December 1, when the report of the Council was presented and the retiring president, Sir Archibald Geikie, delivered an address. Sir William Crookes was elected president of the society, and the other officers and members of council, whose names were given in NATURE of November 13 (p. 324), were also elected.

The council reports that a critical period has been reached in the development of the work of the committee on the Catalogue of Scientific Papers. Since 1901 the sum of 21,151*l.* 15*s.* 2*d.*, mainly contributed by the late Dr. Ludwig Mond, has been expended on the preparation of the Catalogue, and with the exception of the income of the Handley Fund, now amounting to about 190*l.* a year, there are no funds available for continuing the work after the end of this year.

The whole of the tenth annual issue of the International Catalogue of Scientific Literature has been published, with the exception of the volumes of physiology and bacteriology. A meeting of the International Council will be held in 1914. At this meeting the question of continuing the Catalogue beyond the first fifteen issues will be taken into consideration.

In the course of the year the treasurer received from the executors of the late Lord Lister, securities and cash to the value of 8995*l.* 9*s.* 10*d.*, on account of a legacy left by Lord Lister to the society for its general purposes.

The financial position of the National Physical Laboratory has been a cause of anxiety to the Council. In consequence mainly of the strikes and general disturbance of trade at the beginning of 1912, the receipts for the year were less than the expenditure, and but for a considerable revival at the end of the year would have been much less. The responsibility for any deficit rests with the society; and the council, while ready to advance by all means in its power the national work of the Laboratory, considers that the society should be freed from this serious liability. It is in communication with the Treasury on the question. Much valuable work is at a standstill for want of funds.

In his presidential address, Sir Archibald Geikie referred to some of the subjects in the report presented by the council, and particularly to the national activities of the society and the inadequacy of the financial provision necessary for the carrying out of important work. He pointed out that five years ago at the request of the Home Office the council appointed a committee to investigate the physical and physiological problems presented by the disease known as glassworkers' cataract. In proposing this inquiry, the Home Office made no provision for the cost of the numerous experiments and examinations that obviously would be required, while the Royal Society has no funds at its disposal for meeting

such expenditure. As only a small sum has been contributed by the Treasury, the work of the committee has been seriously delayed. The society has acquired the character of a kind of central council of science, and may legitimately claim that few scientific problems could arise affecting modern life for the solution of which the most extensive experience and the most authoritative opinion would not probably be found within its own representative ranks. The public recognition of this serviceableness has greatly increased the range of the society's activities, but there has not been a corresponding increase of financial support. Continuing, the president said:—

There is unfortunately a prevailing but mistaken impression that a society which can thus freely place its knowledge and experience at the disposal of the State must be a wealthy body. It is true that we administer every year a considerable sum of money; but almost the whole of this sum is earmarked for certain definite objects, and cannot be diverted to anything else. Even the annual Parliamentary grant of 4000*l.* for scientific investigation, which is placed in the hands of the society, is not a contribution to the society's own operations. The whole of it, except the trifling sum required for clerical assistance and necessary printing, is allocated to applicants from all parts of the country for their individual researches. . . . There is a second annual Parliamentary grant of 1000*l.* made to the Royal Society to assist in defraying the expenses of publication. But it is understood that a portion of this sum is to be set aside for the purpose of aiding the adequate publication of scientific matter through other channels and in other ways. Thus the whole of the subvention which the society receives annually from the State for its own requirements amounts to only a few hundred pounds towards the cost of its publications, together with the use of its rooms in Burlington House, where it sits rent free, but subject to expenditure for internal upkeep and repairs. . . .

When we consider the amount and value of the gratuitous service given at the request of the various public departments, it is abundantly obvious that the Government of this country is under special obligations to the Royal Society, which, were they expressed in the plain language of professional practice, would be indicated by a considerable sum of money. . . . We claim that our disinterested action deserves to be recognised by at least a generous and sympathetic attitude on the part of the Government towards our aims and objects, and a disposition to help us when our means prove inadequate to carry out the work which we have undertaken for the furtherance of the progress of science.

Sir Archibald Geikie announced that since his address was written Sir James Caird, Bart., of Dundee, so well known for his munificent benefactions to science, had sent him a cheque for 5000*l.* to be expended in yearly disbursements of about 500*l.* for the furtherance of physical research. Subjoined are summaries of the description of the work of the medallists given in the address.

The Copley medal is this year assigned to Sir Edwin Ray Lankester, in recognition of the value of his original researches in zoology and of the importance of his personal influence in stimulating the investigations of his pupils and others, which have materially extended the boundaries of our knowledge of the animal kingdom. His own work, which has been in large measure morphological, has thrown light on the mutual relations of living animals and also on the structure and affinities of long extinct organisms. His researches in the comparative embryology of the higher Mollusca and of the anatomy of the Nautilus gave him an assured place among the zoologists of his day. His early papers on the Ostracoderm fishes of the Old Red Sandstone afforded a memorable example of palæontological acumen. In addition to his original investigations, he has laid zoology under a debt of gratitude to him for his luminous general articles in some of the larger departments of the science.

The council's awards of the two Royal medals annually presented by the King have received his Majesty's approval. The medal on the physical side has been adjudged to Prof. Harold Baily Dixon, to mark the society's appreciation of the importance of his long-continued investigations of the phenomena of gaseous explosion. His important observations on the theory of combustion have shown that water-vapour acts as a carrier of oxygen during the oxidation of carbon, and undergoes a cycle of changes wherein it gives up its oxygen to carbon monoxide. From the further study of the explosion of this monoxide and oxygen, in the presence of other gases, he concluded that any substance capable of producing steam will determine the explosion. By the introduction of photography into his studies of the explosive wave he has been able to throw light on the mode of burning of carbon and its compounds.

The Royal medal on the biological side is bestowed on Prof. Ernest Henry Starling, as a mark of the society's high appreciation of the wide range of his contributions to the advancement of physiology. By his inquiry into the relation of lymph production, and the absorption of fluids from the peritoneal cavity and the cavity of the eye-ball, he showed the dependence of these processes upon the osmotic pressure of the blood and tissue fluids and the hydrostatic pressure in the blood-vessels. In his excellent studies of the mammalian heart he has greatly improved the technique. By much reducing the volume of blood needed to maintain a circulation through heart and lung, he has increased the sensibility of the preparation to variations of state, and by introducing into the circuit of the blood a readily adjusted resistance to the flow he can ascertain the effects of the obstacle upon the heart's action. He has discovered that the normal heart of the dog will consume 4 mgrm. of sugar per gram muscle per hour, but that if the animal is diabetic, the heart is incapable of consuming sugar—an observation of singular value in the light it throws upon the cause of diabetes.

The Davy medal has been awarded to Prof. Raphael Meldola, in acknowledgment of the distinction of his contributions to synthetical organic chemistry, especially in the series of aromatic compounds. He discovered the first representative of the oxazines, a group which has since been developed into one of great importance. He has contributed to the chemistry of naphthalene derivatives, and carried out extensive researches upon the azo- and diazo-compounds, with results which have an important bearing upon the question of the constitution of these compounds. He has likewise added to our knowledge of the chemistry of other groups of nitrogen-containing compounds, notably the triazines and the iminazoles. Of late years he has shown the synthetical value of compounds containing a mobile nitro-group, and has discovered a remarkable new class of quinone-ammonium derivatives.

The Sylvester medal is conferred this year on the veteran mathematician, James Whitbread Lee

Glaisher. His prominent career in mathematical science, which began at an early age, has been continued down to the present day without remission, not only in the production of original papers, but in university teaching, and in the careful editorship of most of the special mathematical journals in this country. To these journals he has constantly contributed much of his own work, such as his papers on the theory of numbers, on elliptic functions, and many other departments of pure mathematics.

In considering the bestowal of the medals this year the council has determined to award the Hughes medal to one who has spent his days in the application of scientific discovery to practical life—Alexander Graham Bell. Although he has been resident for many years on the other side of the Atlantic Ocean, we remember that he was born in Edinburgh, and was educated there and in London, so that we claim him as a fellow-countryman. His preponderating share in the invention of the telephone, now so long ago as 1876, and his practical investigations in phonetics, have laid modern civilisation under deep obligation to him, while his numerous other inventions and experiments show the fertility of his genius.

The anniversary dinner of the society was held on Monday evening at the Hôtel Métropole. Sir William Crookes presided and responded to the toast of "The Royal Society," proposed by the American Ambassador. The toast of "The Retiring President" was proposed by Sir Joseph Larmor and acknowledged by Sir Archibald Geikie. Sir Ray Lankester and Prof. Harold Dixon responded to the toast of "The Medallists," Sir David Gill proposed the toast of "The Guests," and Lord Sumner responded to it.

NOTES.

A CORRESPONDENT points out that the list of the new members of the council of the Royal Society published in NATURE of November 13 (p. 324), contains the names of ten fellows of the society who have not served on the council before, out of the total of sixteen ordinary members of the council. In the council elected in 1912, there were only five members who had not served in previous years; and the list for 1911 included eight fellows who had served before and the same number of fellows who had not done so. This year's list contains, therefore, a larger number of completely new members of the council than is usual. Ten members of the new council, and nine of the retiring council, are Cambridge men.

DR. HENRI DESLANDRES, Paris, has been elected an honorary member of the Royal Institution.

A LECTURE on the properties and uses of radium will be delivered at the Cancer Hospital (Free), Fulham Road, London, S.W., by Mr. C. E. S. Phillips, honorary physicist to the hospital, on Wednesday, December 10, at 5 p.m.

As announced already, the Physical Society's annual exhibition is to be held on Tuesday, December 16, at the Imperial College of Science, South Kensington. In the afternoon, the Hon. R. J. Strutt, F.R.S., will give a discourse on spiral electric discharges, and in the evening Mr. Louis Brennan, C.B., will show some experiments with soap films. About thirty firms of scientific instrument-makers will be exhibiting, and there will also be certain experimental demonstrations.

THE gold medal of the Apothecaries Society was awarded on November 28 to Mr. J. E. Harting, in recognition of his services in preparing and editing the catalogue of the library in Apothecaries' Hall. The society was founded in 1617, and the library, which chiefly consists of medical and botanical works, contains a number of rare old "Herbals," including a copy of Johnson's edition of "Gerarde's Herbal," published in 1633, presented by the author.

THE Board of Trade has appointed a committee to consider the causes of explosions which have occurred in connection with the use of bitumen in laying electric cables, and to report as to any steps which should be taken to prevent explosions in future from the use of bitumen or similar substances. The members of the committee are:—Sir T. Edward Thorpe, C.B., F.R.S. (chairman); Mr. R. Nelson, of the Home Office; Mr. W. Slingo, of the General Post Office; Mr. J. Swinburne, F.R.S.; and Mr. A. P. Trotter, of the Board of Trade. Mr. M. J. Collins, of the Board of Trade, will act as secretary to the committee.

AN International Dairy Congress is to be held at Berne, Switzerland, in June next. It will be the sixth congress organised and held under the auspices of the Federation Internationale de Laiterie, a body having its head office in Brussels, and a committee composed of representatives of all the leading countries in the world. The secretary of the British Dairy Farmers' Association, Mr. F. E. Hardcastle, 12 Hanover Square, W., is acting as secretary to the British Section, and will give full information to any who may be interested. The sections under which papers will be read and subjects discussed are:—I., Hygienics; II., Chemistry and Bacteriology; III., Theory of Management; and IV., Trade.

THE death is announced, in his seventy-sixth year, of the Rev. J. A. Gilfillas, who, with Mr. W. W. Cooke, made important explorations between 1880 and 1890 around the head-waters of the Mississippi. They contributed largely toward fixing Elk Lake, instead of Lake Itaska, as the chief source of that river. Mr. Gilfillas was also an expert in ethnology and in the Indian languages.

AN interesting collection of photographs from Hungary, Germany, Sweden, and New Zealand is now on view at the house of the Royal Photographic Society, 35 Russell Square, W.C., and will be open to the public on presentation of visiting card, daily from 11 a.m. to 5 p.m., until December 20. The collection includes a remarkable series of twenty-seven marine studies taken by flashlight in the Biological Marine Aquarium of Heligoland, by Mr. F. Schensky. The great technical merit of these photographs of fishes, crustacea, sea anemones, molluscs, &c., will be obvious even to the superficial observer; it is very rarely that one has the opportunity of seeing such fine work of this class. The rest of the hundred or so photographs claim attention chiefly because of their pictorial merit.

THE following are among the lecture arrangements at the Royal Institution, before Easter:—Prof. H. H. Turner, a course of experimentally illustrated lectures on a voyage in space, adapted to a juvenile auditory, to begin on December 27; Prof. W. Bateson, six lectures on animals and plants under domestication; Sir John H. Biles, three lectures on modern shipbuilding; Mr. A. H. Smith, two lectures on landscape and natural objects in classical art; Dr. W. McDougall, two lectures on the mind of savage man; Sir Thomas H. Holland, two lectures on types and causes of earth-crust folds; Prof. C. F. Jenkin, three lectures on heat and cold; Dr. C. W. Saleeby, two lectures on the progress of eugenics; Dr. J. A. Harker, two lectures on the electric emissivity of matter; and Sir J. J. Thomson, six lectures on recent discoveries in physical science. The Friday evening meetings will commence on January 23, when Sir James Dewar will deliver a discourse on the coming-of-age of the vacuum flask. Succeeding discourses will probably be given by Mr. H. Wickham Steed, Dr. H. S. Hele Shaw, Prof. J. Norman Collie, Prof. W. A. Bone, Sir Walter R. Lawrence, Bart., the Right Hon. Lord Rayleigh, Prof. J. A. Fleming, Sir J. J. Thomson, Prof. A. Keith, and other gentlemen.

WITH the ordinary issue of *The Times* on Monday, December 1, appeared a special Fuel Supplement of sixty pages, in which the various aspects of the whole subject of fuel are dealt with. The appearance of this supplement to our leading daily journal and the general trend of all the articles, is evidence that the immense importance of the future supplies of fuel must be brought home to the public. Many perhaps still fail to realise the rapid depletion of our resources which is taking place daily, and the necessity for economy in production and economy in application. The first step to economy is wider knowledge, and whether for the lay reader (if there is such a person in this connection), or for the fuel expert, the series of articles is admirably adapted to give a general and sufficiently detailed account of the whole question. The various forms of fuel are described from the economic point of view: their production, distribution, properties, and the best methods of utilisation detailed. Such minor issues as smoke prevention, safety in coal mines, the scientific purchase of coal, and other complementary subjects are dealt with adequately. Nor is the future overlooked, when man will have to manufacture his fuel from materials obtainable from existing natural sources; and the claims of alcohol, which up to the present is but a very minor fuel, are discussed at some length. People more particularly interested in fuel and its commercial application will most certainly welcome the appearance of the supplement, and for others who take an intelligent interest in a subject of such general and economical importance, it furnishes a comprehensive account of the whole question.

MR. J. REID MOIR, of Ipswich, has forwarded a typed letter and printed notices asking for careful treatment of ancient remains, to all the brickfields and other places in Suffolk where continual excavations are in progress. By this means he hopes to hear of any interesting relics which may be found, and for want of knowledge be overlooked or thrown away as being of no value.

IN a letter published in NATURE of November 13, Prof. D. Waterston referred to some excellent radiograms of the Piltdown mandible, and that of a chimpanzee which appeared in an October issue of *The British Journal of Dental Science*. There was an article upon the radiograms in the same issue, but Prof. Waterston was concerned only with his interpretation of the radiograms themselves. Mr. A. S. Underwood, the author of the article, writes to say he considers it misleading to state "that the molar teeth in the fragment not only approach the ape form, but are in some respects identical. These two molar teeth are absolutely human, the difference between them and those of the anthropoids in the arrangement of the enamel alone being quite unmistakable." Any fresh evidence bearing upon the problem of the mandible is of importance, and it is to be hoped that Mr. Underwood will publish at an early date, with illustrations, the evidence he has obtained of "unmistakable" characters in the arrangement of the enamel.

ACCORDING to the report for 1912, the authorities of the Rhodesia Museum, Bulawayo, are considering a scheme for the erection of a new west wing to the building, at an estimated cost of about 1400*l*. The curator reports that as much progress as could reasonably be expected, when the funds at his disposal are taken into consideration, has been made in the development of the museum during the year under review.

WE have received No. 39 of Dr. Schulze's *Das Tierreich*, a fasciculus of 210 pages, devoted to that group of malacostracous crustaceans known as Cumacea or Sympoda. The author is the Rev. T. R. R. Stebbing, who has already contributed to this work the memoir on the gammarid amphipods (No. 21), and who, as in that fasciculus, writes in English. In deference to the usage in the rest of the work, Mr. Stebbing surrenders his favourite practice of treating all generic names as masculine, and on similar grounds he retains the older name Cumacea for the group in place of Sympoda. The objection to the use of the former is based on the cancelling of the generic term Cuma; but although this bars the employment of the family name Cumaidæ, it does not, in our opinion, entail the abolition of the ordinal designation. On the other hand, it is a pity that some objection could not have led to the abolition of such a name as "Vaunthompsoniidæ." The work is worthy of the high reputation of its author as a specialist in the group of animals with which it deals.

WE have received a prospectus of an interesting publication to be issued by the naturalists of the Biological Station in Heligoland. The proposal is to issue a series of plates of instantaneous photographs illustrating the living marine animals and plants of the North Sea. The specimen proof that has been forwarded with the prospectus is an extremely beautiful photograph of the jelly-fish, *Cyanea lamarcki*, showing the numerous delicate tentacles in their

natural position during life. Other photographs of the series were exhibited at the International Congress of Zoology at Monaco, and created much interest and admiration. Each plate will be accompanied by six pages of description, and the publication will be of quarto size. The price, 8 marks for each part of ten plates, is not excessive. The series will be published by Werner Klinkhardt, of Leipzig, with the title, "Tier- und Pflanzenleben der Nord See."

IT is well known that the loss of life during earthquakes in Italy, which in some towns has amounted to more than half the population, is largely due to the faulty construction of the houses. Prof. Omori indeed estimates that 998 out of every thousand persons killed in Messina in 1908 were victims of such defects. The construction of new buildings in the seismic districts is governed by stringent regulations both as regards site and design. Dr. Agamennone, however, suggests in a recent paper (*Rivista di Astronomia*, September, 1913) that these regulations should be supplemented by periodic inspection, and, if necessary, strengthening, of all existing houses.

The Times for November 25 contains an article from its Panama correspondent on the recent earthquakes felt in the canal zone. The strongest shock of the series was that which occurred on October 1, but it seems to have caused little damage except at Los Santos, which is about a hunderd miles from the canal. The writer considers the effects of a fault-displacement through the Gatun dam or the locks at the ends of the canal, and shows without difficulty that the result in either case would be disastrous. It seems unnecessary, however, to take into account a contingency so remote. The danger, if danger there be, is more likely to arise from the secondary effects of a strong shock occurring within a comparatively short distance from the canal. So long as the epicentres remain in a region a hundred miles or more from the canal, the risk of such damage must be small.

ALTHOUGH the crest of the Appalachian chain has long been known to form a line of division between two more or less distinct fresh-water faunas on its opposite flanks, the fact that a similar condition, in a more pronounced degree, holds good in the case of the Alleghenies has been to a great extent overlooked. In order to fill this gap in our knowledge, Dr. A. E. Ortmann has undertaken an investigation of the faunas of the various streams, based chiefly on the fresh-water mussels or naiads, but also including certain other groups, such as crustaceans, the results of which are published in vol. lii., No. 210 (pp. 287–390), of the Proceedings of the American Philosophical Society. It is considered that the Allegheny system forms an ancient and well-marked boundary between the fresh-water fauna of the interior basin and that of the Atlantic slope. In the former area the fauna of the upper Ohio basin is characterised by its uniformity—a feature acquired in post-glacial times; but on the western side there are indications of a pre-glacial faunistic differentiation. On the other hand, the marked distinctness of the Atlantic fauna is held to justify the foundation of two faunistic provinces—Mississippian and Atlantic—despite the fact that the fauna of the latter is a derivative from that of the former area. The Atlantic fauna is divisible into a northern and a southern group; and a dispersal line directed both north and south is recognisable on the Atlantic slope. Finally, a few cases in the mountains point to a crossing of the divide; while on the Atlantic side there occur certain instances of abnormal distribution which demand special explanation.

THE synoptic weather maps for November 7–13 included in the first issue of the Meteorological Office chart of the North Atlantic for December exhibit a very striking feature of the distribution of atmospheric pressure. The useful notes which accompany the maps explain that an extensive and deep cyclonic system lay almost stationary athwart the Transatlantic steamer routes, and remained there persistently for some days. There was a complete wind-circulation, but only few records of gales. Another deep disturbance lay over the American Lake region, and exceptionally violent gales were reported there. The abnormally mild type of weather over this country and western Europe was due to the ocean depression above referred to. The two disturbances were separated by a ridge of high pressure, extending across Newfoundland towards Davis Strait.

DURING the ice season of this year patrols in the North Atlantic were undertaken by the U.S. revenue cutters *Seneca* and *Miami*, and very interesting reports of the cruises of both vessels are contained in the Pilot Chart of that ocean for October, issued by the U.S. Hydrographic Office. The following notes are taken from the observations and deductions made by Capt. Johnston during the cruises of the former vessel. All the ice seen on or near the Grand Bank was of the Greenland type, in berg form. The largest berg seen was about 400 by 300 ft., the height above the water being 70 ft.; as to shape, no two bore any striking resemblance to each other. The only type not seen was the kind popularly pictured in school books, with overhanging, craggy pinnacles. The greatest distance at which ice was observed was eighteen miles, on a clear day. With the searchlight a berg could be seen about three miles on a dimly moonlight night, but owing to the blinding effect on the observer, its general use for a vessel under way is not recommended. A berg may or may not give an echo; about 90 per cent. of attempts made were without result, so that the absence of an echo proves nothing. Sudden changes of sea temperature mean nothing so far as bergs are concerned, and as a rule little or no change was found in the air temperature near a berg. In Capt. Johnston's opinion, the only safe way to navigate regions of icebergs is to stop during thick weather and to run very slowly on dark nights.

IN the Proceedings of the Royal Society of Edinburgh for 1910 Mr. J. B. Ritchie showed that the amplitude of the *n*th torsional oscillation of a weight supported by a thin wire was inversely proportional

to a power of $n+n_0$, where n_0 is a constant depending on the material of the wire. In the Proceedings for 1912–13 Prof. W. Peddie carries the investigation of the problem a step further by showing how the oscillations themselves are performed. To do this he provides the lower surface of the oscillating body with a number of pins, which make contact with mercury placed in slits in the top surface of an ebonite disc. The resulting currents operate the recorders of an electrical chronograph. He finds that the period of the motion towards, is distinctly greater than that away from, the equilibrium position, and that throughout the whole of the former and the first part of the latter path the motion is of the simple periodic type. Both these results, he shows, can be explained on the assumption that the motion when it exceeds a certain magnitude breaks up molecular groups in the suspending wire.

AN important paper on the phenomena occurring in solutions of radio-active products was read by Dr. T. Godlewski before the Academy of Sciences at Cracow on June 2, and also published in *Le Radium* for August last. In the experiments described a solution of radium emanation with its disintegration products in pure water was electrolysed. Radium A appeared at the anode and radium B at the kathode, while radium C was deposited in about equal quantities at both the anode and kathode. The nature of this deposition points strongly to the supposition that the products are present in the colloidal state and not as ions, the radium A forming negative, radium B positive, and radium C both negative and positive suspensions. This assumption was verified by experiments on the effect of adding small amounts of different electrolytes, such as HCl, NH_4OH, $Al_2(SO_4)_3$, and $K_3C_6H_5O_7$, which are known to affect the speed and direction of transportation of such suspensions. For instance, the H ions obtained by adding HCl in very small concentration (0·00003 normal) were shown to diminish the number of negative suspensions of radium A, and increase the number of positive suspensions of radium B. With further increase in concentration of HCl the radium A atoms begin to appear at the kathode. The action of basic ions was also shown to be very pronounced, and in the opposite direction to that of acids. The assumption that the products in neutral solution are present as colloids is also supported by recent experiments of Paneth, who has shown that polonium can be separated from lead by allowing the latter to diffuse through an animal membrane.

PARTS 1 and 2 of the Science Reports for 1913 of the University of Sendai, Japan, contain a series of papers by Prof. Honda and his pupils on the magnetic properties of ferro-, para-, and dia-magnetic substances and the effects of temperature upon them. For ferromagnetic substances the observations cover the effect of temperature on the intensity of magnetisation at various fields, the temperature at which magnetic changes occur and the heat developed or absorbed during the process. A magnetometric method was used. Soils were investigated by the torsion balance method, the specimen being placed in a magnetic field for which $H dH/dx$ was known. The susceptibilities were found to decrease as the temperature rose and to reach a value nearly zero between 500° and 600° C. They decreased also with increasing magnetic fields. Many alloys of antimony, lead, aluminium, zinc, tellurium, tin, and bismuth were investigated by the same method to test the influence of composition on susceptibility. In no case does it appear possible to calculate the susceptibility of such alloys from those of their constituents, and in almost all cases the alloys having their constituents in simple atomic proportions display characteristic magnetic properties.

CIRCULAR No. 42 of the Bureau of Standards, Washington, deals with metallographic testing, and contains a concise account of the scope of the subject, thermal analysis, and microscopic analysis, followed by full directions for preparation and forwarding the samples. Circular No. 25 of the same bureau contains general information regarding standard analysed samples. Details are given of the precautions taken in manufacture to secure pure and homogeneous samples. Before the final bottling, samples for analysis are removed from the jars and sent, one each, to a number of analysts. In general three types of analysts are chosen—commercial chemists, works chemists, and chemists of the bureau. When all the analytical results have been received they are inspected, and, if not sufficiently concordant, analysts are sometimes requested to repeat the determinations without knowing the direction from the mean in which their value lies. The standard samples include various steels, zinc ore, iron ores, naphthalene and sugar for calorimetric standards, benzoic acid, for calorimetry and for alkalimetry, and sodium oxalate. The prices are moderate, averaging two dollars for quantities of 50 to 150 grams.

THE Transactions of the American Institute of Chemical Engineers (vol. v.) contains a paper by A. S. Cushman and H. C. Fuller, of the Institute of Industrial Research, Washington, upon a chemical investigation of Asiatic rice. So far as the results of analysis can be interpreted in the light of the information at hand, the authors conclude that there appears to be no reason why the white milled rices from one section of the world should be held more responsible for malnutrition than similar rices from other parts. In the same volume J. C. Olsen and A. E. Ratner contribute a paper upon the decomposition of linseed oil during drying. While oxygen is absorbed, water and carbon dioxide are given off, the effect upon the weight of the oil being shown. The opacity and hiding power of pigments forms the subject of investigation by Mr. G. W. Thompson. For the purposes of these experiments an apparatus was devised consisting of a photometer which brings two fields of light into juxtaposition, so that they can be compared by the eye. This photometer is placed on top of two tubes, the lower ends of which have lenses. Paint placed between one set of lenses can be compared with a standard paint or with pieces of paper which have been tested on a photometer bench. Mr. M. C. Whitaker contributes a paper on the chemical

engineering course and laboratories at Columbia University. The course provides for post-graduate students who have taken a university degree. It has been observed that for several years more than 20 per cent. of the students of engineering at Columbia have possessed the college degree at entrance.

A COPY of Merck's annual report on recent advances in pharmaceutical chemistry and therapeutics has recently reached us. Lecithin is taken as the subject of the special monograph this year, and some seventy pages are devoted to it. In these are given an account of the chemistry and physiology of the lecithins, a discussion of the rôle which they are believed to play in the phenomena of metabolism and nutrition, and a summary of the results obtained with them in therapeutical experiments. A large amount of work has been done on these bodies, and students will find this account a convenient bird's-eye view of the subject. An extensive bibliography of lecithin literature is appended; both this and the description of the analytical tests will be found useful. Another special feature of the report is a supplement giving a detailed account of the methods used for the physiological standardisation of digitalis preparations in the Pharmacological Institute, Erlangen University. Gratusstrophanthin is used as the standard toxic substance for comparison, the subjects being frogs, mice, rabbits, and cats. Among the ordinary records may be mentioned as of special medical interest those on salvarsan and neo-salvarsan, chineonal, mesothorium, hypophysis preparations, and nucleinic acid; whilst the attention of analysts may be directed to those on cobalt-sodium nitrite, hydrazine sulphate, blood tests, uranium acetate in the determination of albumen, and the use of dimethyl-glyoxal as a reagent for nickel and ferrous iron.

IN his second lecture to the Institute of Chemistry on "The research chemist in the works, with special reference to the textile industry," Mr. W. P. Dreaper directed attention to the importance of a knowledge of theory, and illustrated this point by a reference to the work done in connection with the presence of stains and loss of strength experienced on the storage of certain silk goods. These faults were found to be due to the free sulphuric acid. Only a knowledge of theory could suggest why this acid could be present in cases where it had never been used in any process of manufacture. The so-called "neutral salt reaction" had offered a solution to this problem, and has relieved the dyer from constant blame. Continuing, he said the British aniline dye industry has recently made remarkable progress, and its products are even being sold in Germany. The future will see considerable expansion in this reviving industry.

IN an address recently delivered before the Calcutta Chemical Club Prof. P. C. Rây emphasises the extraordinary progress made by chemical research in Bengal during recent years; in the session 1912–13 alone more than sixty contributions were published from the chemical laboratory of Presidency College by Prof. Rây and his students. Owing to the recent munificent gifts of Sir T. Palit and Dr. Rashbehary Ghosh, it has become possible to found a University College of Science in Bengal, which it is hoped will bring about a renaissance of the scientific spirit in India. It is noteworthy that Dr. Ghosh has expressed the opinion that the higher academic degrees should be conferred only on those who have done original research work. He would abolish examinations for these degrees and make research work the only qualifying test, and Prof. Rây cites a case in which one of his recent students who was "plucked" in the B.Sc. examination, has since shown conspicuous ability in research, and is deserving of the highest degree.

The Engineering Magazine for November contains an illustrated article by W. Wilson, dealing with the development of Auckland Harbour, New Zealand. Nine years ago, when the present engineering staff took up their duties, a wooden wharfing scheme was in existence. Various timbers had been used in its construction, but every available wood was destroyed by an energetic species of Teredo. Even wood that is nearly impervious in Australian waters is attacked here. Ferro-concrete construction has been adopted, and after about seven years' trial has proved an entire success; while the prevailing mudstone on the shores of the harbour is riddled with molluscs, the concrete is quite proof against attack. The article has several photographs showing the condition of the old wooden piles; inspection of these illustrations indicates that the Auckland Harbour Teredo does its work in a most thorough fashion. Often only three years is required to honeycomb even the hardest timber.

THE seventh part of Dr. Koningsberger's *Java* is devoted to the faunas of open fallow lands and of fields which have been long under cultivation, the last chapter, dealing with the fauna of cacao plantations. On p. 311 the author speaks of the black-necked *Lepus nigricollis*, which haunts the fallows, as the Javan hare, whereas, according to Blanford, it is naturally restricted to southern India and Ceylon, whence it has apparently been introduced into Java.

WE have received from Washington a catalogue giving prices and carefully worded descriptions of the publications of the Carnegie Institution. Copies of each of the works, except the "Index Medicus," are sent gratuitously to a limited number of the greater libraries of the world, while the remainder of the edition is sold at a price sufficient only to cover the cost of publication and of transportation to purchasers. The catalogue concludes with an index of authors with condensed titles of their works. Copies of the catalogue may be obtained on application to the Carnegie Institution at Washington, D.C., U.S.A.

THE issue for 1914 of *The Scientists' Reference Book and Diary*, has been received from the publishers, Messrs. Jas. Woolley, Sons, and Co., Ltd., of Manchester. The reference book contains useful chemical and physical constants, glossaries of scientific and technical terms, and a miscellany of useful information. The diary is compact and conveniently arranged. The volumes are contained in a neat leather case of pocket size. The price of this popular diary is 2*s*.

OUR ASTRONOMICAL COLUMN.

THE RADIAL VELOCITY OF THE ANDROMEDA NEBULA. *Lowell Bulletin* (No. 58) contains an important communication by Mr. V. M. Slipher, which gives a first approximation to the radial velocity of the Andromeda nebula. Mr. Slipher used the 24-in. of the Lowell Observatory, with a camera of very short focus, a wide slit, and a very dense prism of 64°. The first of the series of spectrograms was exposed for 6h. 50m., but no mention is made as regards the lengths of the exposures of the other plates. The observations recorded are as follows:—

1912	Velocity
September 17	−284 km.
November 15–16	−296 ,,
December 3–4	−308 ,,
December 29–30–31	−301 ,,
Mean velocity	−300 ,,

Mention is made that tests for determining the degree of accuracy of such observations have not been completed, but the mean value is stated to be within the accuracy of the observations. As the Andromeda nebula is typical of a very great number of nebulæ it will be interesting to know whether other spirals have a movement of the same order, and thus exceed as a class the velocities of stars. The faintness of spiral nebulæ renders the accumulation of data on this point a very slow process, but an attack on a few of the brighter ones would be of great importance and might indicate the general tendency of the velocity magnitude.

PHOTOGRAPHIC MAGNITUDES OF COMPARISON STARS IN CERTAIN OF THE HAGEN FIELDS.—It was with the object of establishing the photographic magnitudes of stars which might be used as standards for comparison in the Hagen fields that Mr. C. H. Gingrich undertook the research which he describes in the October number of *The Astrophysical Journal*. The instruments available at the Yerkes Observatory for the research were a 6-in. Zeiss ultra-violet camera and a 2-ft. reflector; the former instrument was used for the bright stars, and the latter for faint stars, though in this case the exposures were considerably lengthened owing to the necessity of having to cut the aperture down to 1ft. Mr. Gingrich describes in some detail the programme of exposures and the methods of measurement and reduction. The results are summed up in ten tables, each including a field.

THE HARMONIC ANALYSER APPLIED TO THE SUN-SPOT CYCLE.—In a recent number of *The Astrophysical Journal* (October, vol. xxxviii., No. 3) Prof. A. A. Michelson gives the results of a determination of periodicities by the harmonic analyser with an application to the sun-spot cycle. The method employed is to obtain the values of the coefficients of a Fourier series by a mechanical integration by the harmonic analyser. The function to be treated is copied on the machine, which then draws a curve the ordinates of which at given distances along the axis of abscissas are proportional to the coefficients of the corresponding Fourier series. In the present paper he gives a few test illustrations of the performance of the machine, and refers to a similar treatment of the sun-spot curve, as furnished in the paper by Hisashi Kimura, entitled "On the Harmonic Analysis of Sunspot Relative Numbers," printed in the Monthly Notices, R.A.S., May, 1913, p. 543. Prof. Michelson concludes his paper with the statements that it would seem that with the exception of the eleven-year period and possibly a very long period (of the order of 100 years) the many periods found by previous investigators are illusory. He adds that it will probably be found that even the eleven-year period is, in fact, not constant, but is subject to secular change.

R.Z. CASSIOPEIÆ.—A research by Herr K. Graff on this important short-period eclipsing binary system is published in No. 13, *Mitteilungen der Hamburger Sternwarte*. It is pointed out that this system is pre-eminently fitted for study with small instruments since it is circumpolar, occupies a well-marked position lying in the prolongation of the line ϵ to ι Cassiopeiæ, the range of magnitude is important (6·36 to 7·69 in the course of rather less than three hours), and it has a very short period, 1·19525d.

THE NANTUCKET OBSERVATORY.—The new $7\frac{1}{2}$ in. photographic telescope has been placed in position in the Memorial Observatory of the Nantucket Maria Mitchell Association. The observatory has, in addition, a 5-in. Alvan Clark visual telescope, a filar micrometer, and a micrometer for measuring stellar spectra. The Nantucket Maria Mitchell Association has awarded the fellowship of 200*l.* for the year beginning June 15, 1914, to Margaret Harwood. In order that the observatory may be provided for from June 15, 1915, to December 15, 1915, the association offers a second fellowship of 100*l.* for the quadrennial year under conditions similar to those which have governed the 200*l.* fellowship. The committee reserves the right to withhold the second 100*l.* fellowship in case the work presented to the examiners should not in their judgment be of sufficient merit to deserve the award.

CONVERGENCE IN THE MAMMALIA.

THE discussion on convergence in mammalia in Section D at the recent meeting of the British Association was, to some extent, a consideration of matters kindred to several dealt with by Dr. Gadow in his presidential address. In his prefatory remarks Dr. Gadow referred to the importance of perceiving convergent resemblances, and said it was of more value to understand how and why, for instance, even a small but essential Cetacean feature had been brought about than to refer it back to some "Ur-Cetacean," which would still remain a mystical conception.

Prof. Dollo discussed a new case of convergence, namely Balæna and Neobalæna. He pointed out that Neobalæna, a whale with long whalebone, and found in the southern hemisphere, had been considered hitherto either as a true right-whale or as intermediate between the right-whales and the fin-whales. He held that Neobalæna does not belong to the right-whales, and that all the characters which it possesses in common with them are adaptations. Nor is Neobalæna intermediate between the right-whales and the fin-whales, but belongs to the latter group, for all the features which it has in common with the fin-whales are hereditary characters. Rhachianectes is not a primitive fin-whale; it is very specialised and secondarily adapted to littoral life and to its mytilophagous habit. Its hyperphalangy bears witness to its former pelagic life, and its shortened whalebones to its former plankton-feeding habit. The Mystacoceti should be divided into (1) Balænoidea, including a single family—the Balænidæ, with long whalebones, and (2) Balænopteroidea, comprising three families—Balænopteridæ, with short whalebones, Rhachianectidæ, with regressive whalebones, and Neobalænidæ, with long whalebones. Neobalæna is an example of positive convergence with Balæna by independent acquisition of the longibarbous character, and, on the other hand, is an example of negative convergence with Rhachianectes by reason of the loss of the throat-grooves.

Prof. van Bemmelen cited cases of convergence and then proceeded to discuss the relationship between the hare and the rabbit. Having compared these, as well as the different subgenera of Lepus with each other, he felt obliged to assume that the adaptation of a free-living, hare-like duplicidentate to a fossorial mode of life had taken place several times in different parts of the world and in different geological epochs. All rabbit-like members of the family did not form one well-circumscribed group, as opposed to the hare-like members, but they represent a number of side-branches emerging on different levels from a stem which itself leads from primitive hares like the Sumatran Nesolagus to the most highly developed species, *Lepus europaeus*. He pointed out that Ornithorhynchus and Echidna, especially the latter, are highly specialised forms, the more generalised ancestors of which have disappeared. The similarities between these two animals in many points are consequences of convergence and not of homology, *e.g.* the loss of teeth, the retrogression of the internal nares and corresponding elongation of the bony palate. This similar structure of palate has arisen in spite of the different diets of these animals. The factor in the case of Ornithorhynchus was the necessity of breathing while partially submerged (*cf.* the crocodiles and Cetacea), and in the case of Echidna, as in other ant-eaters, the necessity of preventing the living prey from entering the nasal passages.

Dr. Versluys discussed the subject from the philosophical aspect. He pointed out that convergence is so common in mammals that we are inclined to look for some special cause. Why does adaptation nearly always follow the same lines, as if no other way were possible? Is it because the power of natural selection is unlimited so that it can modify any original structure until in every case the one best adaptation is reached, or is the reverse true, *i.e.* is the possibility of modification so limited that, though several adaptations might be equally effective, yet only one can be followed, pre-indicated either by a limited variability or by some hereditary tendency? Nowhere is this similarity of adaptive structure more striking than in the teeth of mammals, and Osborn concluded that there must be operating here some law of predisposition—the influence of hereditary kinship. If such a law be accepted the great abundance of parallel adaptation might be referred to a tendency inherited from a common ancestor, and natural selection could foster these tendencies only where they become useful. Sometimes, however, an astonishing convergence is found in distantly related mammals, *e.g.* the Eocene primate Notharctus exhibits a tooth-pattern closely resembling that of Eocene horses. If we assume some hereditary tendency in this case it must have been present in the very primitive mammals which were the common ancestors of both those forms, and from which also a large proportion of placental mammals must have sprung. It would further be necessary, however, to accept a primitive tendency to form several other tooth-patterns, which became useful and developed only a long time afterwards. If we refuse to accept the presence of some hereditary tendency in the case of Notharctus, why should we accept it in other cases where the parallel modification of structure in more closely related animals would not constitute so difficult a task for natural selection? If we do not accept the hereditary tendency it is necessary to ascribe a very great modifying power to natural selection.

Dr. Versluys pointed out in conclusion that the study of convergence brings us into contact with some of the most important problems of the doctrine of evolution (which it may assist in solving), the problem of the power of natural selection and the survival value of small variations, and the problem of the presence of hereditary tendencies in variation and adaptation.

Dr. W. K. Gregory exhibited and commented upon several groups of specimens illustrating convergence. He pointed out that in many cases of convergence there is a likeness of material or a general homology to begin with, as in the evolution of the carnassial teeth in the Hyænodontidæ and Canidæ, where, although the evolution had taken place in different teeth (the fourth upper premolar in the Canidæ and the second upper molar in the Hyænodontidæ), yet the tissues involved were the same in the converging groups. Sometimes, however, convergence took place between structures formed from quite different tissues, as in the dentition of Thylacoleo and the not dissimilar shearing structures of Dinichthys—in the former case true teeth, in the latter sharpened edges of bone. Dr. Gregory pointed out finally that great advances have been made in the detection of cases of convergence, *e.g.* among the extinct Patagonian Sparassodonts. J. H. A.

ANTHROPOLOGY AT THE BRITISH ASSOCIATION.

IN a retrospect of the proceedings of Section H at Birmingham, first place must be given to the discussion on the practical application of anthropological teaching in universities, which was opened by the president, Sir Richard Temple, who, speaking with the authority of an old administrator as well as an anthropologist, pointed out the advantages which would follow did the future administrators of our subject races receive some training in anthropology before taking up their duties. He suggested that the organisation of a school for this special purpose, well equipped with library and museum, might well be undertaken by one of the newer universities, such as Birmingham. Sir Richard, at the close of his remarks, quoted extracts from letters received from Sir R. Wingate, Sir F. Swettenham, Sir George Scott, Prof. Seligmann, and others, in which his proposals received strong support. In the discussion which followed, Sir Everard im Thurn, late High Commissioner in the Pacific, Mr. W. Crooke, and Colonel Gurdon of Assam, endorsed the president's views as to the desirability of the proposal from the administrative point of view, while Dr. Haddon, of Cambridge, Dr. Marett, of Oxford, and Prof. P. Thompson, of Birmingham, made suggestions as to the general lines upon which such a school might be organised, and gave a brief account of the anthropological instruction already given by their respective universities. The discussion has aroused much interest, and it may be hoped that the committee which has been appointed to consider the question will make some practical proposal to which effect can be given by one of the existing schools or a school still to be established.

Turning to the other proceedings of the section, it may be said that the general level of interest of the papers was high. The programme was exceedingly long, so much so that on two occasions it was necessary for the section to divide, the joint discussion with the Section of Educational Science on the educational use of museums being attended by part of the section only, including the president and Dr. Haddon, while the papers on physical anthropology were presented to a subsection over which Sir Edward Brabrook presided. The papers in physical anthropology, which were followed with close interest by a large audience, included a group of three papers of a somewhat speculative character on the evolution

of man from the ape, the first by Prof. Carveth Read, dealing with the consequences—physical, mental, and social—following from the preference for a meat diet, which differentiates man from the other primates; a second by Dr. Harry Campbell on the essentially mental character of man's evolution, the pre-human anthropoid, being only imperfectly equipped as a beast of prey, and having in consequence been compelled to rely upon the development of his intelligence; and a third by Dr. L. Robinson on the relation of the jaw to articulate speech and its effect on the development of the chin. In the discussion which followed, Prof. Elliot Smith briefly referred to his own position with regard to the part played by the brain in the evolution of man, as set forth in his presidential address at Dundee, and with special reference to Dr. Robinson's paper, said that, in his view, it was not the conformation of the jaw which made speech possible, but the acquisition of speech which developed the jaw; the absence of the genio-glossal muscle and the chin in the Piltdown skull proved nothing as to the power of speech. Prof. Fleure and Mr. T. C. James then gave an account of the further results of their anthropometric survey of Wales, especially in relation to the distribution of racial types, and Prof. Petrie described the early Egyptian skeletons discovered in his excavations, with special reference to the traces of racial admixture discernible in skeletal remains of the early dynasties found at Tarkhan and due to an invading minority race of the first dynasty.

Among the ethnographical papers, considerable interest was aroused by Mr. T. W. Thompson's paper on the tabus and funeral customs of the gypsies, in which, as the result of a close analysis of the customs of both English and Continental gypsies, he was able to show that these were distinctly gypsy in character, while the marriage customs tend to conform to the customs of the country of habitat. Dr. Rivers and the Rev. J. Hall, in a joint communication on a gypsy pedigree, that of the Heron family, were able to demonstrate a number of facts of sociological and biological interest as to the gypsy family and marriage. Prof. W. J. Sollas, in a communication on the relative age of the patrilineal and matrilineal tribes of south-east Australia, discussed the evidence—physical, linguistic, and cultural—which appeared to point to the increasingly primitive character of the tribes from north to south—a conclusion which, as might be expected, was in agreement with the usual assumption that Australia and Tasmania had been peopled from New Guinea—and suggested further that the evolutional change had been from Kurnai through Kulin to Narrinjeri. Mr. E. S. Hartland put forward a warning against the uncritical acceptance of the historical traditions of the Baganda and the natives of the Congo, while Mr. Crooke in like manner was able to show by an examination of marriage customs that there was less stability in the caste and tribal systems of India than Risley had supposed when considering these aggregates as affording an unequalled opportunity for the application of anthropometric methods.

Nearly the whole of one morning's session was devoted to papers dealing with seasonal customs in various parts of the world; Dr. Rivers, in a communication on sun cults and megaliths in Oceania, pointed out the coincidence in the distribution in this region of these monuments and the existence of secret societies, the rites of which might, either by direct evidence or by inference, be connected with the sun cult, an exception, however, being found in the island of Tonga, where there was no evidence for the sun cult. Miss Burne dealt with the seasonal customs of "souling," "catterning," and "clementing" in the western Midlands, which she connected with the beginning of the Celtic year in November, and Mr. J. H. Powell suggested that the custom of hook-swinging in India, which he assigned to a Dravidian origin, was a commutated form of human sacrifice. Miss M. Murray discussed the evidence for the practice of killing the king in ancient Egypt. In her view the evidence for human sacrifice was conclusive, and so far Dr. Frazer's theory of a vegetation spirit was the only one which covered the facts. Mr. W. J. Perry, in a communication dealing with the practice of orientation of the dead in Indonesia, pointed out that in all cases the direction indicated lay towards the home of the dead, and suggested that in this direction lay the place of origin of each people in question. Dr. G. Landtman described the ideas of the Kiwai Papuans regarding the soul, which this people look upon as separable from the body in life as well as in death; in the former case its appearance constitutes an omen, sometimes foretelling misfortune to the owner; and Miss Czaplicka demonstrated the effect of environment upon the religious beliefs of the inhabitants of north-east Siberia, the tundras of the north producing a religious dualism in which a belief in "black spirits" prevails, family shamanism is more important than professional shamanism, and want of light and suitable material produces a poor shamanistic apparatus and a poor myth ritual; while in the more open and more favoured steppe country a belief in "white spirits" and an anthropomorphic and imaginative mythology are found. Major Tremearne supplemented the studies of the Hausas which he had submitted to the section at the Portsmouth meeting of the association by a description of Hausa magical practices and an account of the Bori, or spirit cult, of the Hausas of Tunis and Tripoli. Mrs. Charles Temple, in her analysis of the social customs of the pagan tribes of Northern Nigeria, which was drawn largely from official reports, gave an object-lesson of the work, valuable both to the man of science and to the official, which is possible under an intelligent and enlightened administration.

Archæology usually takes a prominent place in the proceedings of the section, and this year was no exception to the rule. Prof. Petrie's account of excavations at Tarkhan, on a site near Gerzeh, and at Memphis, of remains of the first, the twelfth, and the eighteenth and nineteenth dynasties, carried out by the British School of Archæology in Egypt, attracted a large and appreciative audience. His discoveries of Tarkhan, where the preservation of the tombs is remarkable, have revealed much of the civilisation of the people, apart from the king and court, while, as he pointed out, this site may be regarded as of the highest importance in the study of the meeting of the prehistoric and earliest historic races of Egypt. Prof. G. Elliot Smith traced the dolmen to the typical Egyptian tomb of the pyramid period, imperfectly copied in a degraded form in a foreign land where skilled workmen were unobtainable.

Prof. J. L. Myres's valuable contribution to the archæology of Cyprus was based upon a recent re-examination of the Cesnola collection in New York Metropolitan Museum, which had enabled him to extend the upward time limit of the great series of votive statues to a period when Assyrian influence was not yet fully developed, and Syro-Cappadocian affinities were discernible, and to show that the Minoan costume extended in ceremonial, possibly in common, use, well into historical times, while the Cretan syllabary was found to contain elements linking it on to the Minoan script. Mr. G. A. Wainwright, in discussing the origin of the Keftiu, usually identified with the Cretans, demonstrated by a detailed analysis of the evidence of the Egyptian monu-

ments, that their culture was more nearly allied to the Syrian than the Ægean type. Mr. R. Campbell Thompson explained his system of decipherment of the Hittite inscriptions, and in another communication described a large number of ancient Assyrian medical charms and remedies from inscribed tablets still unpublished. The evidence bearing upon the character and powers of the female magician in Semitic magic was analysed and discussed by Prof. T. Witton Davies. Dr. T. Ashby, director of the British School at Rome, described the successive systems of aqueducts in ancient Rome, and gave an account of a recent attempt to trace the Via Appia, in the course of which he discovered four menhirs near Bari not hitherto described.

The archæology of western Europe was covered by communications from Dr. Marett, describing recent discoveries of Palæolithic and Neolithic age in the Channel Islands, and from Mr. Cantrill on stone boiling in the British Isles; from Mr. H. Peake on the Bronze age in the Rhone Valley, and Mr. O. G. S. Crawford on trade between England and France in the Neolithic and Bronze ages. Mr. W. Dale, in describing an exhibit of flint implements found in the county of Hampshire, raised the question of the dating of the rough "celt" usually assigned to the Neolithic period, but unfortunately owing to lack of time no discussion was possible. Mr. J. P. Bushe-Fox described the excavations on the site of the Roman town of Viroconium, which are being carried out under the auspices of the Shropshire Archæological Society and the Society of Antiquaries, and Dr. Willoughby Gardner gave an account of his further excavations of the Romano-British hill-fort in Kinmell Park, near Abergele. Dr. T. J. Jehu and Mr. A. J. B. Wace described their discoveries in excavating the Kinkell Cave, near St. Andrews, which had been inhabited in Roman and early Christian times. These included a slab of red sandstone with incised crosses, which the authors held to be probably one of the earliest relics of Christianity yet found in Britain. Papers by the Rev. F. Smith, on Palæolithic trap stones, and by the Rev. Dr. Irving, on the prehistoric site at Bishops Stortford, brought to a close one of the most successful meetings of recent years.

OCEAN TEMPERATURES NEAR ICEBERGS.

THE Journal of the Washington Academy of Sciences for September 19 contains, *inter alia*, an account by Messrs. C. W. Waidner, H. C. Dickinson, and J. J. Crowe, of the Bureau of Standards, of observations on ocean temperatures in the vicinity of icebergs and in other parts of the ocean taken by them on board the United States' steamships *Chester* and *Birmingham*.

The party, which left Philadelphia in the *Chester* on June 2, 1912, and was subsequently transferred to the *Birmingham*, registered continuous observations from June 19 until its return to Philadelphia on July 11 of the same year.

The temperature equipment carried consisted of a surface electrical resistance thermometer, a Leeds and Northrup recorder suitable for use with the resistance thermometer, deep sea thermometers, and several mercurial standard thermometers.

Several small bergs were seen on the horizon from the *Chester* on June 17, and almost simultaneously the temperature record indicated a sudden fall from 8·7° to 7·3° C. The fall continued while the berg was approached, and at a distance from it of about 500 yards the temperature was 5·7° C.

At a distance of about 150 yards from the berg, the mass of which was estimated at about 1200 tons, the surface temperatures taken from a boat ranged from 5·8° to 6·7° C. Other observations taken gave the following temperatures: 20 ft. from the berg, 4·5°; 35 ft., 4·9°; 50 ft., 5·0°; 75 ft., 5·4°; 200 ft., 5·7° C.

At a depth of five fathoms, when 50 ft. from the berg, the temperature was 3·6° C., and at 20 fathoms 3·3° C. At some miles distant from the berg, however, the temperatures taken were as low as those observed a few feet from it; moreover, an examination of temperature records, which were obtained under a variety of conditions, in the region of 37° to 43° 30′ north latitude and 43° to 53° west longitude, demonstrated the difficulty of separating large and sudden variations of sea temperature, so frequently met with, from variations that might be caused by the proximity of icebergs.

In some parts of the ocean, temperatures were recorded that were constant to a few tenths of a degree for many hours, whereas in other parts the variations were as large and sudden as any observed in the neighbourhood of icebergs.

The variation in the salinity of sea-water in the vicinity of bergs, resulting from the melting of the ice, were so small as to be masked by the ordinary variations found in sea-water.

Experiments with the foghorn, sounded when in the vicinity of icebergs, with the object of detecting their presence in a fog by the echo from them, were tried without success; but a few experiments made with a bell sounded under water to ascertain whether an echo from the submerged portion of a berg could be detected by means of the ship's submarine signal telephones were attended with more hopeful results.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

BIRMINGHAM.—The Huxley lecture for this year is to be delivered by Sir Arthur Evans, F.R.S., who has chosen as his subject, "The Ages of Minos."

CAMBRIDGE.—The Vice-Chancellor gives notice that the Lowndean professorship of astronomy and geometry is vacant by the death of Sir Robert Ball. The electors will meet for the purpose of electing a professor on Monday, December 22. Candidates are requested to send their names, with ten copies of such testimonials, if any, as they may think fit, to the Vice-Chancellor on or before Monday, December 15, 1913.

Mr. N. Cunliffe has been appointed to the office of assistant to the superintendent of the museum of zoology for one year as from October 1, 1913.

The Walsingham medal for 1913 has been awarded to Mr. F. Kidd, for his essay entitled, "On the Action of Carbon Dioxide in the Moist Seed in Maturing, Resting, and Germinating Conditions."

Mr. H. S. Jones, formerly foundation scholar, Isaac Newton student 1912, Smith's prizeman 1913, has been elected to a fellowship at Jesus College.

LONDON.—Dr. W. T. Gordon has been appointed lecturer and head of the geological department at King's College, in succession to Dr. T. F. Sibly, appointed professor of geology at the University of South Wales, Cardiff. Dr. Gordon has been lecturer in palæontology and assistant in geology at the University of Edinburgh since 1910, and has made extensive researches in palæobotany, and some investigations in stratigraphical geology.

MANCHESTER.—A very interesting and pleasant ceremony was held in the University on Thursday, November 27, when the portrait of Prof. Horace Lamb, F.R.S., was presented by subscribers to the University to be hung in the Whitworth Hall. Prof. Lamb has filled the chair of mathematics in the Uni-

versity of Manchester since 1885, or a period of twenty-eight years, and is now senior professor. An unusual feature of interest lay in the fact that the portrait of Prof. Lamb was painted by his son, Mr. Henry Lamb, a rising young artist. The gathering was well attended by the friends and colleagues of Prof. Lamb, and the presentation of the portrait was made by Prof. Tout and Prof. Rutherford on behalf of the subscribers. Reference was made to the remarkable success of Prof. Lamb as a teacher of mathematics, and to the importance of his original contributions to mathematical physics. The portrait was accepted on behalf of the University by Sir Frank Forbes Adam, the chairman of the council, and very appreciative references were made by Prof. Weiss, the Vice-Chancellor, and by all the speakers, to the esteem and affection in which Prof. Lamb is held by all his friends and colleagues. Letters were read from Dr. Schuster, Sir Joseph Larmor, the Vice-Chancellor of Leeds, and others, who were unable to be present at the presentation, in which they expressed their warm appreciation of the services of Prof. Lamb to the University and to science as a teacher and original investigator. The hope was expressed by all the speakers that Prof. Lamb would long continue to carry on his work in the University which he has served with so much distinction.

DR. G. OWEN, lecturer and demonstrator in physics at Liverpool University, has been appointed professor of physics at Auckland University College, New Zealand.

IT is stated in *Science* that a gift of 870,000*l.* to the Cornell Medical School has been officially announced. The name of the donor is withheld, but he is believed to be Colonel O. H. Payne, of New York City.

SIR THOMAS H. ELLIOTT, K.C.B., Deputy Master and Comptroller of the Royal Mint, will distribute prizes and certificates at the Sir John Cass Technical Institute, Aldgate, E.C., on Wednesday next, December 10, and will deliver an address. There will be an exhibition of students' work and apparatus in the laboratories and workshops.

IN the issue of *Science* for October 24, Prof. F. C. Ferry, writing under the title, "Some Tables of Student Hours of Instruction," gives some interesting facts as to the amount of work done in various American universities in the different faculties. By a "student hour of instruction" is meant the taking of a course of one hour a week by one student through one session. The tables included in the article show that in the order of the relative amount of work done in science and mathematics certain of the American universities stand in the following order:—Leland Stanford Junior, Princeton, Cornell, Wisconsin, Johns Hopkins, Dartmouth, Wesleyan, Amherst, and Columbia. In general, the eastern universities show a greater amount of work in the foreign languages than the western, while the western show much larger numbers in science.

IN a note last week attention was directed to the beginning of the new buildings for the Massachusetts Institute of Technology. We notice in *The Boston Evening Transcript* of November 8, a copy of which has been received, that two of its large pages are devoted to particulars and illustrations of the new buildings. Our contemporary speaks with natural pride of the part taken by old students of the institute in making it possible to provide the new buildings. The engineer, the architect, and many other experts engaged upon the work of construction are old students, many of whom are giving their services. To quote from the article:—"Throughout the whole process the institute has been aided by its own best product. For every portion men technically trained in its own departments have come to its aid, and here it should be understood these men are giving liberally what would be exceedingly costly under ordinary commercial rules." Since the fiftieth anniversary of the founding of the institute, in April, 1911, 1,506,000*l.* has been received in gifts, and a considerable part of the money has come from old students.

AN examination of the calendar for the current session of the University College of North Wales shows that the Court of Governors spares no pains to keep in close touch with the special needs of the areas from which it more particularly draws its students. As typical of the arrangements made to demonstrate the value of higher educational institutions, it may be stated that the calendar points out that an important new departure has been taken by the authorities of the college in the appointment of two "advisers," who will devote themselves to the investigation of special problems affecting agriculture, and the giving of scientific advice to farmers and others who may refer to them questions for solution. These appointments have been made possible by a special grant made by the Board of Agriculture out of a sum from the Development Fund which has been placed at the disposal of the Board for this particular purpose. In addition to the instruction given in the college itself, a scheme of "out-college agricultural instruction" has been organised, and is now being carried out throughout the greater part of North Wales. This scheme is maintained by means of annual grants, amounting altogether to 1100*l.*, which are voted by the County Councils of Anglesey, Carnarvonshire, Denbighshire, and Flintshire. It is interesting to record that the total sum subscribed for all purposes since the establishment of the college is 230,748*l.*

THERE is perhaps no more healthy and hopeful sign of the increasing interest in education, whether elementary, secondary, technological, or university, than is to be found in the numerous conferences which are held from time to time by associations of teachers and administrators to discuss questions, not only concerning the administration of education and the relative responsibility of the central and local authorities, but also the subjects most suitable to the various grades of education and the best methods of presenting them. Of these conferences that of the annual congress of the Irish Technical Instruction Association, the report of which has been recently issued, deserves a high place having regard to the interest of the subjects considered and the high quality of the papers read. It is especially gratifying to note that in Ireland, hitherto so much neglected as compared with the rest of the United Kingdom, a vigorous educational life has been awakened as a result of the efforts of enthusiasts like Sir Horace Plunkett, the founder of the Irish Agricultural Organisation Society, to whose zeal and intelligence is also due the establishment of the Department of Agriculture and Technical Instruction, which has done so much through the enlightened and vigorous efforts of its chief officials, Mr. T. P. Gill and Mr. G. Fletcher, to develop technical education in Ireland. The proceedings of this, the twelfth congress, held in May last, under the presidency of Mr. F. C. Forth, the principal of the Belfast Technical Institute, extended over three days, and was attended by representatives from all parts of Ireland, including members of technical instruction committees, principals and teachers of technical schools, members of chambers of commerce, and officials appointed by Government departments. Amongst the important papers read and discussed

were :—"Citizenship and Technical Instruction" (a subject almost entirely ignored in schemes of technical instruction), by Mr. T. P. Gill; "Apprenticeship Classes," by Mr. B. O'Shaughnessy; "Technical Instruction: its Achievements and Possibilities," by the Rev. Canon Arthur Ryan; and "Domestic Economy: the Family Budget," by Mr. G. Fletcher. The method of treatment and the importance of the subjects considered give the report a high value, and make it worthy of the serious attention of educationists on this side of the Irish Sea.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, November 27.—Sir Archibald Geikie, K.C.B., president, in the chair.—Prof. B. **Hopkinson**: A method of measuring the pressure produced in the detonation of high explosives or by the impact of bullets. A steel shaft about $1\frac{1}{2}$ in. diameter and 4 ft. long is suspended horizontally from strings so that it can swing in a vertical plane as a ballistic pendulum. At one end it carries an end-piece of the same diameter and several inches long. The end-piece is held on by magnetic attraction; the surfaces of the joint are carefully faced. If a bullet be fired at the other end a wave of pressure travels along the shaft, the length of which represents the duration of the blow on the scale 1 in. $= 5 \times 10^{-6}$ second approx. The wave passes the joint without change and is reflected as a tension-wave from the free end. If length of wave exceeds twice that of end-piece, the tail of pressure-wave will have passed the joint when the head of tension-wave reaches it and the piece will fly off, having trapped within it the whole momentum of the blow, leaving the shaft at rest. By experimenting with different lengths of end-piece and finding that which is just long enough to stop the shaft, the duration of blow can be determined. The end-piece is caught in a ballistic pendulum and its momentum measured; thus, knowing the time, the average pressure is determined. Applied to investigation of the blow given by a lead bullet, the method gave results in close accord with those expected on the assumption that the bullet behaves as though it were liquid, the measured duration of blow being nearly that required by the bullet to travel its own length. Measurements by the same method of pressures produced by detonation of a 1-oz. dry guncotton primer showed that, at a distance of $\frac{3}{4}$ in. from surface of cotton, the pressure is practically all gone in 1/50,000 second, the average pressure during that period being about 25 tons per sq. in., and the maximum of the order of 45 tons per sq. in.—J. H. **Jeans**: Gravitational instability and the nebular hypothesis. The work of Maclaurin, Jacobi, Poincaré, and Darwin on rotating fluids has applied only to the abstract case in which the mass is considered perfectly incompressible and homogeneous. To estimate the bearing of their results on astronomical problems, it is important to know to what extent these results remain valid for actual, compressible, heterogeneous masses. The result of the present investigation is summed up concisely by saying that the ideal mass of incompressible fluid has been found to supply a surprisingly good model by which to study the behaviour of the more complicated natural systems considered in astronomy.—B. A. **Keen** and A. W. **Porter**: The diffraction of light by particles comparable with the wave-length. A suspension of finely-divided sulphur, obtained by precipitation from a solution of thiosulphate of soda by the addition of acid, ordinarily diffracts an excess of blue light, so that a white source of light seen through it looks red. One of the authors discovered that if the particles be allowed to grow the red image gradually changes over in colour, becoming at one stage a deep indigo blue, and afterwards passing through various shades of green to white. The present investigation was undertaken to obtain quantitative information in regard to this phenomenon.—Prof. R. J. **Strutt**: Note on the colour of zircons, and its radio-active origin.—Prof. W. H. **Bragg**: The influence of the constituents of the crystal on the form of the spectrum in the X-ray spectrometer. The energy of the pencil of X-rays which falls on the crystal of the X-ray spectrometer is in part spent within the crystal through absorption, which implies the production of kathode and characteristic X-rays, and in part is scattered, producing the reflected ray when circumstances are favourable. It is found that where there is much absorption there is little reflection. The best reflectors are therefore those crystals of which the absorption coefficients are smallest in comparison with their weights or their scattering powers. For this reason alone the diamond must be a very good reflector.—W. L. **Bragg**: The analysis of crystals by the X-ray spectrometer. By a quantitative comparison of the intensities of the successive orders of reflection by various crystal faces, it is shown that the X-ray spectrometer can be made to give a very complete analysis of the crystal structure. The structures particularly investigated in the paper are those of the isomorphous sulphides, pyrites, and hauerite, and of the series of compounds which compose the calcite family of minerals. By a study of these last compounds, it is concluded that the diffracting power of an atom is proportional to its atomic weight.—Dr. T. H. **Havelock**: Ship resistance: the wave-making properties of certain travelling pressure disturbances. The paper contains a theoretical comparison of the wave-making resistance associated with certain distributions of surface pressure. Various inferences are drawn in regard to variation of resistance with speed, and the speeds at which typical interference effects occur. In particular, types are examined which are similar in general form to those associated with the motion of ship models in recent work at the William Froude tank in the National Physical Laboratory.—Dr. R. A. **Houstoun**: The mathematical representation of a light pulse. The object of this paper is to direct attention to a new series of expressions representing the initial form and dispersion of a light pulse. They have been suggested by one of Kelvin's hydrodynamical papers, and are derived from his instantaneous-plane-source solution in the conduction of heat.

Zoological Society, November 11.—Dr. S. F. Harmer, F.R.S., in the chair.—Dr. W. T. **Calman**: Freshwater Decapod Crustacea (families Potamonidæ and Palæmonidæ) collected in Madagascar by the Hon. Paul A. Methuen. One new species of Potamon and five varietal forms of *P. madagascariense* were described. It is suggested that the river-crabs of Madagascar may have had an autochthonous origin from some form resembling *P. madagascariense*. No clear affinities can be traced with the Potamonidæ of Africa or of Peninsular India, but it is pointed out that in the present state of knowledge the river-crabs appear to be a hazardous subject for zoogeographical speculation.—G. A. **Boulenger**: A collection of reptiles and Batrachians made by Dr. Spurrell, in the Colombian Choco. The series of specimens was of great interest, and contained several new species.—C. Tate **Regan**: A revision of the Cyprinodont fishes of the subfamily Pœciliinæ. A number of new genera were defined and several new species were described; the structure of the intromittent organ was found to be of great systematic importance.—Prof. W. N. **Parker**: Investigations on a growth of *Spongilla lacustris* in the Cardiff Waterworks system. The author described

the methods adopted to eradicate the sponge from the infected areas.—Prof. J. Playfair **McMurrich**: Two new species of Actinians from the coast of British Columbia. These specimens probably represented stages of a single species, and belonged to a group hitherto not recorded from the west coast of America.

PARIS.

Academy of Sciences, November 24.—M. F. Guyon in the chair.—A. **Haller**: The alkylation of thujone and *iso*thujone by means of sodium amide. An account of the preparation of dimethyl-, diallyl-, and triallylthujone, and of dimethyl*iso*thujone and allyl-*iso*thujone.—A. **Müntz** and H. **Gaudechon**: Contribution to the study of clays. Experiments on the sedimentation of clays under the action of gravity alone, or the combined action of gravity and an electric field.—Edmond **Perrier**: The international protection of nature. On the initiative of M. Paul Sarrasin and the Swiss Government a conference was held at Berne at which it was decided to form a permanent commission to deal with the question of the preservation of rare animals and birds.—A. **Verschaffel**: Remarks on the communication of A. Claude and L. Driencourt concerning a new impersonal coincidence micrometer.—A. **Guntz** and A. A. **Guntz, Jr.**: The hydrates of silver fluoride. Details of the conditions necessary for the isolation of the three hydrates, $AgF,4H_2O$, $AgF,2H_2O$, and AgF,H_2O.—A. **Calmette** and V. **Grysez**: Experimental demonstration of the existence of a generalised lymphatic stage, preceding localisations, in tuberculous infections. It is shown that no local lesion is produced at the point of penetration of the bacillus.—Michel **Petrovitch**: The minimum modulus of an analytical function along a circumference.—G. **Kœnigs**: Doubly decomposable movements and surfaces which are the seat of two families of equal curves.—R. **Fortrat**: Groups of real and apparent lines in band spectra.—L. **Margaillan**: The neutralisation of chromic acid. The neutralisation of chromic acid has been studied by means of the hydrogen electrode. The curve of electromotive force shows two points of inflection corresponding to the change of colour of methyl orange and phenolphthalein respectively.—Lucien **Daniel**: A new graft hybrid.—Robert **Douin**: The arrangements for the absorption of water in the female capitule and male disc of the Marchantiaceæ.—A. **Guilliermond**: New cytological researches on the formation of anthocyanic pigments. These pigments and the colourless phenolic compounds are always the product of the activity of the mitochondria.—Raoul **Combes**: The experimental production of an anthocyanine identical with that formed in red leaves in autumn, starting with a compound extracted from green leaves. The red compound was shown to be identical with the colouring matter extracted from red leaves. Contrary to the views currently held, it is a reduction, and not an oxidation product.—P. **Nottin**: The influence of mercury on alcoholic fermentation.—F. **Bordas**: The transmission of typhoid fever by the air. Remarks confirming the conclusions drawn in a recent paper by A. Trillat and M. Fouassier.—Ch. **Nicolle** and L. **Blaizot**: Stable and atoxic antigonococcus vaccines.—MM. **Variot** and **Lavialle**: The effects of sweetened milk in the treatment of dyspeptics with gastric intolerance. The special eupeptic properties of sweetened milk appear to be entirely due to the high proportion of cane sugar.—J. **Bergonié**: Posology in physiotherapy.—Ch. **Gravier**: Some results of the second French Antarctic Expedition: Alcyonaria.—R. **Anthony** and L. **Gain**: The development of pterylosis in the penguin.—M. **Fauré-Fremiet**: *Erythropsis agilis*.—J. **Wolff**: The influence of iron in the development of barley and the specific nature of its action. Neither nickel nor chromium can replace iron in the development of barley.—Em. **Bourquelot** and M. **Bridel**: The biochemical synthesis of the glucosides of polyvalent alcohols: the α-glucosides of glycerol and glycol.—Arthur L. **Day** and E. S. **Shepherd**: Conclusions to be drawn from the analysis of the gases from the crater of Kilauea. The gases are undergoing chemical interaction as they rise in the crater, with marked development of heat. Water vapour is present in large quantity, and chlorine in a negligible proportion only. The nitrogen collected contained no argon.—Remarks by A. **Lacroix** and A. **Gautier** on the preceding paper.—Ph. **Glangeaud**: The characteristics of the spring waters in the volcanic formations of Auvergne.—Ph. **Négris**: The discovery of the Eocene above the Cristallophyllian of the Cyclades and the genesis of the Cristallophyllian facies in Greece.—G. **Valsan**: The evolution of the Roumanian plain between the rivers Olt and Arges.

BOOKS RECEIVED.

Outlines of Chordate Development. By Prof. W. E. Kellicott. Pp. v+471. (New York: H. Holt and Co.) 2.50 dollars.

Das Mittelmeergebiet: seine Geographische und Kulturelle Eigenart. By A. Philippson. Dritte Auflage. Pp. x+256+15 plates. (Leipzig and Berlin: B. G. Teubner.) 6 marks.

The Indian Forest Memoirs. Economy Series. Vol. ii., part ii. On the Economic Value of *Shorea robusta* (Sal.). By R. S. Pearson. Pp. vi+70+viii plates. (Calcutta: Superintendent, Government Printing, India.) 3*s*.

Einführung in die Vererbungswissenschaft. By Prof. R. Goldschmidt. Zweite Auflage. Pp. xii+546. (Leipzig and Berlin: W. Engelmann.) 13 marks.

The Scientists' Reference Book and Diary, 1914. (Manchester: J. Woolley, Sons and Co., Ltd.) 2*s*.

Practical Cinematography and its Applications. By F. A. Talbot. Pp. xii+262+plates. (London: W. Heinemann.) 3*s*. 6*d*. net.

The Diseases of Tropical Plants. By Prof. M. T. Cook. Pp. xi+317. (London: Macmillan and Co., Ltd.) 8*s*. 6*d*. net.

Alternating Currents and Alternating Current Machinery. By Prof. D. C. Jackson and Dr. J. P. Jackson. New edition. Pp. viii+968. (London: Macmillan and Co., Ltd.) 23*s*. net.

Viśvakarma: Examples of Indian Architecture, Sculpture, Painting, Handicraft. Chosen by Dr. A. K. Coomaraswamy. Part vi., 12 plates. (London: Luzac and Co.) 2*s*. 6*d*.

Influenza: Its History, Nature, Cause, and Treatment. By Dr. A. F. Hopkirk. Pp. xix+209. (London and Felling-on-Tyne: The Walter Scott Publishing Co., Ltd.) 3*s*. 6*d*.

Modern Rationalism as Seen at Work in its Biographies. By Canon H. Lewis. Pp. ix+418. (London: S.P.C.K.) 4*s*. net.

Butterflies and Moths in Romance and Reality. By W. F. Kirby. Pp. 178+28 plates. (London: S.P.C.K.) 5*s*. net.

Canada. Department of Mines. Geological Survey Branch. Memoir No. 37. Portions of Atlin District, British Columbia, with Special Reference to Lode Mining. By D. D. Cairnes. Pp. ix+129+xxxii plates. (Ottawa: Government Printing Bureau.)

Handbuch der Hygiene. Edited by Profs. M. Rubner, M. v. Gruber, and M. Ficker. III. Band, 3 Abteilung. Die Infektionskrankheiten. Pp. iv+392+xxxii plates. (Leipzig: S. Hirzel.) 24 marks.

Die Anatomie des Menschen. Teil. v. Nervensystem und Sinnesorgane. By Prof. K. von Bardeleben. Pp. 82. (Leipzig and Berlin: B. G. Teubner.) 1.25 marks.

The Year-Book of the Scientific and Learned Societies of Great Britain and Ireland, 1913. Pp. vi+380. (London: C. Griffin and Co., Ltd.) 7s. 6d.

Yorkshire Type Ammonites. Edited by S. S. Buckman. Part xi. (London: W. Wesley and Son.) 3s. 6d. net.

"Squaring the Circle": a History of the Problem. By Prof. E. W. Hobson. Pp. 57. (Cambridge University Press.) 3s. net.

Educational School Gardening and Handwork. By G. W. S. Brewer. Pp. xi+192. (Cambridge University Press.) 2s. 6d. net.

Les Problèmes de la Sexualité. By Prof. M. Caullery. Pp. 332. (Paris: E. Flammarion.) 3.50 francs.

Soils and Crops, with Soils Treated in Reference to Crop Production. By Profs. T. F. Hunt and C. W. Burkett. Pp. xiii+541. (New York: Orange Judd Company; London: Kegan Paul and Co., Ltd.)

Department of Commerce. Technologic Papers of the Bureau of Standards. No. 16, Manufacture of Lime. By W. E. Emley. Pp. 130+plates. (Washington: Government Printing Office.)

Survey of India. Professional Paper No. 14, Formulæ for Atmospheric Refraction and their Application to Terrestrial Refraction and Geodesy. By J. de G. Hunter. Pp. v+114. (Dehra Dun: Office of the Trigonometrical Survey.)

Mitteilungen der Prähistorischen Kommission der K. Akademie der Wissenschaften. II. Band., No. 2, 1912. Pp. 127–227. (Vienna: A. Hölder.)

City and Guilds of London Institute. Department of Technology, Exhibition Road, London, S.W. Report of the Department for the Session 1912–13. Pp. x+467. (London: J. Murray.)

DIARY OF SOCIETIES.

THURSDAY, DECEMBER 4.

ROYAL SOCIETY, at 4.30.—(1) A Method of Studying Transpiration; (2) The Effect of Light on the Transpiration of Leaves: Sir Francis Darwin.—Dimensions of Chromosomes considered in Relation to Phylogeny: Prof. J. B. Farmer and L. Digby.—The Process of Calcification in Enamel and Dentine: J. H. Mummery.—The Optimum Temperature of Salicin Hydrolysis by Enzyme Action is Independent of the Concentrations of Substrate and Enzyme: A. Compton.—The Ratio between Spindle Lengths in the Spermatocyte Metaphases of Helix Pomatia: C. F. U. Meek.—Egyptian Blue: Dr. A. P. Laurie, W. F. P. McLintock and F. D. Miles.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—Electricity Supply in Large Cities: Dr. G. Klingenberg.

LINNEAN SOCIETY, at 8.—Wild Wheat from Mount Hermon, *Triticum dicoccoides* Koern: Prof. J. Percival.—Neurotes, a New Genus of Mymaridæ, from Hastings: F. Enock.—A Contribution to the Study of the Evolution of the Flower; with Special Reference to the Hamamelidaceæ, Caprifoliaceæ and Cornaceæ: A. S. Horne.—The Mollusca of the River Nile: Mrs. Longstaff.

FRIDAY, DECEMBER 5.

INSTITUTION OF MECHANICAL ENGINEERS, at 8.—Thomas Hawksley Lecture: Water as a Mechanical Agent: E. B. Ellington.

JUNIOR INSTITUTION OF ENGINEERS, at 8.—Presidential Address: Sir Boverton Redwood, Bart.

INSTITUTION OF CIVIL ENGINEERS, at 8.—The Liverpool Street Extension of the Central London Railway: H. V. Hutt.

GEOLOGISTS' ASSOCIATION, at 8.—Evolution and Palæobotany: Dr. Marie C. Stopes.

MONDAY, DECEMBER 8.

ROYAL GEOGRAPHICAL SOCIETY, at 8.30.—Is the Earth Drying Up?: Prof. J. W. Gregory.

ROYAL SOCIETY OF ARTS, at 8.—The Measurement of Stresses in Materials and Structures: Prof. E. G. Coker.

TUESDAY, DECEMBER 9.

INSTITUTION OF CIVIL ENGINEERS, at 8.—*Further Discussion:* The Transandine Railway: B. H. Henderson.—*Probable Paper:* Cyclical Changes of Temperature in a Gas-engine Cylinder: Prof. E. G. Coker and W. A. Scoble.

WEDNESDAY, DECEMBER 10.

ROYAL SOCIETY OF ARTS, at 8.—The application of Electricity to Agriculture and Life: T. Thorne Baker.

THURSDAY, DECEMBER 11.

ROYAL SOCIETY, at 4.30.—*Probable Papers:* Intermittent Vision: A. Mallock.—The Relations between the Crystal-symmetry of the Simpler Organic Compounds and their Molecular Constitution. III.: W. Wahl.—The Selective Absorption of Ketones: Prof. G. G. Henderson and J. M. Heilbron.—Absolute Measurements of a Resistance by a Method based on that of Lorenz: F. E. Smith.—A Determination of the Electromotive Force of the Weston Normal Cell in Semi-absolute Volts. (With a Preface by Prof. H. L. Callender, F.R.S.): A. N. Shaw.—Elastic Hysteresis in Steel: F. E. Rowett.—A Simple Form of Micro-balance for Determining the Densities of Small Quantities of Gases: F. W. Aston.—A Second Spectrum of Neon: T. R. Merton.

MATHEMATICAL SOCIETY, at 5.30.—The Linear Integral Equation: Prof. E. W. Holson.—Generalised Hermite Functions and their Connection with the Bessel Functions: H. E. J. Curzon.—Limiting Forms of Long Period Tides: J. Proudman.—The Number of Primes of Same Residuacity: Lieut.-Col. Cunningham.—Some Results on the Form Near Infinity of Real Continuous Solutions of a Certain Type of Second Order Differential Equations: R. H. Fowler.—The Potential of a Homogeneous Convex Body and the Direct Integration of the Potential of an Ellipsoid: S. Brodetsky.—The Dynamical Theory of the Tides in a Polar Basin: G. R. Goddsbrough.—Proof of the Complementary Theorem: Prof. J. C. Fields.

CONCRETE INSTITUTE, at 7.30.—Some Fallacies in Testing Cement: L. Gadd.

ROYAL SOCIETY OF ARTS, at 4.30.—The Cultivation and Manufacture of Indian Indigo: Prof W. P. Bloxam.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—Continuation of Discussion on Dr. Klingenberg's Address on "Electricity Supply in Large Cities."

FRIDAY, DECEMBER 12.

ROYAL ASTRONOMICAL SOCIETY, at 5.—

MALACOLOGICAL SOCIETY, at 8.—Descriptions of Various New Species of Mollusca: G. B. Sowerby.—Synonymy of the Family Veneridæ: A. J. Jukes-Browne, F.R.S.—Descriptions of New Species of Land and Marine Shells from the Montebello Islands, Western Australia: H. B. Preston.

ALCHEMICAL SOCIETY, at 8.15.—Alchemy in China: Prof. H. Chatley.

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