THURSDAY, JUNE 12, 1913.

SEEDS OF FLOWERING PLANTS.

Studies in Seeds and Fruits: an Investigation with the Balance. By H. B. Guppy. Pp. xii + 528. (London: Williams and Norgate, 1912.) Price 15*s.* net.

IN this work we find the results of Mr. Guppy's investigations on the seeds of several flowering plants. The investigations seem to have been prompted by a statement by Goebel to the effect that the biology of the ripening fruit has hitherto scarcely received attention, and a further statement by Pfeffer that the means by which the power of resistance to drying is gained and the changes which cause its loss are quite unknown.

Such subjects are investigated as the permeability and impermeability of seeds, their hygroscopicity, shrinking and swelling, their homologies, their dehiscence, the proportions of the different parts of the fruits, the relation between the number of seeds and the size and weight of the fruit, the abortion of ovules and the failure of seeds, seed coloration, the weight of the embryo, the rest period of seeds, and finally "the cosmic adaptation of the seed." It is impossible in the space of a short review to give any adequate ideas of the whole of the author's investigations.

From the beginning his "usual plan of following indications was adopted, forming crude hypotheses as [he] went along, and dropping them as soon as they had lost their usefulness. Many points, of course, remained undetermined," and Mr. Guppy only offers "a contribution to the study of a difficult but highly interesting subject." In the cases investigated it was found that all the ovules begin to respond to fertilisation; but it frequently happened, as in Arenaria, Stellaria, Primula, Scilla, and Iris, that only two-thirds of the original complement of ovules developed into mature seeds. In several legumes a marked constriction results from the abortion of the ovules, the degree of constriction being determined by the number of contiguous failures.

Special stress is laid on seedless fruits, where the fruit develops under the stimulus of pollination but the seeds fail. The author's results, so far as they go, are full of interest, and he fully realises that much more must be determined before it is possible to draw safe generalisations. To some readers the book will appear discursive and perhaps unconvincing, and without doubt the salient features of the work could have been expressed in fewer words; but throughout the book one sees the unprejudiced observer at work, and many of the results obtained are both interesting and important. Its very discursiveness has a kind of charm, and there is an occasional incisiveness which is refreshing, as in the following:—

"Lord Avebury would regard such persistently functionless ovules as carrying us back to the time when . . . all the ovules developed into seeds. Prof. Bower holds a similar view with reference to the abortive ovules in the beak of a fruit of *Anemone nemorosa*. . . It should, however, be pointed out that this would not follow if we accept the standpoint taken by Dr. Goebel . . . that functionless organs in plants are not necessarily the vestiges of former completely developed ones, and that many more primordia are laid down than become functional."

Each chapter is supplied with a full and useful summary, and there is an excellent index. It is refreshing to find that Mr. Guppy is not content with vaguely referring to authorities, but supplies the name of the work and the volume and the page of the authors he refers to. In this last respect, as well as in some others, his methods are worthy of being adopted by more pretentious writers.

ENGINEERING SCIENCE..

Mécanique Appliquée. By Prof. John Perry. Ouvrage traduit sur la Neuvième Edition Anglaise par E. Davaux. Avec des additions et un appendice sur la mécanique des corps déformables by E. Cosserat and F. Cosserat. Tome Premier. L'Energie Mécanique. Pp. vii + 398. (Paris: A. Hermann et Fils, 1913.)

THERE must surely be few text-books about which such conflicting opinions are held as this well-known book on applied mechanics by Prof. John Perry. One of these opinions, favourable to the book, is held by a majority of teachers of engineering science and by almost all engineers. The other, which is equally unfavourable, is confined to a minority of teachers—doubtless the "academic persons" to whom the author so often refers. There must be something fundamental, some conflict of principle, which can produce so wide a difference of opinion between persons equally competent to judge. We are aided in arriving at the nature of this conflict by the fact that engineers outside the colleges are almost universally in its favour; as they are, indeed, of each of the author's text-books relating to engineering subjects. Perhaps a parable may be admitted. We picture two travellers desirous of arriving at the same destination, one of them alert to have all the precise formalities of the journey carefully observed, and the other careless of by-laws, and only careful that he shall arrive at his destination by a road which, while reasonably

rapid, shall not absorb his every mental activity until such time as the destination is reached.

Put crudely, it is the old choice between devotion to the "means" and devotion to the "ends." Engineers almost always care more for the latter than for the former, being well aware that their route must ever be subject to other than purely abstract considerations. Unless engineering "instinct" points along some reasonably converging line, nothing will persuade them that the "academic" path is the true one. But this is stated as the point of view of English engineers. How does the matter stand with, let us say, the German and the French? This question is to some extent answered by the interesting fact that, although a German edition of Perry's "Applied Mechanics" was published five years ago, it is only in 1913 that a French translation is appearing.

For this purpose the book has been divided into two volumes, of which the first has now been published with a preface by MM. E. and F. Cosserat. After describing generally the method of the book, the writers of the preface remark: "C'est cette méthode, quelque peu hérétique dans notre pays, qui a été dévelopée avec un très grand talent par M. John Perry dans le livre remarquable que nous présentons aux lecteurs français."

The French mind is logical and is attracted by logical method; their engineering is a far more highly refined product than the English—judged, that is, from the scientific point of view. The Germans are capable of as much precision as the French, but are more desirous of taking high place as capable technicians, and inclined, therefore, to study the methods which successful English engineers have adopted. How successful that study has been there are many instances to show. It has occasionally happened, indeed, that German method has far outreached the English, so that the less sturdy opinion in this country has felt there is cause for pessimism, notwithstanding that such industries are rarely the most productive of income, or the least risky in respect of capital.

Germany is willing to learn from England because she values the "fait accompli." France, looking more to abstract considerations, does not think she has much to learn from English writers, and refrains, therefore, from a zealous study of them. If we take, for example, one of the problems dealt with in this book—that of the proper design of springs—we find English engineers relying chiefly on rule-of-thumb methods, whilst the most carefully refined analysis of the subject appeared in French many years ago. Why, therefore, should the French look to us for guidance? Furthermore, it often happens that English writings on the scientific study of engineering work are unknown abroad. A Swedish engineer recently explained to the writer that, in consequence of the different way in which the bookselling business is managed abroad, English technical books are sold to a very small extent, and that ninety-nine out of a hundred foreigners get the impression that by far the greater progress in science and theoretical engineering comes from Germany. The translation of Prof. Perry's book into French will help to eradicate this impression, and we congratulate ourselves, as well as Prof. Perry, upon this sign of appreciation of English engineering science. H. E. W.

PALÆOLITHIC MAN AND BRONZE AGE MAN.

Palaeolithic Man and Terramara Settlements in Europe. By Dr. Robert Munro. Pp. xxiii+507+74 plates. (Edinburgh: Oliver and Boyd; London: Gurney and Jackson, 1912.) Price 16*s.* net.

LAST year Dr. Robert Munro founded a lectureship in the University of Edinburgh to popularise the results of research in anthropology and prehistoric archæology, which have recently become so important and interesting. He himself gave the inaugural course, and these lectures have now been published in a copiously illustrated volume, which will be welcomed equally by the general reader and the student. In the first part Dr. Munro summarises our present knowledge of Palæolithic man in Europe, while in the second part he gives a more detailed account of the Terramara settlements of the Po valley in northern Italy, to which he himself has paid special attention. In all cases the readable text is accompanied by ample references to the literature of the subject.

Dr. Munro does well at the outset to emphasise the fact "that the principles and laws which govern the rest of the organic world, past and present, are equally applicable to Man," and he thus begins with an interesting sketch of organic evolution. He points out that man's career was an entirely new departure owing to his superior mental endowments, and he argues that this superiority was primarily due to the attainment of the erect attitude. There are, however, still many difficulties in accepting the latter opinion, and more facts are needed before it can be satisfactorily discussed.

In the admirable review of the discoveries of Palæolithic man and his handiwork, Dr. Munro makes several interesting suggestions, and formulates judgments on some of the subjects of controversy. He accepts the French classification of

the successive periods as applicable to England, and concludes that the Chellean is not pre-Glacial, but is referable to the middle of the Pleistocene age. He discusses the human skeleton embedded in ochre found by Buckland in the Paviland cave, Glamorganshire, and points out that it is paralleled by similar burials of a late Palæolithic period in France and Moravia. He considers that the importance of the Engis skull has been exaggerated, and concludes that the Tilbury man cannot be later than the beginning of the Neolithic period. He gives reasons for supposing that the early Neolithic immigrants to western Europe may have lived for some time with the Palæolithic peoples whom they found there.

The description of the Terramara settlements, which occupies nearly 200 pages, forms an exhaustive work of reference on a subject on which Dr. Munro speaks with special authority. More than 100 of these large flat mounds in the valley of the Po have now been examined, and it seems clear that they are all referable to the Bronze age. They are generally quadrangular in shape, and their average superficial area is about seven acres. Implements, seeds and fruits, and bones of the animals used for food are so numerous that a very fair idea of the life of the inhabitants can be obtained, and it is evident that they were occupied with many industries. They made their own bronze implements and ornaments, worked also in bone and terracotta, and must have woven much cloth, judging by the extraordinary variety and abundance of spindle-whorls and loom-weights. Their pottery is especially artistic, and the peculiar horned appendages fixed to the tops of the handles have not been found outside the area of the Terramare and certain districts influenced by the civilisation of their inhabitants.

MATHEMATICAL TEXT-BOOKS.

(1) *Matematica Dilettevole e Curiosa.* By Ing. Italo Ghersi. Pp. viii + 730. (Milano: Ulrico Hoepli, 1913.) Price 9.50 lire.

(2) *New Analytic Geometry.* By Prof. P. F. Smith and Prof. A. S. Gale. Pp. x + 342. (Boston and London: Ginn and Co., n.d.) Price 6*s.* 6*d.*

(3) *Experimental Mensuration: An Elementary Text-Book of Inductive Geometry.* By H. Stanley Redgrove. Pp. xvii + 328. (London: W. Heinemann, 1912.) Price 2*s.* 6*d.* net.

(4) *Geometrical Optics.* By A. S. Percival. Pp. vii + 132. (London: Longmans, Green and Co., 1913.) Price 4*s.* 6*d.* net.

(5) *Problèmes d'Analyse Mathématique.* By Prof. E. Fabry. Pp. 460. (Paris: A. Hermann et Fils, 1913.) Price 12 francs.

(6) *Leçons sur l'Intégration des Equations Différentielles aux Dérivées Partielles.* By Prof. M. V. Volterra. Pp. ii + 83. (Paris: A. Hermann et Fils, 1912.) Price 6 francs.

(1) THIS collection of mathematical paradoxes should be of interest to a large circle of readers. It is remarkably comprehensive, occupying more than seven hundred closely printed pages, is profusely illustrated, and is published at a very reasonable price. Those who are acquainted with Mr. Rouse Ball's work will find much in these pages with which they are already familiar, but there will be very few who will not discover something that is new and surprising. In addition to the standard problems of antiquity—the squaring of the circle, the trisection of an angle, and the duplication of the cube—there are elaborate sections on arithmetic, algebra, geometry, and mechanics. There are problems on shunting, map-making, perpetual motion, trammells, constructions with limited instruments, probability, magic squares, boomerangs, draughts, chess, and many other themes of a popular character. It is, however, impossible to give any detailed account of so miscellaneous a work; enough has, perhaps, been said to show that there is abundant material to while away any number of idle hours.

(2) It is gradually becoming recognised that the practice in elementary text-books of restricting cartesian geometry to straight lines and curves of the second degree gives the student a narrow idea of the power and generality of analytic methods. For ordinary purposes a course of the character set out in the volume before us is, in our view, far more valuable than that given in most English text-books. Intricate properties of conics and systems of conics, homogeneous coordinates, invariants, &c., are omitted, and space is thus obtained for curves of higher degree and the elements of three-dimensional geometry. There is an excellent collection of examples, few of which demand from the student any high degree of analytic skill.

(3) The author gives us, in the present work, a distinctly original text-book on geometry. He is in sympathy with the principles laid down in the circular issued by the Board of Education, and, in addition, contends that this subject loses most of its educational value if it is not united from the first with mensuration and trigonometry. The trigonometrical ratios are accordingly introduced in the second chapter, and applications are made at every convenient opportunity. With the exception of a few of the chief geometrical theorems, which are mainly derived by inductive processes, there is no formal geometry, and practically all

the examples are of a numerical type. In our opinion, a text-book such as this is more useful to the teacher than the student; we are inclined to think that it is too diffuse for the latter, but it contains so much that is suggestive and stimulating that few teachers would not gain from using it to supplement and guide their class-work. A good feature of the book is the inclusion of descriptions of calipers, verniers, diagonal and plain scales, the micrometer screw-gauge, the spherometer, the planimeter and opisometer, methods of measurement of volumes, the construction and use of a scale of chords, and Simpson's method for evaluating areas. There is also an appendix on the use of duodecimals.

(4) The author writes primarily for medical students, but there is no reason why his work should not be equally suitable for any student of elementary physics; very small demands are made on the mathematical capacity of the reader. The fundamental results are established at such length, and so clearly, that they should be intelligible to all. Great importance is attached to the use and meaning of algebraic signs; as soon as this idea is grasped, the formulæ employed assume simple forms. The text-book is purposely practical rather than academic; there is, for example, little mention of the general mathematical theory of systems of lenses or properties of the paths of rays in heterogeneous media. But the author supplies an abundance of excellent illustrations and exercises which will give the student a far better grasp of the principles of the subject than he would gain from an abstract mathematical treatise.

(5) This collection of about 270 problems (many of which contain several parts), selected from recent French examination papers, is divided into twelve sections: integration, multiple integrals, analytic functions and curvilinear integrals, differential equations, plane curves, skew curves and surfaces, asymptotic lines and lines of curvature, ruled surfaces, partial differential equations, geometrical applications of partial differential equations, total differentials, elliptic functions. The statement of the problems occupies one-seventh of the book; the rest is devoted to their solution. Where we have tested them we have found them sufficiently clear and detailed for any student of average ability. We have no hesitation in saying that this collection will be of real value to students and teachers alike; and its utility will be still further increased if the publishers are able to issue the problems in a separate volume.

(6) These lectures, which were published a few years ago, are now re-issued with a few notes and corrections. Pressure of other work has prevented the author from attempting to re-write them in the light of the very considerable progress that has been made in the last six years, but the addition of numerous bibliographical references will enable the reader, if inclined, to see what has been done. In a comparatively small compass the author covers a wide range of theory. In dealing with the bearing of the theory of differential equations upon physical problems, he investigates the elliptic, hyperbolic, and parabolic types with a view to the interpretation and application of the many-valued form of solution and the relation to multiply-connected domains.

OUR BOOKSHELF.

Myths of the Modocs. By Jeremiah Curtin. Pp. xii + 389. (London: Sampson Low, Marston and Co., Ltd., n.d.) Price 12*s.* 6*d.* net.

"THE value of Indian myths lies in the fact that they represent the mental labour of men who lived ages before those who recorded their thoughts on papyrus, baked brick, or burnt cylinder" (p. 383). The author has supplied us with a valuable set of documents embodying the floating traditions of the Modocs, whose country lies on the borders of Oregon and California. "Man does not appear in any of these myths" (p. 383). In their non-human and non-moral elements the myths belong to the same stratum as the oldest Irish and Welsh tales, which are generally admitted to be pre-Celtic. In his too brief notes on the myths the author is evidently impressed with their obvious astronomical significance. The first he records "is evidently a sun myth." Mr. Curtin obtained the bulk of his information from "the oldest woman of the Klamath-Modoc tribe of Indians," and from one who, in the prime of his life, was chief of his people.

It is certain that if the witnesses were cross-examined on their astronomical knowledge, the astronomical significance of the myths would have appeared much clearer than it is found in the book. A golden opportunity has been missed. In one case the astronomical key was simply thrown into the author's hand. The myth of the "Star Brothers" ends as follows:

"'You and your brother will no longer be persons; you will be stars, and between summer and winter your people will fight over you.'

"The younger boy was at the edge of the sky when the old man's spirit said: 'You will be a star.' Right away he was one. As soon as the elder boy reached the edge of the sky he became a star too.

"NOTE.—These two stars appear early in the morning toward the end of winter. They are the heralds of spring" (p. 117).

It is practically certain that the author's informant could have pointed out the "Star Brothers." What we have given us is the very basis of the astronomical interpretation of myths and monuments. JOHN GRIFFITH.

A First Book of Rural Science. By J. J. Green. Pp. viii+146. (London: Macmillan and Co., Ltd., 1913.) Price 1*s.* 6*d.*

THE teacher who wants to give a rural bias to his school work still has to depend at least as much on his text-book as on his garden for help in his lessons. Amidst the vast number of books on rural science that the nature-study movement has called forth, a few stand out prominently as being eminently adapted to the purpose. Amongst them we have no hesitation in placing this little book. The information is sound, and is clearly and concisely set out; while the order is both logical in method and convenient in practice.

Beginning with seeds, the author follows on with plant growth, plant nutrition, and reproduction. Next he passes to the subject of soils, and then to the relationship between the soil and the crop. Throughout the author displays a vivid knowledge of rural conditions, and he seeks to connect up the child's training with the things that come into the scholar's daily experience. This desirable end is successfully accomplished. New varieties of plants, for example, are now among the common incidents of rural life. The book gives a short but good account of how they are formed. The micro-organisms of the soil have also come in for much attention from agricultural lecturers and others, and here, again, sufficient information is given to enable the student to form an intelligent grasp of the matter. Manures are described in sufficient detail for the purpose, and manurial trials are illustrated. Altogether the book can be cordially recommended both to teachers and students.

Dent's Practical Notebooks of Regional Geography. By Dr. H. Piggott and R. J. Finch. Book ii. Asia. Pp. 64. Book iii. Africa. Pp. 48. (London: J. M. Dent and Sons, Ltd., 1913.) Price 6*d.* net each.

THESE books, and others like them, are a welcome indication that teachers in schools are beginning to understand that children learn more satisfactorily by doing than by listening. The authors are experienced teachers who recognise that with the small amount of time available for geography in ordinary classes every expedient must be tried to select only practical exercises of prime importance. In these little books the practical work is all worth doing, and the instructions given are precise and to the point.

Earthquakes and other Earth Movements. By Prof. John Milne. Sixth edition. Pp. xvi+388. (London: Kegan Paul, Trench, Trübner and Co., Ltd., 1913.)

THE additions and alterations rendered necessary by the knowledge gained since 1903, the date of publication of the fifth edition of his book, are collected by Prof. Milne in an additional appendix of some eleven pages. The chief topics of the appendix are the teleseismic observations which, Prof. Milne says, have already thrown new light upon the homogeneity and rigidity of our world, and have led to the explanation of phenomena in other departments of science.

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.*]

The Ionisation of Gases in the Schumann Region.

IN July last I published a note in the *Physikalische Zeitschrift* (July 13, p. 583) on the ionisation of gases by light and the spectrum of aluminium in the Schumann region. As my views therein expressed have recently been misquoted in print on two occasions, I fear I did not make myself clear. It may be worth while, therefore, to add a word.

It was my object to explain the results of Lenard's volume ionisation experiments by exhibiting the spectrum of his source of light. To this end I published a spectrogram of the aluminium spark in air in the Schumann region. The illustration showed that, though the spectrum contained some strong lines between λ1850 and λ1600, there was but one group of any strength between λ1600 and λ1250; this group occurred near λ1300. Lenard's data indicated that the rays which produced most of the ionisation lay on the more refrangible side of λ1600. I stated, therefore, that the group near λ1300 was probably responsible for most of the effect which Lenard observed, because it was the *only* strong group existing in the aluminium spectrum in the region under consideration. This is evidently very different from the opinion ascribed to me by Mr. A. Ll. Hughes (Phil. Trans., vol. ccxii., p. 226): ". . . Lyman concludes that the ionisation of air by light does not take place unless the light contains wave-lengths less than about λ1300."

While I am on the subject, I should like to add that the question as to what wave-lengths are responsible for the volume ionisation observed in gases seems to me to be still open. We know that the effect increases with decrease in wave-length in the Schumann region, but that it "sets in about λ1350" is not perfectly obvious. Prof. Palmer has been kind enough to test the volume ionisation due to the mercury arc, at my suggestion. He finds a small but perfectly definite effect. This confirms the recent results of Bloch, obtained with an arc in quartz (*C.R.*, vol. clv., p. 1076). I have just concluded a study of the spectrum of the arc, and I have been unable to discover any lines below λ1400. The most refrangible line which I have observed through quartz is at λ1775. It seems fairly certain, therefore, that some volume ionisation can be produced by light of wave-length longer than λ1700. THEODORE LYMAN.

Jefferson Laboratory, Cambridge, Mass., May 22.

Artificial Hiss.

HAS Lord Rayleigh tried the effect of holding a piece of sheet iron or of compressed charcoal in the small pointed flame of an ordinary foot blowpipe when the air supply is somewhat in excess of the needs of the flame? By adjusting the gas supply, the air pressure, and the position of the iron sheet, sounds can be obtained varying from *f* to *s* or *sh*. The oxy-hydrogen flame, supplied with a slight excess of oxygen, is even better. The air entering a vacuum desiccator through a narrow stopcock gives a fairly good *s* sound. E. R. MARLE.

Hartley University College, Southampton, May 30.

IN reply to the letter in NATURE of May 29 (p. 319) under the heading "Artificial Hiss," the following is a suggestion which may be an answer to the question, though not a practical solution to the problem.

A loud hissing noise accompanies the passing of an electric arc across the gap in such a lamp as is used for optical lanterns, &c. Though this hissing noise does as a rule last for only a short time, yet it appears to me quite a simple matter to regulate the carbons so as to prolong the sound. The actual "hiss" sounds much more of a sibilant than an *f*, such as is produced by a current of air or steam being forced under pressure through a small opening.

Charterhouse, June 2. H. L. KIEK.

Red Water.

IN NATURE of April 4, 1912, Messrs. Mackenzie and Finlay wrote relative to the cause of the occurrence of colouring matter in a sample of water from a crater lake in Uganda, and subsequently in the issues of April 11 and June 6 Messrs. H. Warth and C. Crossland respectively wrote describing the occurrence of similar characteristics in the great salt lake of Sambhar, in Rajputana, also pools at Suez, and near the Rawaya salt lake.

Dr. Gavin McCallum, in a paper read at a meeting of the Geelong Field Naturalists' Club, in March, 1911, entitled "Forms of Life at the Salt-pans," directed attention to this coloration of the water and its blood-red appearance, and described it as being not due to the "colour of the liquid itself, but to the presence in enormous numbers of uniform small round cells. Dr. McCallum also mentions another form as being oval in shape with two cilia or lashes at the narrower end," the cilia and a small portion at the narrower end being colourless. At various times samples of the "red water" have been collected, and kept constantly under microscopical examination both by Dr. McCallum and myself, with the result that we can say the colouring is wholly due to a flagellate organism not unlike *Polytoma uvella*, Müll, as figured in the last edition of the "Encyclopædia Britannica," but as this is given as being a species of Chlamydomonadidæ in the article on Flagellata, and as a similar genus appears in the article on algæ by a different writer, some confusion evidently exists as to both these orders.

The oval form, as mentioned by Dr. McCallum, has two flagella, about one-third longer than the body, which appear to arise from a sort of collar or circular opening at the anterior end; there are two contractile vacuoles near the base of the flagella, and an eye-spot; except the flagella and a small portion at the anterior end, the whole organism is so deeply pigmented with red matter that it is difficult to determine its constituent parts. There are other features, but these it is at present premature to mention. The globular form appears as the brine reaches saturation point, and is a sort of resting stage conditioned by the salinity of the medium in which it lives; this form gives rise to zoospores.

Associated with the flagellate organism is an interesting crustacean, the brine shrimp, very similar to *Artemia salina*, but in all the articles dealing with this crustacean the female is said to carry the eggs underneath the tail, whereas in this shrimp they are carried in sacs on either side, like the egg sacs of the Cyclops. The male, which is much larger than the female, has the usual claspers for holding the female. Dr. McCallum mentions in his article that at 7° to 8° Baume the shrimp sickens and dies; at this stage it becomes the host of the flagellate organism, which absorbs the decaying organic matter in the interior of the shrimp's body, leaving an absolutely hyaline cast skin.

I may mention that during this period of the organism's existence it is nearly always green, the red matter only making its appearance at a later stage. As the brine reaches crystallisation the ensuing salt is of a reddish hue, due, of course, to the pigmented organism, and it is a matter of conjecture as to whether or no each spherical monad does not form the nucleus of each crystal of salt. The salt, upon exposure to the sun, bleaches, but the zoospores contained within the spherical or globular membrane retain their vitality and issue forth in countless numbers of infinitely small green, actively moving flagellate organisms, upon redissolving the salt.

FRED WHITTERON.

Geelong, Victoria, March 31.

Phreatoicus in South Africa.

AT the beginning of this month I found some isopods in one of the swift-running streams on the top of Table Mountain; they were quite common in and under the moss covering the stones in the bed of the stream, and were very sluggish. On examination they prove to belong to the family Phreatoicidæ. The occurrence in South Africa of a member of this peculiar family, which hitherto has been recorded only from New Zealand, Australia, and Tasmania, is of great interest as bearing on the question of the ancient land connection between the southern continents.

It is a new species, and will shortly be described in the Annals of the South African Museum.

KEPPEL H. BARNARD.

South African Museum, Cape Town,
Cape of Good Hope, May 20.

GEOGRAPHY AND TRAVEL.[1]

(1) THIS work has originated in the desire of its author to make some public statement of indebtedness. It is, as it were, a memorial laid upon an altar. Dr. Cornish, in his researches, has dealt with phenomena that are cosmic rather than humane; yet we now perceive them set against a background, old as that of the cave-dwellers, where accomplishment is due to the fact that man does not live his life alone. Whether their vessel is rolling fifty-six degrees in the Bay of Biscay, or nearing Ceylon in incense-laden air, whether they are walking in the symbolic garden of the Shogun, or in the shattered streets of Kingston, the essential feature is that the travellers are together. The form adopted as a title merely adds emphasis to this impression.

Except for the stirring adventure of the Jamaican earthquake of 1907, these travellers saw little that others have not seen and liberally described. But what they saw they realised as trained observers. "The greatest astronomical

[1] (1) "The Travels of Ellen Cornish." Being the Memoir of a Pilgrim of Science. By Dr. Vaughan Cornish. Pp. xvi+293+plates+maps. (London: W. J. Ham-Smith, 1913.) Price 12*s.* 6*d.* net.

(2) "The Continents and their People: Asia." A Supplementary Geography. By J. F. Chamberlain and A. H. Chamberlain. Pp. ix+198+3 maps. (New York: The Macmillan Company; London: Macmillan and Co., Ltd., 1913.) Price 3*s.*

(3) "Modern Geography for High Schools." By R. D. Salisbury, H. H. Barrows, and W. S. Tower. Pp. ix+418+vii plates. (New York: Henry Holt and Co., 1913.) Price 1.25 dollars.

(4) "Three Years in the Libyan Desert: Travels, Discoveries, and Excavations of the Menas Expedition." By J. C. Ewald Falls. Translated by Elizabeth Lee. Pp. xii+356+plates. (London: T. Fisher Unwin, n.d.) Price 15*s.* net.

interest of a voyage to the equator is to get the completed view of the Milky Way." The truth of this is memorable, when one thinks of the successive streams of stars and the unfathomable spaces, changing night after night as the vessel swings down across the line. An area of cloud sailed under for twelve days in the North Pacific (p. 90) is shown to have been as large as Australia. It "would form a considerable feature as seen from the moon. Presumably it would appear from there as a great bright patch." At Niagara numerous observations were made on the forms of waves, and one of the fine photographic illustrations is here reproduced (Fig. 1).

Dr. Cornish believes that the redistribution of load through erosion of the highland-axis north of Kingston caused a subsidence which propagated the shocks. He also has some remarks in the next chapter on earth-creep movements on the sides and floor of the Panama Canal.

It was finally Mrs. Cornish who wished, after a trying illness, to revisit Panama, "where things were being done which were worth doing." The book is a slight one, and is in no way a record of research; but none will judge it lightly who can appreciate in scientific work the stimulus of complete companionship.

(2) The "supplementary geography" of Asia is

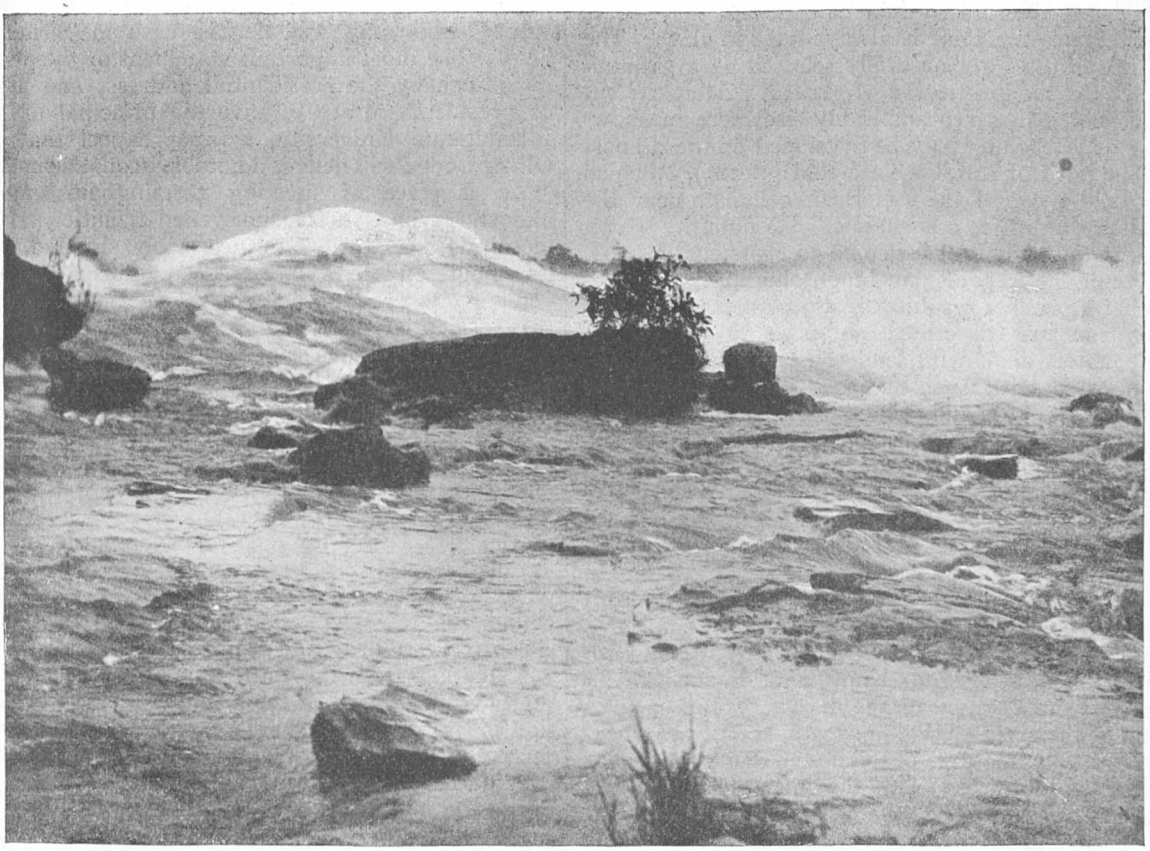

FIG. 1.—Standing wave formed by a hidden rock, Upper Rapid, Niagara. From "The Travels of Ellen Cornish."

On p. 146 an interesting calculation is made as to how long, under modern conditions, it would take a traveller to see the world by daylight, and the "globe-trotter" is humbled when he learns that, by doing 300 miles a day, he would require 136 years to appreciate the earth.

All readers may learn something from the account of the destruction of Kingston, of the cameras carried out from the tottering house, and then put back with a fine perception when the human tragedy of the streets was realised (p. 184), of the later undulations felt upon a grass-lawn, and of the investigation of the causes of the shock when all still lay in ruin.

presented by Messrs. Chamberlain in language suitable for an elementary class. Numerous photographs illustrate the human aspects of the subject, and these have evidently been selected so as to leave natural features as much as possible in the background. In fact, the book is in no sense a description of the continent, but it might well be read by pupils who have already become acquainted with the great contrasts of Asiatic structure, from the Arabian desert to the volcanic isles upon the east. This is, perhaps, implied in the subtitle of the book, which conveys very little geographical teaching of the kind now looked for in progressive schools. We can conceive its being

quite attractive as a gift-book, though twenty lines in cockney from Kipling's "Mandalay" will convey more of Asia than all the mediocre verse that is so freely quoted in its pages.

(3) The essential difference between the compact and detailed geography written by Messrs. Salisbury, Barrows, and Tower and the numerous recent American works on physical geography and physiography lies in the fact that this new book is mainly concerned with human relations to the earth's surface. But the groundwork of physical conditions is well laid. No attempt is made to describe the continents or the oceans, and this duty is probably left to the well-trained teacher and his wall-maps. Features met with on the earth are referred to their causes, and their effect on human enterprise is always kept in view. The United States are naturally selected as a groundwork for the illustration of general principles; but the book will serve admirably elsewhere in showing how teaching may be developed on these lines. "The need of salt," we are told (p. 183), "helped to hold most of the American colonists near the Atlantic coast for a long time." A quantity of salt that would now sell for some 30 cents cost 6*l.* 10*s.* west of the Appalachian Mountains in 1778. The general benefits resulting from the continental ice-invasion are described on p. 265. Soils are adequately dealt with, and the last 150 pages are concerned with such subjects as "the uses and problems of inland waters," irrigation, life in deserts and great forests, and the causes of the distribution of population. The book shows throughout how the problems of man's existence on the earth are fundamentally due to climate and topographic features. It provides, in fact, the kind of geography which every citizen should understand, whether he is developing a local industry or extending the borders of an empire.

(4) The three years spent by Mr. Falls with his cousin, Monsignor Kaufmann, in the Libyan desert were devoted to the discovery and excavation of the early Christian sanctuary of St. Menas. Incidentally, features of the desert and of the soda-lakes are described; but the interest is naturally archæological. The photograph (p. 120) of a Beduin with his gun, seated in the waste of cut stone that represents a lost city of the empire, is one of those impressive scenes that the camera most convincingly records. But behind the camera is needed the artist with the right imaginative perception. The author mentions incidentally that photographs can be taken from a camel-saddle. As a matter of fact, this high seat is ideal for a preliminary survey, and would probably be of service in the African bush, in place of viewing the landscape from occasional ant-hills.

Miss Lee's translation is usually clear and simple; but we have doubts about the "fields" of mica on p. 57, while the account of snake-charming on pp. 303 and 304 is very puzzling. What are we to make of a "happy presentation" of snakes, or of "the Moses rod was only useful on the ground"?

G. A. J. C.

THE BIRMINGHAM MEETING OF THE BRITISH ASSOCIATION.

Arrangements for the Meeting.

THE Birmingham meeting of the British Association next September promises to be a notable one. Already more members have agreed to attend than has been the case at the corresponding period for the last few years, and the secretaries expect that the number both of local and of visiting members and associates together will reach 3000. But size, though an element in rendering the meeting notable, is not of the first importance, and it is the importance of the pronouncements made during the sessions which more than anything else stamps a meeting as of signal value. This may well be the case in Birmingham. The most important statement of the meeting is usually the presidential address, and since as president we are to have the principal of the Birmingham University, we may expect that Sir Oliver Lodge will deliver a notable pronouncement.

As a place of meeting Birmingham enjoys almost, perhaps quite, unrivalled facilities. Not merely is it centrally and accessibly situated, but its main buildings are placed unusually conveniently to one another, to the stations, and to the residential districts. A corridor or a street only intervene, as a rule, between two sections, so that the time often lost in passing from one section-room to another is here gained.

The centre of this system of sections is the reception room. This room serves almost every purpose except the one which its name implies. It is the bureau of information and headquarters of the association for the time being. It serves as the general meeting-ground, post-office, and place of supply of publications. On these accounts the town hall has been chosen, as being close to the railway and tram system.

Radiating from the town hall as a nucleus are the buildings in which the business of the association is transacted. The city council chamber will serve for the meetings of council, of the general committee, and of the committee of recommendations, the last being the financial body that allocates the grants of the association. The University building, Mason College, will contain eight out of the thirteen sections, and in addition there will be here a ladies' room, the Press bureau, the president's room, and the quarters of the permanent officers. Queen's College (no longer appertaining to the University) will lodge the economic section in its examination hall. The small lecture theatre of the Midland Institute will serve for the geographical section, whilst the closing meeting and probably the meetings of delegates will take place in the large theatre. In the Technical School, Suffolk Street, the sections devoted to engineering and chemistry will find their headquarters. Lastly, anthropology has its meeting room in the Temperance Hall, Temple Street, and is therefore the only outlying section.

Among men of science from abroad who have accepted invitations to the meeting are:—Prof.

Svante Arrhenius, of Stockholm; Prof. Reinke, the veteran botanist of Kiel; Prof. Pringsheim, of Breslau, Germany; Prof. Keibel, the embryologist of Freiburg; and M. Lallemand, the geodetic expert from Paris. The list is, however, at present incomplete.

Programme of the Meeting.

The meeting will formally open on Wednesday, September 10, with the presidential address by Sir Oliver Lodge, at 8.30 p.m., in the Central Hall, Corporation Street. The retiring president, Sir Albert Schäfer, is unable to be present owing to an engagement in America. On Thursday, September 11, the work of the thirteen sections opens with the delivery of the several presidential addresses, beginning in most cases at 10 or 11 o'clock. On Thursday afternoon there will be a reception and degree ceremony at the new University buildings, Bournbrook. The Vice-Chancellor will preside, and an opportunity will be given for an inspection of the various University departments (mining, metallurgy, engineering, chemistry, geology, and physics.)

On Thursday evening the Lord Mayor will hold a reception at the New Art Gallery, the Council House, beginning at 8.30. This will give visitors an early opportunity of realising the advance which Birmingham has made in housing and exhibiting its art collections. Also it is hoped that the new Natural History Museum will be available during the evening.

On Friday afternoon, following upon the usual spell of scientific work during the morning, there will be a garden party at Bournville, by the invitation of Messrs. Cadbury Brothers. This, and any other garden parties that may be offered to members, will naturally be limited to a specified number. Applications will be received at the reception room.

On Friday evening the first of the two evening discourses will be given by Sir Henry H. Cunynghame, K.C.B., of the Home Office, on explosions in mines and the means of preventing them, at 8.30 p.m., in the Central Hall, Corporation Street.

On Sunday special services will be arranged at most of the places of worship in Birmingham. The Lord Bishop has consented to preach in the Cathedral Church.

On Monday morning the work of the sections will be resumed, but on Monday evening the local committee will entertain the association to grand opera and to other entertainments mentioned below. On Tuesday, and probably also on the preceding Thursday, there will be a meeting of the Conference of Corresponding Societies in the Midland Institute, at 3 p.m.; and on Tuesday evening the second evening discourse will be given in the Central Hall, at 8.30, by Dr. Smith Woodward, F.R.S., of the British Museum, on missing links among extinct animals, a subject upon which he is one of the foremost authorities. On Wednesday morning the closing meeting will be held in the large theatre of the Midland Institute.

The Handbook.

The custom of the association is to induce the local committee of the place of meeting to publish two handbooks, one for the enlightenment of the visiting member, enlarging upon the history, topography, organisation, and scientific interests of the locality; the other for the enlightenment of the local member, who, in nine cases out of ten, knows little of his or her neighbourhood. The first is *the* handbook. The second is the excursion guide-book. The handbook is a work of reference, a volume of some 500 pages, laborious and expensive to produce. The guide-book is a small pocket affair that can be easily carried and consulted. Both these books are given free to every member or associate on presentation of their tickets at the reception room.

The handbook, under the editorship of Dr. Auden, this year reflects most aspects of municipal activity. The history of local enterprise, and of the chief Birmingham institutions, is dealt with by competent authorities. The existing state of these several bodies is described by others, and if the contributors had enough collective insight the future to which the city is tending, or striving for, might well be prophesied by those who had a sufficiently clear vision of what they wish to attain. In town planning this is more possible than in most other subjects, and as Mr. Neville Chamberlain has undertaken this section we may hope for an important forecast in that direction. Perhaps the sections of the work dealt with most fully will be those treating of economics and of geology; whilst, without any doubt at all, the most novel thing in the handbook will be the geological and topographical maps. These, under the guidance and help of Prof. Lapworth, mark an epoch in map-making.

Sectional Excursions.

The work of the association is not limited to that done in the meeting rooms. Most of the sections devote some time to excursions or visits. The geologists, as a rule, spend a considerable part of their time in field work, and an organised programme for this purpose has been prepared by Dr. T. T. Groom, with the supervision of Prof. Lapworth. The date of the meeting coincides with Prof. Lapworth's retirement from active university service, but it is hoped that both he and his successor, Prof. Boulton, will be able to take part in showing geologists those features of interest in the district which have been made famous by the classic investigations of the University geological staff.

The economic section, probably, will survey some part of the Midland waterways; the agriculturists have many opportunities of interesting their members in the application or the results of agricultural practice; and the engineers, geographers, and those interested in education will find much of historical or of present-day interest

in the neighbourhood. But as all these excursions have naturally to be limited, it is hoped that only those members who are really interested in the subject to be studied will join the excursions.

Visits to works, either by appointment or by presentation of membership tickets, have been arranged by the excursions sub-committee. Most of these naturally appeal to engineers—for example, the Daimler works at Coventry, the Milward works at Redditch, the Great Western Locomotive works at Wolverhampton. Others, such as the Bournville works of Messrs. Cadbury, interest a larger number of visitors. Details with regard to facilities for these and other visits may be obtained in the reception room.

General (Saturday) Excursions.

The practice of the association has gradually tended to convert Saturday during the meeting into a day given up to excursions. The excursions sub-committee has planned a number of whole-day trips; whilst for those members who do not wish to give so much time, half-day excursions are available. The general programme of itineraries is as follows: Stratford-upon-Avon, Charlecote Park, and Warwick Castle; Coventry, Stoneleigh Abbey, and Kenilworth Castle; Banbury, Wroxton Abbey, Compton Wynyates, and Broughton Castle; Bromsgrove, Hewell Grange, Grafton Manor, Droitwich, Hanbury Hall, Mere Hall, Westwood, Salwarpe Court, and Hartlebury Castle; Tewkesbury, Deerhurst, Bredon, Woolas Hall, Pershore, Evesham, and Abbey Manor; Worcester; Lichfield and Wall; Sutton Coldfield and Oscott College; the Forest of Arden villages—Solihull, Knowle, Henley, Wootton Wawen, Alcester—and Coughton Court; Malvern, British Camp, and Madresfield Court.

The mayors of the cities and boroughs to be visited are offering a civic welcome to members of the association, and the owners of historic buildings and beautiful estates on the routes of excursions are offering exceptional facilities for inspection on the Saturday.

Entertainments.

The lighter side of the association week has been the subject of careful consideration by the subcommittee appointed for the purpose. For the first time grand opera is to be given. On Monday, September 15, the local committee will entertain the association in the Prince of Wales Theatre, Broad Street; in the new Repertory Theatre, Station Street; and in the Picture House, New Street.

The opera to be performed will probably be Glück's "Orpheus," under the direction of Herr Denhof, and a well-known work by a modern dramatist will be produced at the Repertory Theatre; whilst special kinemacolour and other films, dealing mainly with scientific subjects, will be displayed in the New Street Picture House.

It is a little unfortunate that the Botanical Gardens, Edgbaston, cannot be used freely, but those who have an hour to spare will be well advised to go to the gardens by the Harborne motor-'bus. Botanists and zoologists particularly will find much to interest them in the exhibits.

The arrangements for working-men's lectures, and the nature of the topics to be discussed during the visit of the association, will form the subject of later articles. F. W. G.

MICROSCOPE STANDS.

MORE than a year ago (NATURE, December 21, 1911, p. 245, and January 11, 1912, p. 351), in some articles on microscope stands, we were enabled to give the opinions of several recognised authorities on the various methods adopted to utilise the optical properties of the instrument.

It was shown that, speaking generally, there were two distinctive types, which might be conveniently styled English and Continental. Further, the English type of microscope was thus defined:—

"By the term 'English microscope' is meant the distinctive type of instrument which has been built to embody conveniences for working with modern high-class objectives and condensers, which conveniences cannot be found in combination in any other microscopes than those of British origin. Among them are the following:—(1)* The tripod foot; (2)* a long range of coarse adjustment for the use of low-power objectives; (3)* the body tube fitted with mechanical draw tube to allow for the adjustment of objectives for thickness of cover-glass; (4) the mechanical stage scientifically constructed as a part of the whole instrument; (5) the compound substage with rackwork to focus and screws to render the substage condenser axial with any objective that may be in use; (6)* fine adjustment to substage; (7)* the Wenham binocular body; (8) the various fittings for substage apparatus, eyepieces and objectives of the Royal Microscopical Society's standard gauge; (9)* all the working parts fitted with sprung bearings and controlling screws, so that compensation for wear and tear may be readily effected."

It was pointed out that in no Continental microscope are the fittings marked with an asterisk provided in the manner that is usual in an English one.

The defenders of the Continental model contended that many of the above-named means of adjustment were unnecessary, and held that the greater simplicity of the Continental model was to the advantage of the worker. Among these means of adjustment they named the centering arrangement for the substage and its fine adjustment.

It may be mentioned that the arrangement for oblique illumination and decentering of the iris diaphragm, so common in the Continental model, is of very rare occurrence on the English microscope.

One of the writers pointed out that changes were going on, and that a common ground was being approached. The centering arrangement discarded as useless for the ordinary condenser was really being introduced for an achromatic condenser and the many arrangements for dark field illumination.

Another great step in advance has recently been made. We have received from Messrs. Leitz, a German firm which produces perhaps more microscopes than any other, two models designed with a view to incorporate the most important features of the English and Continental models.

In one the tripod base is well spread, is exceptionally rigid in the horizontal as well as the vertical position, and allows of free access to the substage. The substage is of the compound type, consisting of rack and pinion focussing adjustment, with centering screws controlling condenser sleeve, which is of the Royal Microscopical Society standard gauge. The stage is of the square fixed type, and may be provided with a detachable mechanical stage. The curved limb allows of additional working space on the stage and incidentally forms a convenient handle for lifting the microscope. The fine adjustment consists of the cam and worm screw continuous motion, originally introduced in the Leitz Continental microscopes, coarse adjustment being by diagonal rack and pinion, and draw-tube with millimeter scale.

The other form is similar, but it is fitted with a mechanical stage forming an integral part of the instrument. The stage is provided with anterior, posterior, and lateral movements of greater range than is generally found in similar models, and is controlled by two milled heads mounted upon one spindle. The stage is also provided with millimeter scales and verniers reading to 1/10 mm. (1/250 inch).

A model on the above lines, but of much larger dimensions and having a wide body-tube, is particularly valuable in photomicrography. It is stated that these new models are made in the firm's London workshop.

But Messrs. Leitz, we now find, are not the only firm which is endeavouring to make stands as complete as possible in the way of adjustment. We have received from Messrs. Angus, the London agents of the Spencer Company of the United States, one of their latest models, which is admirably designed and worked out, and in it we find the English arrangement for the centering of the substage, as well as the German device for oblique illumination.

In these new models furnished by Leitz and Spencer, then, we find the maximum of adjusting power, and on this account they may be considered to be universal instruments, and it should not be forgotten that this universal quality of adjustment need not necessarily be confined to instruments of the largest size. The mechanical stage and the oblique illumination device may be made much lighter than they generally are, and the Spencer model shows how space may be saved by mounting the two screws of the former on a vertical spindle.

One of the great outstanding differences, then, remaining at present between the English and Continental microscopes is the absence of the simple oblique illumination device in the former. Regarding the use of this we are aware there are many different opinions.

NOTES.

IT is officially announced that the King has become patron of the Entomological Society of London.

AT the meeting of the Chemical Society, held on Thursday, June 5, Prof. Dmitri Petrovitsch Konovaloff, of St. Petersburg, and Prof. Alfred Werner, of Zurich, were elected honorary and foreign members of the Chemical Society.

THE annual conversazione of the Royal Society of Arts will be held on Tuesday next, June 17, at the Natural History Museum, South Kensington, and that of the Institution of Electrical Engineers will be held at the same place on Thursday, June 26.

THE trustees of the British Museum have agreed to undertake the publication of the natural history results of Capt. Scott's Antarctic expedition. The work of publication will be carried out at the Natural History Museum, South Kensington. It is understood that on the arrival of the *Terra Nova* in this country the collections will be sent in the first place to the Natural History Museum.

THE Cannizzaro prize of 10,000 lire, founded by the late Dr. Ludwig Mond, has been awarded by the Reale Accademia dei Lincei, of Rome, to Mr. Frederick Soddy, F.R.S., lecturer in physical chemistry at the University of Glasgow, for his researches in radio-activity. The presentation of the prize took place in the Capitol on June 1, in the presence of his Majesty the King of Italy.

THE annual general meeting of the Research Defence Society will be held on Tuesday, June 24, at five o'clock, at the Royal College of Physicians, Pall Mall. The chair will be taken by Sir David Gill, K.C.B., F.R.S., president of the society. The report will be presented by the Hon. Sydney Holland, chairman of committee. Other speakers will be Sir William Osler, regius professor of medicine at Oxford; Bishop Frodsham, sometime Bishop of North Queensland; and Mr. Waldorf Astor, M.P.

THE death is announced of Dr. Forbes Winslow in his seventieth year. Dr. Winslow was known as a specialist in lunacy, and founded the British Hospital for Mental Disorders. He was the author of numerous works on mental diseases and kindred subjects, among them being "The History of Lunacy Legislation," "Manual of Lunacy," "The Suggestive Power of Hypnotism," and "The Criminal Responsibility of the Insane." For eight years he was editor of *The Psychological Journal*.

THE death is announced, in his sixty-third year, of Mr. W. McMurtrie, the predecessor of Dr. Wiley in the post of chief chemist to the U.S. Department of Agriculture. Mr. McMurtrie had served for some years as assistant chemist before his appointment to that office in 1873. In 1882 he left Washington and became professor of chemistry at the University of Illinois. While holding the latter post he was also chemist to the Illinois State Board of Agriculture. Of late years he had been a consulting chemist in New York. He was the author of monographs on the

culture of the beet, the culture of sumac, grape culture in the United States, and wools and other animal fibres.

IN a note in the issue of NATURE for May 22 last (vol. xci., p. 300) attention was directed to the formation of an influential committee to endeavour to establish a uniform notation in the theories of potential and elasticity. The committee of organisation has issued an appeal to astronomers, mathematicians, and physicists, asking them to cooperate in this attempt to secure uniformity, and as a beginning solicits answers to the question: "What are the notions and notations in respect of which it is desirable to establish uniformity?" Answers to this inquiry—which may be in English, French, German, or Italian—should be addressed Mr. Arthur Korn, Charlottenburg, Schlüterstrasse 25. As has been stated, discussions on the subject will be arranged to be held at the international congresses of mathematicians in 1916 and 1920, and it is hoped that the final report of the committee will be issued in 1921.

DR. F. W. MOTT, F.R.S., delivered the first of his Chadwick Public Lectures on Friday, June 6, upon the subject of "The Structure and Development of the Brain." In the course of the lecture he described the structure of the brain in relation to its function as the organ of mind, particular attention being directed to the significance of the folds and fissures, first as determining the extent of the surface grey matter, and, secondly, in the formation of a convolutional pattern. Just as faces show similar features and expression by heredity, so the convolutional pattern of the brains of relatives exhibits a similarity in its folds and fissures. The fact that a parallelism exists between arrest of development of the grey matter and feebleness of mind, and between loss of mind and the decay or destruction of the grey matter, tends to prove that the intellecual and moral character of the individual should be regarded as a natural process of organic development—a product of nature and nurture. The subject of Dr. Mott's second lecture to-morrow, June 13, at 5 p.m., at the Royal Society of Arts, is "Inborn Potentialities of the Brain of the Child."

A JOINT session of the Aristotelian Society, the British Psychological Society, and the Mind Association was held on June 7 and 8 at University College, London, and Crosby Hall, Chelsea. The first meeting consisted of a symposium, "Are Intensity Differences of Sensation Quantitative?" by Dr. C. S. Myers, Prof. Dawes Hicks, Dr. H. J. Watt, and Dr. Wm. Brown, under the chairmanship of Prof. Spearman. Dr. Myers showed that the "all or none" principle is obeyed by all kinds of reflexes and all kinds of sensibility. The type of reaction is therefore the correlate of quality of sensation and the difference of degree—moreness or lessness of the same reaction is the correlate of difference of intensity of sensation. The second and third meetings, presided over by the Hon. B. Russell, were devoted respectively to a discussion on memory and consciousness, opened by Dr. Robinson, and to a symposium, "Can There be Anything Obscure or Implicit in a Mental State?" by Mr. H. Barker, Prof. G. F. Stout, and Prof. R. F. A. Hoernle. Dr. Robinson said that M. Bergson, in his "Matter and Memory," neglected the fact that memory was an assertion, and that he did not do justice to the function of meaning in remembering. Intuition and intelligence must be somehow inclusively related. A vigorous discussion revealed many criticisms opposing this anti-Bergsonian thesis. In the symposium Prof. Stout maintained that within the field of consciousness, whether of mere sense experience or of thought, there are contents which are not separately discerned. The opposing point of view to this was due to a confusion resulting from the fact that the presence of implicit consciousness can only be ascertained by a process of analytic scrutiny rarely present in normal conscious life.

MR. ANANDA COOMARASWAMY has issued part iv. of his useful album of Indian sculpture, "Visvakarma." The plates include two representations of the Buddhist Avalokitesvara, the personification of power, preserver of the world and men, from Ceylon; one of the local goddess, Pidári, from Madras, and a set of Nága and Nágini water or snake deities from Ceylon, Ajanta, and southern India. In some cases the reproduction of the photographs is not as clear as might be desired, but they are sufficient to answer the purpose of the publication. The collection will be of much value to students of Indian religion, archæology, and art.

THE recent report of the census of the people of the Andaman Islands, taken in 1911, shows a melancholy decrease in the population. Of the Yerawa and Bojigngiji groups, estimated to number 3500 when British occupation began in 1858, only 455 survive. This decrease is attributed by Mr. R. F. Lowis to three causes—increased infant mortality in the case of parents who have come under the influence of civilisation, and to an epidemic of measles; a tendency to infertility as a result of the introduction of syphilis; an increased death-rate among adults, accounted for by the draughty buildings in which the sick are housed, and the use of clothes and blankets in hospitals, which are discarded when the patients resume their jungle life. The savage Jarawas alone, who live isolated from civilisation, seem to be holding their ground, and it is only in this group that any hope remains of the preservation of this remarkable people.

THE alleged atrocities in connection with the rubber trade in the Putumayo district of Peru, now the subject of investigation, have directed attention to the Indian tribes of that region. An English explorer, Capt. T. W. Whiffen, whose evidence has been given before the Parliamentary Committee, contributes to vol. xxiv., part i., of *Folk-lore* an interesting account of these races. He was probably the first and the last white man to observe them while they were unaffected by outside influences. These tribes of the Issa-Japara River region do not, as Dr. Martius supposed, furnish an example of culture degeneration. There is no trace of any submerged

superior culture; on the countrary, they have not emerged from the condition of the Stone age. While the people to the north smoke cigars and those to the south use pipes, they make a treacly decoction from the leaf which friends lick ceremonially in the tribal palaver, or to ratify a contract. When twins are born, the second, particularly if a girl, is killed; and deformed or sickly children are drowned by the mother. Among the Boro the father practises the couvade. The only social or artistic function is the dance, announced by beat of drum heard at a distance of eight or ten miles. Prisoners are slain and ceremonially eaten by their captors. After death the soul hovers round the hut for a time, and then wanders to the happy hunting-grounds of the Good Spirit. It may be hoped that Capt. Whiffen will publish a detailed account of these people, with a reproduction of the good photographs which he exhibited before the Folk-lore Society.

THOSE who were present at the fourth International Congress of Genetics at Paris in 1911 will always recall it as a meeting that was very much alive, and evidence of this is to be found in the report which has recently appeared. Some fifty-eight communications made to the congress are printed in this volume of nearly 600 pages. The greater part of them deal with plants, though there are a dozen papers on animals, and several of a general nature. Many of the communcations are of great interest and permanent value, and special mention may be made of Orton on the inheritance of disease resistance in plants, of Lotsy on crosses between different species of Antirrhinum, and of Walther on the inheritance of coat colour in horses. But the whole volume is full of interest and suggestion, and valuable as giving an excellent idea of the scope of genetic research, and of the great activity at present prevailing. Two languages are used throughout—French and English. A French abstract is given with the English papers, while all other papers are in French with an English abstract appended. The volume is beautifully got up and fully illustrated, a pleasant feature being the collection of portraits of workers in this branch of knowledge. It is published by Masson et Cie., and costs 25 francs.

IN an address given at the anniversary meeting of the Royal Society of South Africa in March last, the president of the society, Dr. L. Peringuey, dealt with the antiquity of man in South Africa. So far no human remains have been found in South Africa which belong to the Palæolithic period. On the other hand, stone implements of the various European Palæolithic periods of culture abound in South Africa—Chellean, Acheulean, and Mousterian—but there is no evidence that these types followed each other in point of time; all seem to have been in use at the same period. Dr. Peringuey is convinced that there was a direct relationship between the later Palæolithic cultures of Europe and South Africa—the Aurignacian and Solutrean. The problem of determining the degrees of antiquity of the various Palæolithic cultures of South Africa is rendered difficult by the fact that the climate and the fauna of South Africa have altered very little, if at all, during the Pleistocene period, whereas in Europe there have been recurring periods of change. Lately the fossil remains of two extinct antelopes—"gnu- and pallah-like creatures"—have been discovered in the Free State, with large flakes and other implements of a Palæolithic type. Remains of very similar antelopes occur in the Pliocene formations of India and Attica. Molar teeth of a mastodon have also been found in gravels of the Vaal River along with Palæolithic implements. It will be thus apparent that man's presence in South Africa is of great antiquity, although as yet the necessary data have not been gathered for estimating the degree of that antiquity. So far only Europe and certain parts of America have been searched for man's earliest traces; it seems very probable that Dr. Peringuey and his colleagues may soon be in a position to elucidate, by their discoveries in South Africa, some of the problems which are at present puzzling their European colleagues.

MR. R. S. PEARSON, of the Indian Forest Service, has published (Indian Forest Records, vol. iv., part v.) a detailed and valuable report on the utilisation of bamboo for the manufacture of paper pulp. Four species of bamboos (*Bambusa arundinacea, B. polymorpha, Cephalostachyum pergracile, Melocanna bambusoides*) were examined with regard to their suitability for paper-making; the area over which the examination took place was restricted to Lower Burma and the west coast of the Indian peninsula, as both these localities are geographically well suited for import and export purposes, and contain vast areas covered with bamboos. Figures as to yield, &c., were carefully collected; in order to obtain practical proof of the quality and cost of preparing pulp from bamboos about eighty tons of raw material of the four species were converted into pulp, and eventually into paper at Calcutta; and the report is printed on paper made from *B. polymorpha* (the most useful species), both nodes and internodes being used. The report contains very valuable data for estimating the probability of the success of establishing a paper-pulp industry in Burma and India.

THE interesting weather maps for May 9–15, published in the first issue of the Meteorological Office charts of the North Atlantic and Mediterranean for June, show a continuation of the type of conditions which had prevailed during the preceding two weeks, affording a noteworthy illustration of an almost stationary cyclonic system over the north-eastern quarter of the Atlantic for nearly three weeks. The high pressure in the north of Europe and western Siberia spread along the arctic circle to Iceland, formed a barrier against the eastward progression of Atlantic disturbances, and held the depression above referred to in practically the same position until nearly the middle of May. The latest reports showed that "a huge area of high barometrical pressure covered nearly the whole of the North Atlantic." Some icebergs were passed in 42° 30′ N. and 49° W. about April 4. Since April 10 (up to the time of going to press, on May 15) ice had not been sighted south of latitude 44° N.

"FORECASTING the weather" is the title of an interesting bulletin (No. 42) by Mr. G. S. Bliss (section director), recently issued by the U.S. Weather Bureau. It shows the great advantage enjoyed by the bureau in being able to watch the developments and movements of storm-areas over the entire country between the Atlantic and the Pacific, and from Canada to Mexico and the West Indies, by the receipt of telegrams twice daily containing observations made at the same physical instant of time. The author shows how perfectly the machinery works, and how rapidly the operations are performed, from observation to map-making. In less than two hours the various forecasters are prepared to issue particulars for a day or two in advance for any State or city with nearly as high a degree of accuracy as they can for their own locality. This useful bulletin is accompanied by weather maps and an epitome of the various processes at work in the atmosphere, to assist students in applying to the maps the principles learned in a cursory study of the elements. It is claimed that by mapping the whole northern hemisphere the Weather Bureau is enabled to forecast general conditions for a week or ten days in advance with a creditable degree of accuracy.

IT is well known that the distance of the epicentre of a great earthquake is determined by the duration of the first series of preliminary tremors. The relation is not a simple one for all distances, but Mr. G. Negri states (*Anales de la Soc. Cien. Argentina*, vol. lxxv., 1913) that the duration I_1 of the preliminary tremors in minutes and the distance S of the epicentre measured along a great circle in thousands of kilometres are connected by the following relations: if S be equal to or less than 1, $I_1 = 2{\cdot}05.S$, if S lie between 1 and 9, $I_1 = \sqrt{(16834.S)} - 2{\cdot}32$, and if S be greater than 9, $I_1 = (S + 5{\cdot}929)/1{\cdot}463$. Thus the curve which represents these relations consists of three portions which are respectively straight, parabolic, and straight. Mr. Negri suggests that earthquakes which originate at distances represented by the above limits might be termed near, distant, and antipodal.

IN the May number of *The American Journal of Science*, Prof. L. P. Wheeler, of Yale, examines the more recent measurements of the refraction and dispersion of metals in the light of the electron theory of dispersion. The experimental data cover silver, copper, gold, nickel, and cobalt, but the accuracy attained is still insufficient to make the comparison satisfactory. It appears, however, from the results available that the number of free electrons in each of these metals must increase with the frequency of the incident radiation slowly and fairly uniformly in the infra red, and more rapidly in the regions for which the metals are transparent. The dispersion due to the free electrons is more important than that due to the bound electrons, especially in the region of short wave-lengths, and the form of the dispersion curve given by theory agrees with that found experimentally in its main features, although the inaccuracies of the experimental results do not permit of any satisfactory comparison of details.

Science Progress for April contains an important article by Dr. J. V. Eyre on the projected revival of the flax industry in England. Dr. Eyre has, on behalf of the Development Commissioners, visited, during the past two years, the principal flax-growing countries of Europe, and made a special study of the methods adopted in cultivating the plant and separating the fibre. The information gathered has been recently presented to the Commissioners in the form of a report, which is summarised in the article now referred to. The inquiry leaves no room for doubt that the climate of this country is well suited to flax, and experiments are in progress as to the possibility of cultivating and separating the fibre at a profit. Taking into account the fact that flax is now worth nearly twice as much as it was ten years ago, and other considerations which are specified in detail, there is strong reason to believe that the judicious revival of the industry by improved methods would be of benefit to British agriculture. During the past year flax was grown in Bedfordshire experimentally as a fibre crop, and useful information gained as to the more difficult operations of harvesting and retting, special tanks being constructed for the latter purpose. It is proposed in the present year to make trials on a larger scale, and for this purpose a society has been formed under conditions of non-profit trading, so as to be eligible for a grant from the Development Commission.

THE third of a series of articles on the Panama Canal appears in *Engineering* for June 6, and deals with the lock-gates. The locks are 110 ft. wide, and have a nominal length of 1000 ft.; intermediate gates are provided, together with valves, allowing lengths of chamber of 278·5, 370, 550, 908·5 and 1000 ft. respectively to be employed, an arrangement which will result in a considerable saving of time and water with vessels of short length. The gate leaves are built of flat girder work sheathed with plating, and the whole of the support is given by a pintle at the base and a yoke above; there is no roller path provided. The leaves have a length of nearly 65 ft. and are 7 ft. wide; the largest are 82 ft. high. The largest leaf has a weight of 1,483,700 lb. The material used in the gates is open-hearth steel, having an ultimate tensile strength of 60,000 lb. per sq. in. Under ordinary conditions, the working stresses do not exceed 13,000 lb. per sq. in., and do not exceed 15,000 lb. per sq. in. under extreme conditions.

THE city of Edinburgh recently appointed a commission "to visit various cities in England with a view of inspecting self-propelled cars and obtaining further information on the subject." The deputation has issued a report which is commented upon in *Engineering* for June 6, and gives some valuable data as to various installations for running tramcars by petrol, in place of by cable or by electricity. At Morecambe the autocar service was opened eighteen months ago: the line is 1·2 miles long, and passes through a sparsely populated district. The first year's working shows a surplus of receipts over all expenditure. The car seats thirty-seven passengers; its weight unloaded is 8 tons. It is propelled by a 40 h.p. four-

cylinder petrol engine, the mileage per gallon of petrol being seven to eight. The average daily run for each car is about seventy miles. The total cost of car is from 985*l*. to 1150*l*. The Leyland Motor Company, which built the cars, gave a five years' guarantee that the costs of working, exclusive of wages, upkeep of car body, and administration expenses, should not exceed $3\frac{1}{4}d$. per car-mile so long as the price of petrol did not exceed 9*d*. per gallon. Birmingham, Coventry, and London were also visited, and as the result of the inquiries, the deputation recommends the introduction experimentally of petrol-driven cars in Edinburgh.

AMONG the latest additions to the "Cambridge Manuals of Science and Literature" are five volumes dealing with scientific subjects. Prof. John Cox, under the title "Beyond the Atom," tells the story of discoveries in radio-activity, and his brief summary of the work of Rutherford, Curie, and many others will prove of interest to students and general readers alike. Dr. Gadow's book on "The Wanderings of Animals" gives the main facts of geographical distribution in a readable form. Prof. Fortescue writes on wireless telegraphy for readers with a general scientific knowledge who desire to know something, not only of the accomplishments of wireless, but also of the means by which they are attained. Mr. O. H. Latter's book on "Bees and Wasps" deals with British species of Hymenoptera in a thoroughly practical manner, and Mr. Clement Reid's "Submerged Forests" gives a simply worded account of a very interesting series of geological researches. The "manuals" are one shilling net each, and at the rate the library grows the student will be able soon to secure at this small cost an authoritative account of every branch of modern scientific research.

OWING to the development of their optical business, Messrs. Newton and Co., 72 Wigmore Street, London, W., are unable to find space for their philosophical and physical apparatus department, and are consequently disposing of their stock at low prices. The catalogue of apparatus for sale is comprehensive, and includes particulars of shop-soiled and second-hand instruments used in the study of physics and chemistry, lanterns and lantern apparatus, and microscopes and accessories.

OUR ASTRONOMICAL COLUMN.

THE VARIATION OF SOLAR RADIATION.—With the permission of the secretary of the Smithsonian Institution, a definite and important statement under the names of Messrs. C. G. Abbot, F. E. Fowle, and L. B. Aldrich is published in the *Astronomische Nachrichten*, No. 4656, with the title "The Variation of the Sun." The observations from which the conclusions are drawn were begun in the year 1902, when preliminary experiments were made at Washington to determine the solar constant of radiation. About 700 determinations of it have now been secured, and they depend on observations made at altitudes ranging from sea-level to 4420 metres. The results, some of which are mentioned in this communication, will be published in detail in the Annals of the Astrophysical Observatory of the Smithsonian Institution (vol. iii.) now in the press, and will probably appear next month. The authors nevertheless publish in this statement some of the more important conclusions, which are as follows:—

(1) The mean value of the solar constant of radiation for the epoch 1905–12 is 1·929 cal. per sq. cm. per min. (2) An increase of 0·07 cal. per sq. cm. per min. in the "solar-constant" accompanies an increase of 100 sun-spot numbers (Wolfer). (3) An irregular variation frequently ranging from more than 0·07 cal. per sq. cm. per min. within an interval of ten days is established by numerous nearly simultaneous measurements at Mount Wilson, California, and Bassour, Algeria. (4) Indications of two wholly independent kinds incline the authors to think that these variations of solar radiation are caused within the sun, and not by interposing meteoric or other matter.

The extreme importance of the conclusions here stated cannot be overrated, and students of solar physics in its broadest sense will await with eagerness the publication of the detailed investigation.

PROMINENCES ASSOCIATED WITH SUN-SPOTS.—The discovery of radial motion in sun-spots by Mr. Evershed revealed the fact that there are two opposite movements in the penumbra of every spot, the gases at the level of the reversing layer flowing outwards away from the umbra, while those at the higher levels of hydrogen and calcium flow inwards. It was thought that a study of the higher solar region, namely that of the prominences, might shed some light on these remarkable motions, and with this object Mrs. Evershed undertook a study of the fine prominence photographs taken at the Kodaikanal Observatory. The results of this investigation are described in the current number of the Monthly Notices of the R.A.S. (vol. lxxiii., No. 6), and they are accompanied by a series of fine reproductions of numerous types of prominences explained in the paper.

Mrs. Evershed states that the investigation suggests more problems than it solves, yet some preliminary conclusions are nevertheless drawn. The most general result seems to indicate that the movements observed in the prominences situated directly above sun-spot groups are of quite a different kind from those in the penumbræ of spots, being intermittent and variable in direction and amount instead of uniform and constant. Reference is also made to the presence of forces other than those of an eruptive and gravitational nature, which is responsible for such a peculiarity as was observed in some rising prominences which moved with an accelerating velocity into space by a force opposed to gravity.

STUDIES IN STELLAR STATISTICS.—The general question of the distribution and motion of stars in space is perhaps the most important problem of the day, and the attention of astronomers has been turned more and more towards it since the initial investigation of Kapteyn in 1904, who determined for the first time the elements of the two star-streams. Space will only allow here of a list of a few of the more recent papers connected with this subject. Mr. F. W. Dyson has contributed to the two last numbers of the Monthly Notices of the R.A.S. (vol lxxiii., Nos. 5 and 6) two important researches on the distribution in space of the stars in Carrington's circumpolar catalogue, discussing in the first the proper motions in a direction perpendicular to the solar motion, and in the second the proper motions in the direction of the solar motion. In the same publication (No. 6) Mr. H. C. Plummer continues his series of papers on

stellar motions, the title of this contribution being "A Preliminary Discussion of the Galactic Motions of the Bright Stars of Type I., with Some Additional Material." Mr. C. V. L. Charlier, in the *Meddelanden från Lunds Astronomiska Observatorium*, series ii., No. 9, publishes the second of his studies in stellar statistics, entitled "The Motion of the Stars," giving an account of an extensive research into the proper motions of Boss's catalogue based on correlation methods.

RECENT OBSERVATIONS OF NOVÆ.—The results of a valuable piece of work are recorded by Prof. E. E. Barnard in *Astronomische Nachrichten*, No. 4655. They relate to the present appearance of many of the novæ which have been discovered from time to time. The following is a very brief digest of some of the notes he gives, but reference should be made to the original paper for further details of each star:—

Nova	Discovered	Max. recorded mag.	Present mag.	Remarks
T Coronæ ...	1866 ...	2 ...	9 ...	Colourless
Cygni	1876 ...	3–4 ...	15·0 ...	Hazy
Andromedæ ...	1885 ...	6 ...	Invisible...	—
Aurigæ	1891 ...	4·5 ...	14 ...	Ill-defined
Sagittarii ...	1898 ...	4·7 ...	15 ...	Hazy and ill-defined
Persei	1901 ...	<1·0 ...	12·05 ...	Colourless
Geminorum (1)	1903 ...	8·16...	16·3 ...	—
Aquilæ	1905 ...	5 ...	<17 ...	—
Lacertæ	1910 ...	5·0 ...	12·5 ...	Nebula bluish-white
Geminorum (2)	1912 ...	4 ...	8± (fluctuating) ...	—

With regard to the last nova, Prof. Barnard writes: "On February 8, 1913, with good seeing and at the proper focus the Hα image of Nova Geminorum No. 2 was clearly seen. It was small and sharp and intensely crimson, and was surrounded by a greenish-blue halo some 3″–4″ in diameter. The normal focus, however, was not different from that of an ordinary star."

THE NATIONAL PHYSICAL LABORATORY DURING 1912.

THE annual report of the National Physical Laboratory, Teddington, was presented to the meeting of the general board on April 25, and marks another milestone of steady progress. The birth of the laboratory but some ten years ago is fresh in the minds of most of us, but many may not realise the extent of its development; few institutions can indeed parallel it in rapidity of growth.

As a nation we were late in starting a national laboratory, but we have been unusually quick in making use of the facilities and advantages which it affords. To it from all parts of the Empire come requests for advice and assistance—requests increasingly exacting and ever-widening in scope; the National Physical Laboratory is fast taking its place as the Imperial laboratory. Its staff, formerly fewer than half a dozen, now numbers 150 of all grades; its history recounts an uninterrupted succession of new buildings. Progress such as this bears witness to the labour and devotion which the director, Dr. Glazebrook, has showered on the laboratory, to the loyal cooperation of his staff, and to the wise administration of the Royal Society.

The National Physical Laboratory is steadily gaining in the nation's appreciation; in common fairness the nation should put itself in the position of being able to say that it has provided for the laboratory in such fashion that financial cares need not distract its administrators from their proper sphere. The laboratory should be able to attract and keep on its staff brilliant young men who are keen to work at research for the profit of the nation and the advancement of learning. The men are not wanting; it is for the country to see that their remuneration is commensurate, and that they are adequately housed and equipped for their work.

The laboratory is being increasingly consulted by the different Government Departments. During the year various matters have been carried out for the Admiralty, the War Office, the Foreign Office, the Home Office, the Board of Trade, the Local Government Board, the India Office, &c. Last year the expenditure amounted to more than 32,000*l.*; the Treasury grant was only 7000*l.* The remaining 25,000*l.* had to be raised by payments for work done and by donations.

A new building designed to accommodate the administration offices and the optics division is approaching completion; this will satisfy a most imperative need. Generous donors have supplemented the special Treasury grant of 15,000*l.* for the purpose; these include the 1851 Commissioners (5000*l.*) and a number of the City Companies. But further funds for equipping these and other departments are urgently needed. The new buildings are to be opened by the Right Hon. A. J. Balfour on the day of the annual visitation, Thursday, June 26.

Turning now to the work of the year, its comprehensive nature is at once evident. The National Physical Laboratory is a physical laboratory in the widest sense, and accordingly we find in its yearly record papers on almost every branch of physics and technology. Some forty original communications were published during the year; it is possible now to touch on only a few of these.

Taking first the work on the fundamental electric units, the Lorenz apparatus for the determination of the ohm in absolute measure was completed during the early part of the year, and a large number of experiments have already been carried out by Mr. F. E. Smith. Some idea of the precision attained may be gathered from the fact that the estimated probable error of any single measurement is of the order of two parts in 100,000. The final result of the measurements is not yet available, but it may perhaps be said that the value will probably be somewhat less than has been generally supposed. Comparisons with the resistance-standards of the Bureau of Standards, the Reichsansalt, and the Laboratoire Central d'Electricité have been made during the year, with the result that the English and German values were found to agree within one part in a million; the American value was ten parts in a million greater.

Mr. Campbell has evaluated the ohm in absolute units by two alternating-current methods, remarkable for their ingenuity. The testing of wavemeters is becoming an important feature of the work in the electrical department.

The British Radium Standard, consisting of 21 milligrammes of extremely pure radium-chloride, is now deposited at the laboratory. Dr. G. T. Beilby provided the funds for the purchase of the standard, which has been compared with the international standard at Sèvres, and will shortly be available for standardising radium preparations.

An important paper dealing with the discharge of electricity from carbon at high temperatures was presented to the Royal Society by Dr. Harker and Dr. Kaye. By reason of the conditions and magnitude of the experiments, ionisation currents amounting to several amperes were obtained.

The thermometry division is investigating the thermal conductivities of the various heat insulators used

for cold-storage purposes, and for steam-pipe lagging—a piece of work which presents special difficulties and has long been needed. The equipment for testing the thermometers hitherto verified at Kew Observatory has been set up; some idea of the magnitude of this work will be gathered from the fact that more than 33,000 thermometers were tested last year. A research on the viscosity of oils has been completed by Mr. Higgins.

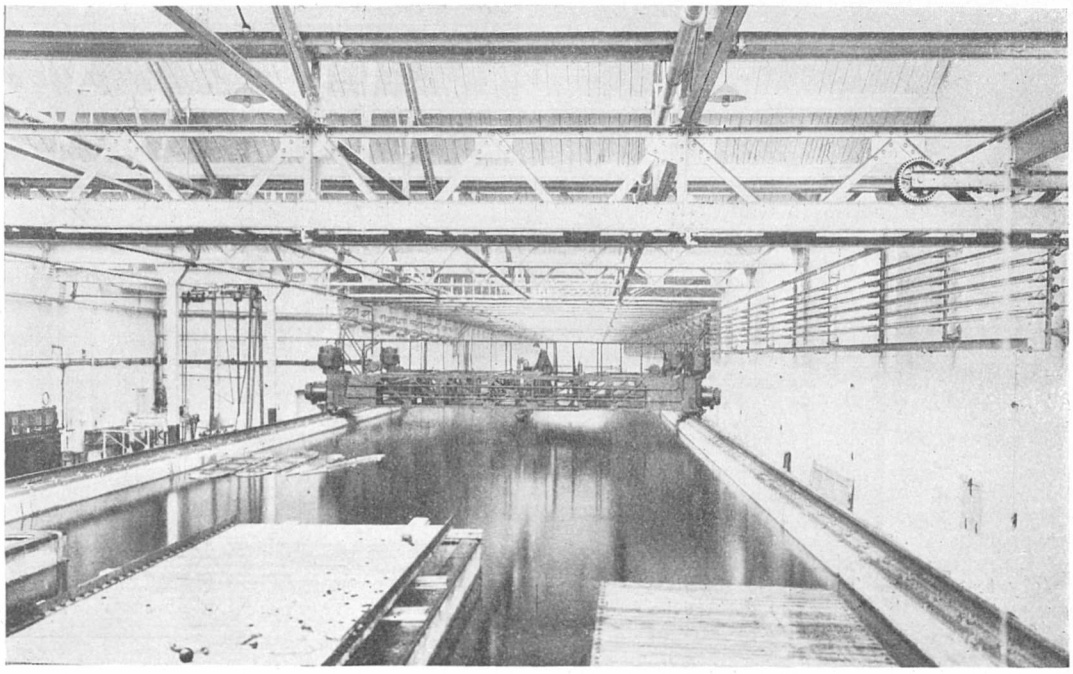

FIG. 1.—The tank and carriage, with model ready for towing.

comparisons of candle-power units have been made with the Bureau of Standards and the Reichsanstalt through the medium of tungsten filament lamps (Mr. Paterson). The agreement of the results is extremely good, and incidentally affords evidence that the photometry of lights of different colours is not of necessity liable to the errors which are commonly attributed to it. Work has been published by the electrotechnics division on the electric strength of ebonite, the compressibility of micanite, the dielectric losses in insulators (Mr. Rayner), and the heating of flexible cords and cables (Mr. Melsom).

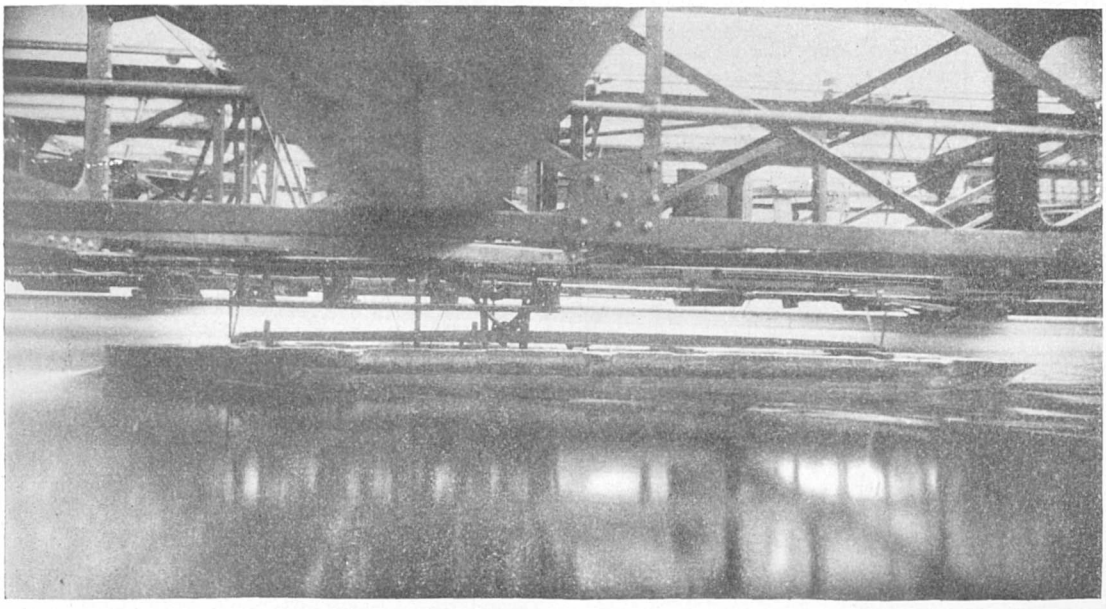

FIG. 2.—Model being towed—showing waves created.

The photometric division has conducted an inquiry into the visibility of ships' lights, and is at present engaged in an investigation of "glare," particularly that produced by motor-car headlights. Inter-

Some important researches have been carried out

by Mr. Baker and his colleagues in the Naval Tank. The most noteworthy is that with a series of ship models, each having the same principal dimensions, but with a different distribution of the displacement in a longitudinal direction. The experiments revealed the limits of speed to which various forms can be driven without excessive wave-making, and have also increased the general knowledge of eddy-making at the sterns of ships. An extensive series of experiments has also been carried out on hydro-aëroplane floats. Fig. 1 gives a general view of the tank with a model in place under the carriage by means of which the model is towed. Fig. 2 shows the wave profiles for a model of mercantile form with fairly bluff ends. It is satisfactory to note how very small the loss of water from the tank still continues—a tribute to its design and construction.

In the metallurgical department, Dr. Rosenhain and Mr. Archbutt have published the tenth report of the alloys research committee of the Institution of Mechanical Engineers. The report, which deals with the alloys of zinc and aluminium, contains features of great interest in view of the increasing importance of light alloys in aëronautical and instrument work. Dr. Rosenhain and Mr. Ewen have communicated an important paper on intercrystalline cohesion in metals, while Mr. Humfrey has been working on the effects of strain in iron at high temperatures.

The metrology division has been largely occupied with the arrangements for the reception of the Kew Observatory test work. The behaviour of the silica standard metre has been closely followed, and the value of its expansion-coefficient determined (Mr. Donaldson).

Dr. Stanton and his staff have carried out extremely valuable work in a number of directions, more particularly on wind-pressures (at the Tower Bridge), on the frictional high-speed flow of water and air in pipes, and on the pressure and flow round aëroplane surfaces. The experiments conducted in the 4-ft. wind channel have afforded valuable information to the Royal Aircraft Factory at Farnborough in designing biplanes and dirigible balloons. The Treasury has accordingly authorised the erection of a new 7-ft. channel at the laboratory; this is now approaching completion.

The new experimental road constructed for the Road Board is complete, and abrasion and endurance tests have been begun.

The optical division has been concerned with the testing of photographic shutters, the absorbability of glass for ultra-violet light, and the testing of telescope objectives and trial lenses. The staff took an active part in the organisation and proceedings of the Optical Convention which was held during the year at South Kensington.

This short summary may suffice to give a notion of some of the many fields of activity in which the National Physical Laboratory is working for progress. There are important problems waiting to be taken up; it is in many cases purely a question of "ways and means" which prevents a start being made.

THE ROYAL OBSERVATORY, GREENWICH.

AT the annual visitation of the Royal Observatory on June 7, the Astronomer Royal, Dr. F. W. Dyson, F.R.S., presented his annual report. The following extracts indicate the chief items of interest:—

The observatory has ceased to generate its own electric current for lighting and other purposes, and now obtains current from outside. Alternating instead of direct current is now used, and a small supply of direct current is obtained by means of a rotary converter.

In the new magnetic observatory, shortly to be erected, provision is made for the continuation of the long series of Greenwich observations of the variations of the magnetic elements. This series is unique as regards the length of time during which observations have been made on the same site. The care which has been taken to guard the observatory from all artificial electromagnetic disturbances which could affect the accuracy of the observations has preserved the suitability of the site for such work.

Observations of double stars have been made with the 28-in. refractor from a working catalogue containing all known double stars showing appreciable relative motion, and a number of pairs from the catalogues of Hussey and Aitken under 2″ separation. κ Pegasi was observed on five nights, δ Equulei on three nights, 70 Ophiuchi on thirteen nights, and ε Hydræ on one night.

The 26-in. refractor, the 30-in. reflector, and the 6-in. Cooke triplet have been in constant use during the year. The new cell for the crown lens was received and mounted in July. The adjustment of the crown and flint lenses for tilt and eccentricity relative to one another was made in August.

During the year 164 plates were taken for determination of stellar parallax, 124 of these being new plates and forty being re-exposures of plates taken six months previously. The programme for each star consists of six photographs. Three photographs taken in the evenings are re-exposed in the mornings about six months later, and are then developed. Three plates are exposed in the mornings, and, after re-exposure six months later, are also developed. For several stars the cycle has been completed and the plates have been measured for three stars. The results obtained are $+0{\cdot}082'' \pm 0{\cdot}017''$, $+0{\cdot}043'' \pm 0{\cdot}009''$, and $-0{\cdot}014'' \pm 0{\cdot}012''$. The star which gave a negative parallax is one with a small proper motion. It is considered that these probable errors are too large, and that one of $\pm 0{\cdot}005''$ should be attainable. The increased constancy in the adjustment of the object glass secured by the new cell, and the use of the rotating sector by which the star observed is reduced to the magnitude 10·5m. to 11·0m. of the comparison stars, are expected to make a considerable improvement.

The 6-in. Cooke triplet which belonged to the late Mr. Franklin Adams has been employed in the determination of the photographic magnitudes of the stars brighter than 9·0m. in the Greenwich astrographic zone. During the year fifty-three photographs of fields compared with the standard polar area have been taken. Fifty-six plates have been measured, completing the eighty-eight necessary for the whole zone. The catalogue of the resulting magnitudes is nearly completed, and will contain 8000 stars.

Fifty-nine photographs of Neptune and satellite, taken in 1909–10, have been measured, and the results published.

At the date of the last report, 152 out of the 206 Franklin-Adams photographs had been counted in the manner then explained. During the year fifty of the remaining plates have been dealt with. The four plates still uncounted have not yet been received from Johannesburg.

The requisite photometric data for the reduction of these counts to statistics based on actual photographic magnitudes are now being obtained at a steady rate. The plan of taking long exposures on a field and a standard polar area has been abandoned, because of the rarity of nights on which the sky is uniform and constant for more than one hour. Instead of this, exposures of 5m. duration are being taken on the

central fields of the Franklin-Adams plates and on the standard polar area. The actual procedure consists in giving an exposure of 5m. on a field taken at the same altitude as the pole, two exposures on the pole, and then a second exposure on the field. These will serve to determine standard magnitudes down to the 13th or 14th magnitude on the Harvard photographic scale. With these short exposures it will be possible to make several determinations for each field required. For the fainter stars photographs will be taken with a wide grating and the magnitudes derived by comparison with the diffracted images of the brighter stars. These determinations have the advantage of being independent of the changing transparency of the sky. The star-images are compared with a scale formed by taking a number of different exposures on the same plate—the scale being calibrated by the Harvard standards.

With the astrographic equatorial 176 photographs have been taken on fifty-nine nights. Of these, 154 were for the determination of the photographic magnitudes of the stars in the Greenwich section of the Astrographic Catalogue by the method described in last year's report, and 107 of them were considered satisfactory for the purpose. There are now twenty-nine plates on the working list to be taken to complete the series.

Attention is directed to the determination of the position of the sun's axis which has been carried out by Mr. Maunder. The attempt has been made to utilise as fully as possible the long series of measures of the positions of sun-spots made at Greenwich. Although Carrington's determination proves to be only a few minutes in error, it is desirable that the position of the sun's axis should be obtained with all possible precision, and that the limits of accuracy should be known. A redetermination should be made at each sun-spot cycle.

An apparatus was set up on July 5 for the reception of the wireless time-signals from the Eiffel Tower and Norddeich. The signals have been constantly observed since that date, the morning signals being observed each day (except Sundays). The night signals from the Eiffel Tower have been observed on 128 and the rhythmic signals on eighty-two occasions. The night signals from Norddeich have been observed on 124 occasions. The morning signals from the Eiffel Tower were observed by both Mr. Lewis and Mr. Bowyer on 167 days; there is a mean difference L−WB = −0·066s. in their times of observation with an accidental discordance of ±0·06s. between the observers. Similarly in the receipt of the Norddeich signals the two observers showed a mean personal difference L−WB = −0·043s., and a similar accidental discordance. Thus the ordinary signals are observed by either observer with a mean error of less than ±0·05s. The rhythmic signals are apparently received with an error of less than ±0·01s., and the mean discordances between these and the ordinary signals are less than ±0·05s.

As regards the actual difference between the time sent out by the Eiffel Tower and that of the Greenwich 10h. and 11h. signals, from 184 observations Mr. Lewis makes the Eiffel Tower signal 0·256s. late on Greenwich, and Mr. Bowyer from 234 observations makes it 0·313s. late. It is supposed that the difference is mainly due to the difference of personal errors of the standard observers at Paris and Greenwich. The mean discordance after allowing for this constant difference is ±0·11s.

The Norddeich signals are, according to 160 observations of Mr. Lewis, 0·297s. late on the Greenwich time signals, and 0·340s. late according to 229 observations of Mr. Bowyer. Allowing for this there is an accidental discordance of ±0·23s.

The daily comparison of the Eiffel Tower signal affords a useful regular check on the time as determined at Greenwich. At the request of the director of the Paris Observatory, this comparison has, since the installation of the receiving apparatus, been forwarded daily to him as a check on the rate of the clock at Paris. These comparisons are specially serviceable in cloudy weather. In October the Astronomer Royal attended the "Conférence internationale de l'heure" as one of the British delegates, where the further development of the wireless time-service was discussed. The distribution of time in this way is of great value to navigators, and is likely to be of importance in the determination of longitude on land.

ORNITHOLOGICAL NOTES.

THE May number of the New York Zoological Society's Bulletin is devoted to the needs and results of wild-life protection in America, more especially as regards birds. A feature of this issue is a coloured plate representing five species of brilliantly coloured birds—the quezal, the great bird of paradise, the scarlet ibis, the cock-of-the-rock, and the white egret—which are in special danger of extermination in various parts of the world. Altogether, it is estimated that something like one hundred species are in danger owing to the feather trade or on account of their value as food. It is no answer to say that the present comparative abundance of some of these species renders protective measures unnecessary, for it is pointed out that the same argument was used in 1857 in the case of the passenger-pigeon and Wilson's snipe, the former of which is now extinct, save for one survivor in the zoological gardens at Cincinnati. The purchase of Marsh Island as a bird sanctuary by Mrs. Sage is recorded as an important step in the right direction.

In connection with the above may be noticed an article by Mr. B. H. Grove in the May number of *The American Naturalist* on the influence of agricultural development in Wyoming on the bird-fauna, in which it is pointed out that several species are on the increase, while others—notably the quail—have made their first appearance, as new-comers, into this State during the last few years.

The January number of *The Emu* contains the report of a committee of the Royal Australasian Ornithologists' Union appointed to consider the nomenclature of Australian birds and to publish a revised list of names. Although the list which accompanies the report is not based on absolute priority, the committee acknowledges its indebtedness, in its compilation, to the one recently published by Mr. G. M. Mathews, in which that principle is adopted throughout. Trinomialism is rejected.

In an article by Capt. H. Lynes on the drumming of snipe in the May issue of *British Birds*, it is pointed out that the performance is normally connected with the sexual function, but that it may occasionally take place at other seasons, although always within the limits of the breeding area. R. L.

THE AMERICAN PHILOSOPHICAL SOCIETY.

THE annual general meeting of the American Philosophical Society was held in Philadelphia on April 17–19 inclusive. A large number of papers was presented, their general character being of a high order of merit, and it is possible here to refer only to a few of them. The president, Dr. W. W. Keen, was in the chair at most of the meetings.

In a contribution on the flora of Bermuda, Mr.

Stewardson Brown, conservator of the botanical section of the Philadelphia Academy of Natural Sciences, said that more than 1450 separate collections of plants have been made from all parts of the archipelago, with the exception of a few of the smaller islands which are only rocks with but little vegetation. The native species of flowering plants and ferns, exclusive of the endemic forms, number 155, all of which are identical with those existing on the American mainland or the West Indian islands. The fourteen endemic species, four of which have been added through these studies, are all more or less nearly related to those of the south-eastern United States, West Indies, or tropical continental America, and are probably derived from such ancestors by modification during long periods of isolation. It would appear that the greater portion of the native flora has come to Bermuda from the south-west through the agency of ocean currents, hurricane winds, and migratory birds, of which a considerable number of species visit the islands regularly each year.

Prof. George E. Coghill, professor of zoology, Denison University, Granville, Ohio, read a paper on the correlation of structural development and function in the growth of the vertebrate nervous system. Recent studies in comparative neurology have resolved the central nervous system of vertebrates into four longitudinal divisions which are severally functional units. Among lower vertebrates the relative development of these divisions, the somatic sensory, the visceral sensory, the somatic motor, and the visceral motor, has been in a significant manner correlated with the behaviour of the species. Such correlations by the comparative method formed the point of departure for this study on the correlation of the behaviour of embryos with the developing structures in the growth of the nervous system. Some of the more general results of this method of study are (1) the demonstration of the nature of the primary reflex arc of the vertebrate nervous system; (2) the discovery of the adaptive nature of the early reflexes when considered from the phylogenetic point of view; (3) proof that the final common path of the most primitive reflexes is elaborated into the nervous mechanism of locomotion; (4) the explanation of the typical behaviour of a vertebrate upon the basis of demonstrable reflex arcs; (5) a distinctive contribution towards a biological neurology.

Prof. Victor C. Vaughan, professor of hygiene and physiological chemistry in the University of Michigan, dealt with the nature and significance of fever. It has been shown experimentally that fever is due to the digestion of proteins in the blood and in the tissues. Bacteria are living proteins. They get into the body and grow, converting the proteins of man's body into bacterial proteins. After a period of incubation the cells of the body pour out a ferment which digests and destroys the bacteria. In this process fever originates. In itself fever is beneficial; it is a manifestation of the attempt on the part of nature to destroy the invading organism. However, nature may overdo the matter, and fever *per se* become dangerous when it goes much above 105°. Any kind of fever, acute fatal, intermittent, remittent, or continued, may be induced in animals by repeated injections of properly graduated doses of foreign protein.

Prof. Mazÿck P. Ravenel, professor of bacteriology in the University of Wisconsin, described the control of typhoid fever by vaccination. In the United States vaccination against typhoid fever was recommended in 1909. The results were so favourable that it was made compulsory for all officers and enlisted men under forty-five years of age in 1911. The most striking results were obtained during the mobilisation of troops in Texas in 1911. There were 12,801 troops in Texas, all vaccinated. There was only one case of typhoid fever, occurring in a private of the hospital corps, who had not completed his immunisation. The case was mild and resulted in recovery. In 1898 10,759 troops were stationed in Jacksonville, Florida, under very much the same conditions as regards climate, &c. Vaccination was not practised at that time. There were 2693 cases known or believed to be typhoid fever, with 248 deaths. The French troops in Morocco, under most unhygienic surroundings, have entirely escaped typhoid fever where vaccination was practised. In Wisconsin the State Laboratory of Hygiene sends out the vaccine free of charge to all physicians in the State. In more than 3000 vaccinations only two cases of typhoid fever have come to notice; both these cases mild and atypical.

A paper on Guatemala and the highest native American civilisation was read by Prof. Ellsworth Huntington, of Yale University. Among the native civilisations of the western hemisphere that of the Mayas was decidedly the highest. Not only did they develop the arts of architecture and sculpture to a surprisingly high point, but they were the only American race to evolve the art of genuine hieroglyphic writing. To-day the magnificent ruins of the later, decadent Maya period, dating about 1000 A.D., are relatively accessible, as they lie in the dry and well-populated strip which borders the peninsula of Yucatan on the north. The oldest ruins, however, those representing the period of highest development a few centuries after the time of Christ, are located in one of the most inaccessible regions of America. In the last 1500 years, more or less, there must have taken place a change of great magnitude. Three possibilities present themselves. First, the Mayas may have possessed a degree of energy, initiative, and of resistance to fevers much in excess of that of any other known people. Secondly, in their day tropical fevers of the more destructive types may have been unknown in Central America. And thirdly, the climate may have changed. Alluvial terraces and their relation to such ruins as Copan furnish strong independent evidence of climatic pulsations during the past 2000 years.

Prof. W. M. Davis, of Harvard University, discussed Dana's contribution to Darwin's theory of coral reefs, and an account of his paper has already appeared in these columns (February 6, 1913, p. 632.)

Dr. Charles D. Walcott, secretary of the Smithsonian Institution, gave illustrations of a remarkable and ancient fossil fauna discovered by him in the mountains of British Columbia, 2000 ft. above Field, on the Canadian Pacific Railway. The fossils are most beautifully preserved, and include such delicate forms as Medusæ, holothurians, finely preserved marine shells of various kinds, and a variety of crustaceans. Some of the latter are so perfectly preserved that the branchia, legs, and alimentary canal are shown, and even in several forms the liver is so perfect that the ramifications of the tubes through it are reproduced by photography. Altogether more than eighty genera of invertebrate fossils have been found from a bed not more than 5 ft. in thickness. They are all of marine origin, and lived at a period when there were no vertebrates in existence.

The Alleghenian divide and its influence upon fresh-water faunas was described by Dr. Arnold E. Ortmann, curator of invertebrate zoology in the Carnegie Museum of Pittsburg. Although it is known that the Allegheny Mountains form a boundary between the aquatic forms inhabiting their western and eastern slopes, particulars about the relations of the two faunas were missing. Dr. Ortmann furnished facts

for a number of aquatic forms of life, chiefly the fresh-water mussels, the Pleuroceridæ, and the crayfishes, covering the region from the New York-Pennsylvania State line to the northern boundary of Tennessee. The main results are that the groups mentioned have not been transported overland to any extent, and consequently are apt to furnish evidence as to the former drainage conditions. The Allegheny Mountains have acted most of the time as an effective barrier to the dispersal of fresh-water life, at least since the end of the Cretaceous. The Atlantic side received its fauna from the interior basin—not across the mountains, but around the northern and southern ends. A few instances are known where single species crossed the divide, and these cases are found in two sharply restricted regions.

Progressive evolution among hybrids of Œnothera was discussed by Prof. Bradley M. Davis, of the University of Pennsylvania. Certain cultures of hybrids between *Oenothera biennis* and *O. grandiflora* have presented in the second generation a high degree of progressive advance in flower size and in the size of the leaves and the extent of their crinkling. An hypothesis for such progressive evolution is offered by the Mendelian principle of recombination of factors for large size on the assumption of multiple factors for the dimensions of organs, but this hypothesis also demands the presence in the same culture of groups of plants containing the factors for small size. When in an F_2 generation there is a considerable group of plants with flowers larger than those of the larger parent there should also be expected corresponding groups with flowers as small as, or smaller than, those of the smaller parent. In F_2 generations of about 1000 and 1500 plants respectively there were no groups of plants with flowers as small as, or smaller than, those of *O. biennis*, the small-flowered parent. The cultures as a whole presented a marked advance in flower size. A similar situation was presented by the character of the foliage in certain F_2 generations. The leaves throughout the mass of these cultures were much larger than those of the parents and generally much more crinkled. It is difficult to explain the results on strict Mendelian principles of segregation. Admitting the complexity of the situation when such an extreme cross is made as that between *O. biennis* and *O. grandiflora*, there still appears to Dr. Davis sufficient reason in the data at hand to present the problems as material for reflection on the Mendelian theory of the stability of factors and the principles of their distribution unchanged in the organisation of gametes.

Attention was given to the subdivision of the United States into climatic areas more or less susceptible of quantitative definition by Prof. Burton E. Livingston, professor of plant physiology in Johns Hopkins University, in a paper on climatic areas of the United States as related to plant growth. From a thorough study of the climatic data which are at hand, it appears that any two systems of isoclimatic lines, one system representing the geographical distribution of temperature conditions and the other representing that of moisture conditions, have a strong tendency to cross each other, thus dividing the country into climatic areas, each one capable of quantitative description.

Dr. William Duane, late of the Curie Radium Laboratory, University of Paris, referred to some unsolved problems in radio-activity (illustrated). He discussed such questions as: How can atoms which are physically and chemically similar to each other yet be so different that some of them will disappear immediately and others not for a long time? The explanation of this probably lies in the internal structure of the atom and not in external causes, for external conditions have no known effect upon the phenomenon. The second unsolved problem to which attention was directed was connected with the rays given off by the substances during their transformations. The third problem had to do with the γ rays. He asked: Is the γ ray a wave form spreading out as sound waves do from their source, or is it of corpuscular nature resembling the sparks projected from an exploding rocket? The fact that the β ray, which the γ ray is capable of producing, does not depend upon the distance from the source of the γ ray to the point at which the β ray is produced seems to indicate that the latter hypothesis is correct.

Dr. Edward C. Pickering, director of the Harvard College Observatory, introduced the subject of the determination of visual stellar magnitudes by photography. Ordinary photographic plates are most sensitive to blue light, while the yellow rays are those that effect the eye most strongly. Accordingly, blue stars appear brighter and red stars fainter in a photograph than to the eye. Isochromatic plates are, however, manufactured which are very sensitive to yellow light. If a yellow screen is interposed, the blue light is cut off and red stars appear even brighter, relatively, than they do to the eye. By using a thin yellow screen which cuts off only a portion of the blue rays it is possible to obtain plates having the same colour index as the eye. To fulfil this condition several blue and several red stars have been selected near the north pole. Photographs are then taken with different screens until one is found which gives images of the same relative brightness as the naked eye. With the 16-in. Metcalf telescope at Harvard, stars as faint as the twelfth magnitude may be photographed in this way with an exposure of ten minutes. With an exposure of two hours, stars can be photographed about as faint as they can be seen with a telescope of the same size. On a perfectly clear night a photograph is taken of the north pole with exactly ten minutes' exposure, then similar exposures on four different regions, then a second time on the north pole, on five other regions, and a third time on the north pole. The twelve plates are developed together and various precautions taken to secure uniform results. The magnitudes of numerous stars near the north pole have been measured with great care, and the magnitudes of the stars on the other plates can thus be determined on the same scale.

The spectroscopic detection of the rotation period of Uranus was the subject of a paper by Dr. Percival Lowell and Dr. V. M. Slipher, of the Lowell Observatory, Flagstaff, Arizona. By means of the spectroscope, it is possible to measure the speed of approach or recession of a luminous body; for the lines of the spectrum are shifted toward the violet or red in proportion as the body moves toward or from the observer. Hence, if the image of a rotating planet be so thrown upon the slit of the spectroscope that one end of the slit is illuminated by light from the approaching side of the planet and the other end by light from the receding side, the lines will be tilted through an angle which measures the speed of rotation. In this way, from spectrograms obtained at the Lowell Observatory in 1911, the authors determined the rotation of the planet Uranus about its axis to take place in ten hours and fifty minutes, in a direction opposite to that of the rotation of the planets nearer the sun. Thus, for the first time, an authentic determination of the rotation of this planet has been made by a direct method.

Dr. V. M. Slipher also described the spectrum of the nebula in the Pleiades. Two photographs of the spectrum of the faint nebula near Merope, a bright

star in the Pleiades, were obtained in December, 1912, with a slit spectrograph attached to the Lowell 24-in. refractor. The two plates were exposed five and twenty-one hours respectively. They agree in showing a continuous spectrum crossed by the dark lines of hydrogen and helium, the spectrum of the nebula being a true copy of that of the brighter stars of the Pleiades. The light of the nebula is thus shown to be of stellar origin. As it seems improbable that a mass of stars, all of the same spectral type as the Pleiades, should so group themselves behind the Pleiades as to give the appearance of a nebula, the author believes it more probable that the nebula consists of diffused material surrounding the stars and shining by reflected starlight. This is the first successful observation ever published upon the spectrum of this faint nebula.

A symposium on wireless telegraphy and telephony was an important part of the meeting. Among the papers read was one on radiated and received energy, by Dr. Lewis W. Austin, head of the U.S. Naval Radio-Telegraph Laboratory. Mathematical theory indicates that the energy radiated from a radio-telegraphic antenna will produce an electromotive force on a receiving antenna proportional to the current in the sending antenna, to the height of the sending antenna, to the height of the receiving antenna, inversely proportional to the wave-length, and inversely proportional to the distance between the two antennas. Since the loudness of signal is proportional to the square of the current in the receiving antenna, the signal falls off as the square of the distance between the two. This law has been verified by the experiments made by the United States Navy Department between the new high-power station at Arlington and several other stations situated in and near Washington. Observations at distances above 100 miles show that in addition to the diminution in intensity of signal with the distance, there is in an absorption either in the atmosphere or ground, such that at a distance of 1000 miles over salt water, with a wave-length of 1000 meters, the received current is only approximately 1/25; that is, the received signals are reduced to 1/600 of what they would have been had there been no absorption. The absorption decreases as the wave-length is increased, so that for communication over great distances, long waves 4000 to 7000 metres in length are used, while for short distances of a few hundred miles short waves are better, since they are radiated more energetically. These facts apply to daylight communication only, which is in general regular, night ranges, though greater than day, being freakish and uncertain. The absorption over land is much greater than over water, especially for the shorter wave-lengths. In recent tests between the Arlington station and the scout cruiser *Salem*, on its voyage to Gibraltar and return, messages were received from Arlington in the day-time on the *Salem* up to a distance of 2100 nautical miles, and at night as far as Gibraltar. A comparison was also made of the action of two types of sending sets, one being the regular spark-sending set and the other a set in which the waves are produced from an electric arc. It has been claimed that the continuous waves emitted by the arc are less absorbed than the broken-up trains of waves produced by the spark. Up to 1000 miles no difference in the absorption was observed, but at 2000 miles the observations indicated that the received arc energy was relatively four times greater than that of the spark.

During the meeting Sir A. J. Evans, Sir Joseph Larmor, and Dr. Schuster were elected foreign members of the society.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

BIRMINGHAM.—Prof. W. S. Boulton, professor of geology at University College, Cardiff, has been appointed to succeed Prof. C. Lapworth, F.R.S., who is retiring at the close of the present session. Before his appointment to University College, Cardiff, Prof. Boulton had been assistant lecturer in geology at Mason College, under Prof. Lapworth.

Dr. O. J. Kauffmann has been appointed successor to Prof. A. Carter, as joint professor of medicine, and the chair of surgery, vacated by Prof. G. Barling, on his election as Vice-Chancellor, has been filled by the election of Mr. W. P. Haslam.

Dr. T. Stacey Wilson has been invited to deliver the Ingleby Lectures for 1914.

Dr. P. T. Hughes is to represent the University at the International Congress of Neurology and Psychiatry at Ghent.

LEEDS.—At the request of the Development Commissioners, the University has undertaken the preliminary arrangements for an investigation in flax growing and in the methods of retting which would be suitable for a central rettery. Selby has been chosen as the chief place of experiment, and 120 acres of land have been sown with various selected types of seed. Negotiations are in progress for the establishment of a central rettery where the whole crop may be treated. The Treasury has sanctioned a grant from the Development Fund to cover the cost of the preliminary steps. The question of the subsequent control and direction of the experimental station is still being considered by the Development Commissioners.

OXFORD.—The annual report of the delegates of the Oxford Museum, which was presented to Convocation on June 10, is a lengthy document occupying thirty-two pages of the *University Gazette*. It includes separate reports of the museum departments, prepared by the regius professor of medicine, the professors of pathology, physiology, human anatomy, comparative anatomy, zoology, experimental philosophy, physics, engineering science, chemistry, geology, rural economy, and mineralogy, by the curator of the Pitt-Rivers Museum, and the reader in pharmacology. The introductory matter records the resignation of Prof. Odling, and the election of Prof. Perkin to the vacant chair of chemistry, together with the appointment of Mr. J. A. Gunn to the newly established readership in pharmacology. The reports of the several professors give evidence of much activity in both teaching and research; in most cases they include lists of important additions to the collections of specimens and the stock of apparatus. The longest and most elaborate contribution is that of the Hope professor of zoology (Prof. Poulton), whose account of the work of his department takes up more than half of the whole publication. The events of which he makes special mention are the taking over by his department of the lower portion of the south room of the old Radcliffe Library, and the meeting of the International Congress of Entomologists at Oxford last August. Attention is directed to many valuable additions to the collection, and particularly to the African insects presented by Messrs. K. St. A. Rogers, W. A. Lamborn, J. A. de Gaye, and Dr. G. D. Carpenter. An interesting list of accessions to the Pitt-Rivers collection is given by the curator (Mr. H. Balfour), who makes special mention of stone implements collected in Ashanti by Mr. R. S. Rattray, a former diploma student in the department. Space will

not allow mention of the other reports, all of which contain matter of interest.

DR. T. K. MONRO has been appointed professor of practice of medicine in the University of Glasgow, in succession to the late Prof. S. Gemmell.

MR. P. F. KENDALL, junior assistant curator of the zoological museum of the University of Sheffield, has been appointed lecturer in zoology and geology in the South-Eastern Agricultural College at Wye.

THE widow of the late Dr. Hervieux, who died six years ago, has given 4000*l.* to found two bursaries for poor students. We learn from the *Revue Scientifique* that Mme. Hervieux has also bequeathed to the Paris Academy of Medicine a bust of her late husband.

UNDER the auspices of the Edinburgh Mathematical Society, a mathematical colloquium will be held in Edinburgh during the week beginning Monday, August 4, and lasting five days. The following courses of lectures have been arranged:—"The Theory of Relativity and the New Physical Ideas of Space and Time," Prof. A. W. Conway; "Non-Euclidean Geometry and the Foundations of Geometry," Dr. D. M. Y. Sommerville; "Practical Harmonic Analysis and Periodogram Analysis: an Illustration of Mathematical Laboratory Practice," Prof. E. T. Whittaker, F.R.S. Further particulars may be obtained from the honorary secretary of the Edinburgh Mathematical Society, 19 Craighouse Terrace, Edinburgh.

THE prospect of early educational legislation has led lately to much discussion and to many speeches by prominent persons on various aspects of the problem of providing an adequate and properly organised system of education. Opening the new buildings on June 6 of the Newcomen's Foundation Domestic Trade School for Girls in London, the President of the Board of Education, Mr. Pease, said that when the history of the past fifty years comes to be written it will show that there has been too great an effort to make individuals read books. The result has been that people too often take their opinions from books, instead of forming them for themselves as the result of their own experience, their own thought, and their own work.—On June 6 and 7 the annual meeting of the Association of Education Committees was held, and resolutions were passed (*a*) declaring that it is imperative that a revision of the incidence of the cost of education as between the national and the local contributions shall precede any further legislation or administrative action which will increase the cost of education; (*b*) expressing the opinion that a new form of State contribution should be substituted for the very unsatisfactory system of grants to local education authorities, and that the Exchequer grants should increase automatically as new and increased responsibilities were put upon local education authorities; (*c*) expressing the opinion that the time has arrived when the strongest possible protest should be offered to local authorities undertaking any further financial obligations until the Government has redeemed its promise of further financial aid. Mr. Pease, who attended the meeting, said it is realised that more money ought to be given by the State in support of education, and that education committees should cooperate one with another with the view of coordinating the whole system of education in the country and making it more perfect.

COMMEMORATION Day at Livingstone College, Leyton, was held on June 7, and formed the centenary celebration of David Livingstone's birth. After a preliminary statement by the principal (Dr. C. T. Harford), the chairman (Bishop Montgomery) addressed the meeting. He emphasised the importance of medical training for missionaries, especially for those who had to go to tropical countries. Sir A. Pearce Gould said that the life of Livingstone was an outstanding contradiction to and repudiation of materialism. He spoke of the value of the college training for all missionary students, and urged the advantage of the course for missionaries on furlough, who would thus be brought into touch with recent medical researches. He referred to Livingstone's skill as a physician, and to his anticipations of modern research. Livingstone clearly saw the close connection between mosquitoes and malaria, and that there was an absence of malaria in the highlands where there were no mosquitoes, but in the lowlands where they swarmed malaria was prevalent. Livingstone recognised that the bite poisoned the blood, and noted that "the germ which enters when the proboscis is inserted to draw blood, the poison germ, is capable of reproducing itself." Livingstone also saw clearly the high importance of quinine in cases of fever. The Rev. W. D. Armstrong, who had been fifteen years on the Congo, spoke of the extreme value of his medical training in the maintenance of his own health whilst he was sampling Congo diseases, and in the valuable work he was able to do for his wife and fellow-missionaries at critical times. He spoke of the frequent call for help from traders, who were often entirely dependent on the missionary for medical help. This relationship had been an efficient means of establishing good relations between traders and missionaries in the troublous times of the rubber controversy. At the conclusion of the meeting the visitors had opportunities of examining the college laboratory for research in tropical diseases and the Livingstone relics which were on exhibition.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, June 5.—Sir Archibald Geikie, K.C.B., president, in the chair.—Dr. R. **Broom**: The origin of mammals (Croonian Lecture). An endeavour is made to trace the evolution of mammals from Cotylosaurian ancestors through the carnivorous Therapsida.—Dr. E. A. Newell **Arber**: The fossil floras of the Wyre Forest, with special reference to the geology of the coalfield and its relationships to the neighbouring Coal Measure areas.

Zoological Society, May 20.—Prof. E. A. Minchin, F.R.S., vice-president, in the chair.—Dr. R. **Broom**: The South African pseudosuchian reptile Euparkeria and allied genera. Besides giving an account of the very completely known South African form, the author also discussed the structure of the Elgin allied forms, Ornithosuchus and others. The group of pseudosuchians he regarded as an extremely important primitive reptilian order, as there is good reason to believe that not only does it contain the ancestor of the dinosaurs, but also the ancestors of the pterodactyles and birds. Euparkeria and Ornithosuchus are, in structure, almost dinosaurs, and it is held that when the bipedal habit was more fully acquired the few characters not quite dinosaurian would become dinosaurian. Birds are held to have originated from a pseudosuchian which, by a bipedal habit, had acquired a dinosaur-like hind limb, and had then become arboreal in habit and acquired the peculiar power of flight.—E. G. **Boulenger**: Experiments on the metamorphosis of the Mexican axolotl (*Amblystoma tigrinum*). A detailed description was given of the changes that take place in the course of transformation. The author also exhibited a number of specimens in the perfect or amblystome condition. The conclusions arrived at, as a result of

his experiments, were that, in accordance with Mlle. de Chauvin's experiments, and contrary to those of Dr. Powers, the axolotl will, with a few exceptions, transform if placed under special conditions which force it to breathe air more frequently than usual; that starvation, irregular feeding, and temperature have no influence on the metamorphosis; that the elimination of oxygen from the water has likewise no bearing on the point, as the animal will not, in the circumstances, rise to the surface and make use of its lungs at more frequent intervals than animals placed under normal conditions.—G. E. **Bullen**: Some cases of blindness in marine fishes. Work hitherto performed, *e.g.* that of Hofer, de Drouin de Bouville, and others, upon the pathology of fishes has been directed largely upon species of fresh-water habitat. The present author has found, in certain specific cases of blindness in marine fishes, pathological conditions similar to those described, and others with slight modifications, in several fresh-water species. The examples dealt with in detail are traumatic corneal opacitis in a conger-eel, corneal opacitis, &c., in a greater weaver, and corneal opacitis and cataract in a pollack. Dr. R. W. **Shufeldt**: The patella in the Phalacrocoracidæ. From a study of the patella in a number of species of this family, the author had found that in adult individuals that bone was composed of the true patella solidly fused with the proximal portion of the cnemial process of the tibiotarsus, which became dissociated from the latter early in the life of the bird. Late in life this fusion obliterated the tendon of the ambiens muscle, which heretofore had been described as passing through the patella and persisting through life.

Royal Meteorological Society, May 21.—Mr. C. J. P Cave, president, in the chair.—E. **Gold**: Determination of the radiation of the air from meteorological observations. The theory of the cooling of the air during the night hours was developed and applied to observations made near the earth's surface and 130 ft. above it, in order to obtain an estimate of the radiating power of the atmosphere. The results obtained show that even on calm, clear nights, when the air at the higher level is warmer than that near the surface, the cooling of the air is affected by convection, and the observations available do not suffice for the determination of the correction to the value of the radiating power necessary on this account.—S. C. **Russell**: Results of monthly and hourly cloud-form frequencies at Epsom, 1903–10. The author had made hourly records of the varieties of cloud observed each day throughout the eight years, and these he has grouped under fifteen forms of cloud. The total number of individual records approximates to 100,000. The cumulus cloud yielded the greatest number of daily values (1622), the stratus coming next (1155). The upper clouds, which include the cirrus, cirro-stratus, and cirro-macula, showed a marked prevalence during the summer with minima during the winter. Morning and evening maxima, with a mid-day decline, are common to all these varieties. The intermediate clouds, which include cirro-cumulus, alto-stratus, alto-cumulus, and cumulo-stratus, are also more prevalent in the summer than in the winter. The lower forms, which include strato-cumulus, nimbus, fracto-nimbus, fracto-cumulus, stratus, and fog, attain their maxima in the winter months, their minimum frequency being in the summer. The clouds of diurnal ascending currents, cumulus and cumulo-nimbus, are independent of any seasonal variation in hourly frequency, the maxima at noon and 3 p.m. respectively, taking place at these hours in every month of the year.

Geological Society, May 28.—Dr. Aubrey Strahan, president, in the chair.—P. G. H. **Boswell**: The age of the Suffolk valleys, with notes on the buried channels of drift. The main watershed of Suffolk follows generally the Chalk Escarpment. Suffolk forms a plateau, dissected by a valley-system which is palmate in form. The strata cut through by the valleys, and the mantle of glacial deposits which more or less covers the whole county, are described briefly. Reasons are given for thinking that the Contorted Drift does not extend far south of the Waveney. The valleys, although they may have been etched earlier, are on direct evidence post-Pliocene in age; but, by analogy with the Waveney and the Norfolk rivers, they may be younger than the Contorted Drift. The Upper Boulder Clay covers much of the plateau, and wraps down into the valleys. The Glacial Sands, &c., below it also appear at times to lie on the valley-slopes. Intense glacial disturbances are found to be situated always on "bluffs" or "spurs" of the plateau, which were in existence before the advent of the valley-glaciers to the action of which the disturbances have been attributed. In each of the main valleys occur one or more buried channels of drift; borings made recently allow these to be described in detail, and the deposits filling them to be discussed. These buried channels were probably eroded by sub-glacial water-streams. The evidence indicates that the pre-Glacial or early Glacial contours of Suffolk were in the main much as they are now.—D. E. **Innes**: The internal structure of Upper Silurian rugose corals from the Grindrod collection, Oxford Museum.

Physical Society, May 30.—Prof. A. Schuster, F.R.S., president, in the chair.—Prof. A. W. **Bickerton**: The origin of new stars. The author gave an account of a theory which he has held for many years. He points out that the energy developed by mutual fall of colliding suns is so great that shearing must ensue. Hence the problem of oblique impact of all suns is taken in two divisions—first, the actually colliding parts that are torn away and coalesce, and, secondly, the parts that escape the collision but are profoundly influenced by it. The impact of meteoric swarms, nebulæ, and sidereal systems may similarly be taken in two parts. The coalesced part is called the third body. The properties of this new body are best studied in the third star resulting from grazing suns. The third star is thermodynamically unstable, and selectively sorts its atoms into ensphering shells. It rotates, and has at its formation a special distribution of its elements. It will produce a new star. Its deduced properties correspond with the three criteria of thermodynamic intensity, complex light curve, and the physical peculiarities shown in each series of the spectrograms of novæ.—Dr. W. H. **Eccles**: Electro-thermal phenomena at the contact of two conductors with a theory of a class of radio-telegraph detectors. The paper deduces mathematically the laws connecting the current and the applied E.M.F. in a circuit containing a light contact of two conductors. When an electric current passes across a light contact of two different substances, heat is liberated or absorbed in accordance with the law of Peltier, heat is generated in accordance with the law of Joule, and, in the regions of the conductors where there is a temperature gradient, heat is liberated or absorbed in accordance with the laws of the Thomson effect. These thermal actions are very noticeable in contacts made of badly conducting natural oxides or sulphides on account of the high resistivity and the large thermoelectric effects in these substances. The low thermal conductivities of these substances exalt the electrical consequences by conserving the heat. The bulk of the wireless tele-

graphy of the world is carried on by such contacts as these, and the present paper, therefore, constitutes a theory of the action of these detectors.—J. **Walker**: The extraordinary ray resulting from the internal reflection of an extraordinary ray at the surface of a uniaxal crystal. By the principle of least time it is shown that the diameter of the extraordinary wave-surface described round the point of incidence, that is, conjugate to the reflecting surface, is coplanar with the incident and reflected extraordinary rays, and is the median of the triangle formed by these rays and a parallel to the reflecting surface. The direction-cosines of the reflected ray are then obtained in terms of those of the incident ray and the said diameter of the wave-surface.—S. **Butterworth**: The evaluation of certain combinations of the ber, bei, and allied functions.

NEW SOUTH WALES.

Linnean Society, March 26.—Mr. W. W. Froggatt, retiring president, in the chair.—*Annual General Meeting*.—Presidential address: "A Century of Australian Civilisation, from a Zoologist's Point of View." The address was devoted to a consideration of the great changes that have been wrought by the advent of the white man with his domestic animals, in the displacement of the aboriginal population and the original fauna, in the course of a hundred years' civilisation.—*Ordinary Monthly Meeting*.—Mr. W. S. Dun, president, in the chair.—A. H. S. **Lucas**: Notes on Australian marine algæ. No. 1.—H. J. **Carter**: Revision of the Australian species of the subfamilies Cyphaleinæ and Cnodaloninæ (family Tenebrionidæ).

April 30.—Mr. W. S. Dun, president, in the chair.—A. B. **Walkom**: Stratigraphical geology of the Permo-Carboniferous system in the Maitland-Branxton district, with some notes on the Permo-Carboniferous palæogeography in New South Wales. The vertical succession of the formations represented in the area under consideration—Lower Marine Series, Greta Coal Measures, and Upper Marine Series—has been worked out in some detail. Vertical sections of the Lower Marine Series were obtain in three localities, showing a thickness of nearly 4800 ft. In his important monograph on the geology of the Hunter River Coal Measures of New South Wales (1907), Prof. David mapped the outcrop of this series and gave numerous detailed sections of the coal seams developed at many points along the outcrop; but, at this time, very little was known about the development between Branxton and Pokolbin. Additional data now available show that in four localities, as elsewhere, the main Greta seam is split, and that the upper split has been struck in each case; the lower split seems to be entire at Rothbury, but splits again further north.—A. B. **Walkom**: The geology of the Permo-Carboniferous system in the Glendonbrook district, near Singleton. The Glendonbrook district lies from five to fifteen miles E. by N. from Singleton. Permo-Carboniferous rocks are developed there in a small isolated basin. They consist chiefly of sandstones, conglomerates, and shales belonging to the Lower Marine Series, Greta Coal Measures, and Upper Marine Series. The whole basin is only some three miles in diameter, and is surrounded by rocks of Carboniferous age. Further to the west, nearer Singleton, owing to heavy faulting, rocks belonging to the Upper Coal Measures and Upper Marine Series also appear. All these rocks are described more or less in detail, and their relations to one another discussed. A coal seam about 10 ft. thick occurs in the Greta Coal Measures in the basin mentioned above.—A. B. **Walkom**: Notes on some recently discovered occurrences of the pseudomorph, glendonite. Glendonite, a pseudomorph after glauberite, has been recorded from seven horizons in New South Wales and Tasmania, all, however, in the Upper Marine Series. In this paper, the occurrence of the mineral in rocks of the Lower Marine Series is recorded for the first time, with details of a comparison of crystals from both series.

BOOKS RECEIVED.

"J." A Memoir of John Willis Clark. By A. E. Shipley. Pp. xi+362. (London: Smith, Elder and Co.) 10*s*. 6*d*. net.

The Essence of Buddhism. By P. L. Narasu. Second edition. Pp. xx+359. (Madras: S. Varadachari and Co.)

The Posture of School Children. By J. H. Bancroft. Pp. xii+327. (London: Macmillan and Co., Ltd.) 6*s*. 6*d*. net.

Jesus Christus und sein Stern. By A. Stentzel. Pp. vi+240+16 plates. (Hamburg: Astronomischen Korrespondenz.) 6 marks.

Schriften der Naturforschenden Gesellschaft in Danzig. Neue Folge. Dreizehnten Bandes. Zweites Heft. Pp. 1+167. (Danzig.)

34 Bericht des Westpreussischen Botanisch-Zoologischen Vereins. Pp. 20+268. (Danzig.)

Le Système du Monde des Chaldéens à Newton. By J. Sageret. Pp. 280. (Paris: F. Alcan.) 3.50 francs.

Determinative Mineralogy, with Tables. By Prof. J. V. Lewis. Pp. iv+151. (New York: J. Wiley and Sons; London: Chapman and Hall, Ltd.) 6*s*. 6*d*. net.

The Textile Fibres. By Dr. J. M. Matthews. Third edition. Pp. xi+630. (New York: J. Wiley and Sons; London: Chapman and Hall, Ltd.) 17*s*. net.

A Monograph on Johne's Disease (Enteritis Chronica Pseudotuberculosa Bovis). By F. W. Twort and G. L. Y. Ingram. Pp. ix+179+9 plates. (London: Baillière, Tindall and Cox.) 6*s*. net.

Cambridge County Geographies. Lincolnshire. By Dr. E. M. Sympson. Pp. viii+193+2 maps. (London: Cambridge University Press.) 1*s*. 6*d*.

The Control of Water, as Applied to Irrigation, Power, and Town Water Supply Purposes. By P. A. M. Parker. Pp. vii+1055. (London: G. Routledge and Sons, Ltd.) 21*s*. net.

Pflanzenmikrochemie. By Dr. O. Tunmann. Pp. xx+631. (Berlin: Gebrüder Borntraeger.) 18.50 marks.

Grundzüge der geologischen Formations- und Gebirgskunde. By Prof. A. Tornquist. Pp. iv+296. (Berlin: Gebrüder Borntraeger.) 6.80 marks.

The Venom of Heloderma. By L. Loeb, with the collaboration of C. L. Alsberg, E. Cooke, E. P. Corson-White, and others. Pp. vi+244. (Washington, D.C.: Carnegie Institution.)

The Food of Some British Wild Birds. By W. E. Collinge. Pp. vii+109. (London: Dulau and Co., Ltd.)

Human Behavior. By Profs. S. S. Colvin and W. C. Bagley. Pp. xvi+336. (London: Macmillan and Co., Ltd.) 4*s*. 6*d*. net.

The Science of the Sciences. By H. Jamyn Brooks. Pp. 312+ix. (London: D. Nutt.) 3*s*. 6*d*. net.

Maps and Survey. By A. R. Hinks. Pp. xvi+206+xxiv plates. (London: Cambridge University Press.) 6*s*. net.

Hampstead Heath: its Geology and Natural History. Prepared under the auspices of the Hampstead Scientific Society. Pp. 328+xi plates+3 maps. (London: T. Fisher Unwin.) 10*s*. 6*d*. net.

Memoirs of the Geological Survey. England and Wales. The Concealed Coalfield of Yorkshire and Nottinghamshire. By Dr. W. Gibson. Pp. vi+122+iii plates. (London: H.M.S.O.; E. Stanford, Ltd.) 1s. 6d.

Annual Report of the Council of the City and Guilds of London Institute. Pp. xlix+125. (London: Leonard Street, E.C.)

Weights and Measures Act, 1904. Board of Trade Notices Annotated. By H. Cunliffe and G. A. Owen. Vol. i. Pp. viii+199+vii plates. (Smethwick: H. Cunliffe.) 5s. net.

A Bibliography of the Tunicata, 1469–1910. By J. Hopkinson. Pp. xii+288. (London: The Ray Society; Dulau and Co., Ltd.) 15s. net.

Tanners' Year Book, 1913. Pp. 178. (London: The Technica Publishing Company.)

Hausa Folk-Lore, Customs, Proverbs, &c. Collected and Transliterated with English Translation and Notes. By R. S. Rattray. 2 vols. Vol i., pp. xxiv+327. Vol ii., pp. 315+iii plates. (Oxford: Clarendon Press.) 2 vols., 30s. net.

Handbuch der Pharmakognosie. By A. Tschirch. Lief. 31–34. (Leipzig: C. H. Tauchnitz.)

Metallographie. By Dr. W. Guertler. Erster Band, Die Konstitution. Heft 7–12. (Berlin: Gebrüder Borntraeger.)

Yorkshire Type Ammonites. Edited by S. S. Buckman. Part ix. (London: W. Wesley and Son.)

Outlines of Stationery Testing. By H. A. Bromley. Pp. 74. (London: C. Griffin and Co., Ltd.) 2s. 6d. net.

The Earth: its Genesis and Evolution. By A. T. Swaine. Pp. xviii+277+xii plates. (London: C. Griffin and Co., Ltd.) 7s. 6d. net.

Electricity in Mining. By Siemens Brothers Dynamo Works, Ltd. Pp. xiv+201. (London: C. Griffin and Co., Ltd.) 10s. 6d. net.

Einführung in die Spektrochemie. By Prof. G. Urbain. Pp. viii+213+9 plates. (Dresden and Leipzig: T. Steinkopff.) 9 marks.

The Oxford Geographies:—A Commercial Geography of the World. By O. J. R. Howarth. Pp. 236. (Oxford: Clarendon Press.) 2s. 6d.

DIARY OF SOCIETIES.

THURSDAY, JUNE 12.

ROYAL SOCIETY, at 4.30.—Recent Researches on the Palatine in Relation to Geology, Ethnology, and Physics: Commendatore Boni.—The Growth and Sporulation of the Benign and Malignant Tertian Malarial Parasites in the Culture Tube and in the Human Host: J. G. Thomson and D. Thomson.

MATHEMATICAL SOCIETY, at 5.30.—The Electromagnetic Force on a Moving Charge in Relation to the Energy of the Field: Sir J. Larmor.—Einige Ungleichungen für zweimal differentiierbare Funktionen: Prof. E. Landau.—(1) The Fractional Part of $nk\theta$; (2) The Trigonometrical Series Associated with the Elliptic θ-functions: G. H. Hardy and J. E. Littlewood.—A Proof that every Equation of Degree n has n Roots Real or Imaginary: W. N. Roseveare.—The Evaluation of a Certain Definite Integral: J. Hammond.—Foucault's Pendulum: Dr. T. J. I'A. Bromwich.

FRIDAY, JUNE 13.

ROYAL ASTRONOMICAL SOCIETY, at 5.—Note on Variable Stars of Cluster Type: H. C. Plummer.—The Determination of Maxima and Minima of Variable Stars of Long Period: M. E. J. Gheury.—A Photographic Determination of the Proper Motion of 250 Stars in the Neighbourhood of Σ 443: A. A. Rambaut.—The Planet Jupiter in 1890: A. Stanley Williams.—The Origin of Solar Electricity: J. A. Harker.—Note on a Method of Balancing Dome Shutters: W. H. Maw.—Devices for Subtabulation: T. C. Hudson.—Some Spectrographic Measures of the Solar Rotation at the Kodaikánal Observatory: J. Evershed and T. Royds.—Preliminary Results of Observations made with the Cookson Floating Zenith Telescope: A. S. Eddington.—*Probable Papers:* The Spectrum of Nova Geminorum No. 2, 1912, April, and 1913, February–April: Rev. A. L. Cortie.—The Position of the Sun's Axis as Determined from Photographs of the Sun from 1874 to 1912: F. W. Dyson.

MALACOLOGICAL SOCIETY, at 8.—Note on the Genus Pseudomalaxis, Fischer, and Descriptions of a New Species and a New Subgenus: Marqués de Monterosato.—Note on the Freshwater Mollusca found with *Unio Auriculatus*, Spengl, at Barn Elms, Surrey: A. S. Kennard and B. B. Woodward.—The Land Mollusca of the Kermadec Islands: Tom Iredale.—Definitions of Further New Genera of Zonitidæ: G. K. Gude.

PHYSICAL SOCIETY, at 8.—Some Experiments on Tinfoil Contact with Dielectrics: G. E. Bairsto.—A Method of Measuring the Pressure of Light by Means of Metal Foil: G. D. West.

MONDAY, JUNE 16.

VICTORIA INSTITUTE, at 4.30.—From Suez to Sinai: A. W. Sutton.

TUESDAY, JUNE 17.

MINERALOGICAL SOCIETY, at 5.30.—The Crystal-habit of Topaz from New Brunswick, Canada: H. V. Ellsworth.—(1) The Meteoric Stone of Baroti, Punjab; (2) Mineralogical Notes: Dr. G. T. Prior.—Photographs illustrating Crystal-structure as Revealed by Röntgen Radiation: W. L. Bragg.

ROYAL STATISTICAL SOCIETY, at 5.—The Trade of the British Empire: Simon Rosenbaum.

WEDNESDAY, JUNE 18.

ROYAL MICROSCOPICAL SOCIETY, at 8.—(1) The Measurement of Working Aperture; (2) A Method of Investigating Diatom Structure: Hamilton Hartridge.—The Higher Bacteria (Sphaerotilus): E. Moore Mumford.—The Structure of the Nucleus: E. J. Sheppard.

ROYAL METEOROLOGICAL SOCIETY, at 4.30.—Pilot Balloon Observations in Barbados, 1910–1912: J. S. Dines.—The Harmattan Wind of the Guinea Coast: H. W. Braby.—The Correlation of Rainfall: J. Peek and Dr. E. C. Snow.

THURSDAY, JUNE 19.

ROYAL SOCIETY, at 4.30.—*Probable Papers:* Atomic Specific Heats between the Boiling Points of Liquid Nitrogen and Hydrogen. I. The Mean Atomic Specific Heats at 50° Absolute of the Elements a Periodic Function of the Atomic Weights: Sir James Dewar.—An Active Modification of Nitrogen produced by the Electric Discharge. V.: Hon. R. J. Strutt.—The Electrical Emissivity and Disintegration of Hot Metals: Dr. J. A. Harker and Dr. G. W. C. Kaye.—A Method of Measuring the Viscosity of the Vapours of Volatile Liquids, with an Application to Bromine: Dr. A. O. Rankine.—The Efficiency of Selenium as a Detector of Light: E. E. Fournier d'Albe.—Synthesis of the Anhydrides of α Aminoacyl Glucosamines: A. Hopwood and C. Weizmann.—The Flexure of Telescope Mirror-discs arising from their Weight, and its Influence upon Resolving Power: H. S. Jones.—(1) A Condition that a Trigonometrical Series should have a certain Form; (2) Trigonometrical Series the Cesaro Partial Summations of which Oscillate Finitely: Prof. W. H. Young.

LINNEAN SOCIETY, at 8.—Impressions of the Feeding-tracks of *Limax maximus* and *Helix aspersa*: Mrs. Longstaff.—African Species of the Genus Crotalaria: E. G. Baker.—Aphareocaris, nom. nov. (Aphareus, Paulson), a Genus of the Crustacean Family Sergestidæ: Dr. W. T. Calman.—Water-colour Drawings of Australian and South African Plants: Miss Fuller.—An Anatomical Study of the Cone-genus Lepidostrobus: Dr. Agnes Arber.—Fresh-water Rhizopoda from North and South America: G. H. Wailes.—A Revision of the Genus Symphytum, Tourn.: Cedric Bucknall.—Some New British Plants: Dr. C. E. Moss.

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