THURSDAY, JUNE 25, 1914.

MATHEMATICS AND CIVILISATION.

Die Kultur der Gegenwart. Edited by P. Hinneberg. *Die Mathematischen Wissenschaften,* unter Leitung von F. Klein. Part iii., section i. Fascicles i., ii. (i. H. G. Zeuthen: *Die Mathematik im Alterthum u. im Mittelalter*; ii., A. Voss: *Die Beziehungen d. Mathematik zur Kultur d. Gegenwart,* and H. E. Timerding: *Die Verbreitung mathematischen Wissens u. math. Auffassung.* Berlin and Leipzig: B. G. Teubner, 1912–14.) Price 3 marks each.

THESE three monographs are agreeably different, as well as complementary; and even where they overlap, the variety of treatment is interesting. The first section is the most detailed and (comparatively) technical; its author, as might be expected, gives an excellent and well-balanced account of Greek and medieval European mathematics. Something more might have been said about the earlier Indian inventions; only a very brief paragraph is devoted to China, and apparently nothing is said about Japan.

Mr. Voss's article is extremely interesting and well-arranged. He shows how mathematics have influenced, and been influenced by, technical crafts, physical theories, and philosophy; and he has the courage to make high, but legitimate, claims for a science which seems to be as unpopular in Germany as it is with us. He points out that mathematics is pre-eminently a creation of the spirit of man; that it is his least restricted field of activity; and that we are under a moral obligation to cultivate it. It is very refreshing to find these truths stated with such decision and clearness; and no one who is convinced of them should neglect a seasonable opportunity of repeating them. The popular attitude towards mathematics is exceptionally unfair. The ordinary man does not despise a physician, or a judge, or a divine, because he himself is ignorant of medicine, or law, or theology; but it is very rarely that he regards mathematics as anything more than a set of rules for calculation, or mathematicians more than computers at best, and at worst harmless cranks who waste their time on puzzles, quite useless to the practical man. The most exasperating folk of all are those who have to use mathematical formulæ for technical purposes, and adopt towards the science which serves them, while they do not understand it, a sort of silly, patronising attitude, such as that of a good-natured merchant to one of his junior clerks.

To put the main argument in a form which may appeal to a man of common sense, we affirm, without fear of refutation, that the history of culture is a history of intellectual development, in which the main feature is a change of habits of thought; instead of vague fancies, irrational dogmas, crude superstitions, we are gradually acquiring clear concepts, consistent theories, and some sort of ethics worthy of the name. Towards this wholesome change nothing whatever has contributed so much as the study of pure mathematics; its inclusion, for instance, in a school curriculum is amply justified by its power of exposing intellectual dishonesty—what Smith minor calls "fudge"—to the practice of which we are all more inclined than we should like to admit.

To take an illustration of what we mean. In the second Book of Samuel (ch. xxiv.) it is stated that David's sin in numbering his people was punished by a heaven-sent pestilence which killed 70,000 men. Christians having adopted the Jewish Canon as an inspired document, the prejudice created by this story was so great that no Christian census was taken before 1700 A.D.; and no trustworthy census dates before the first year of the nineteenth century. Even now there are people who resent the census, and by making false entries do their best to make it untrustworthy; but there must be few who really think an act of simple enumeration sinful, and a good many who understand the value of the census for insurance purposes, at any rate.

The interest of Mr. Timerding's essay is of a more pedagogic kind. Among other interesting things we may note the references to Jacobi, his mode of teaching, and views about intuition (pp. 128–30); "blackboard physics" (p. 137); and especially the account of recent changes in mathematical teaching in Germany. Near the end of the article the author makes a statement which (with due reservations) we are inclined to challenge. He maintains that in technical schools (*fachliche Schulen*) the aim of mathematical teaching is "entirely different" from what it is in the general schools; adding, in effect, that the attention of technical students should not be diverted from such applications of mathematics as they are likely to have to make. We believe, on the contrary (and not without experience), that technical students (such as engineers, or accountants, or draughtsmen), can be interested, rather more easily than ordinary students, in the principles of mathematics, by taking them in the right way. This, we believe, is by beginning with definite numerical examples of the kind they will meet with in their profession, and then proceeding, by an inductive method, to the general formulæ and theories which solve all such problems. In this way, an engineer becomes interested in electricity,

or thermodynamics, as the case may be, an accountant in the theory of errors, a draughtsman in projective geometry. By adopting the opposite course a very great risk is run; that of stifling the speculative instinct of a really gifted pupil. Suppose Hertz or Heaviside or Helmholtz had been debarred from all but "technical" sources of information! No doubt the teacher will occasionally talk over the heads of half his class; but if he does not do this too often no great harm is done. And the chance of securing for humanity a real thinker is such a glorious one that nobody who understands the meaning of such a success will hesitate for a moment in advancing so far as he can, and so far as he dare, from the vulgarity of technique to the culture of theory. G. B. M.

PSYCHOLOGY AND CHILD HYGIENE.

(1) *Human Behaviour: a First Book in Psychology for Teachers.* By Prof. S. S. Colvin and Prof. W. C. Bagley. Pp. xvi+336. (New York: The Macmillan Company; London: Macmillan and Co., Ltd., 1913.) Price 4*s.* 6*d.* net.

(2) *Inductive versus Deductive Methods of Teaching: an Experimental Research.* By W. H. Winch. Pp. 146. (Baltimore, U.S.A.: Warwick and York, Inc., 1913.) Price 1.25 dollars.

(3) *How I Kept My Baby Well.* By Anna G. Noyes. Pp. 193. (Baltimore, U.S.A.: Warwick and York, Inc., 1913.) Price 1.25 dollars.

(4) *Minds in Distress.* By Dr A. E. Bridger. Pp. xi+181. (London: Methuen and Co., Ltd., 1913.) Price 2*s.* 6*d.* net.

(1) IN their text-book on "Human Behaviour," Prof. Colvin and Prof. Bagley have endeavoured to formulate the main principles of psychology in terms of conduct. For the immature and inexperienced teacher they believe that a "functional" viewpoint is the more helpful. The topics they have selected are those most closely related to the practical work of the schoolroom. Memory, habit, instinct, feeling, emotion, attention, economical learning, higher thought-processes—these are discussed far more fully than is usual in teachers' text-books. The treatment is throughout concrete. Each principle is formulated with a lucidity that is almost dangerous; and enforced with a wealth of illustration that is almost too convincing—drawn as it is from classroom practice or from everyday life more often than from the psychological or educational laboratory. Experimental work is by no means ignored. But detailed references to it are rare in the text and rarer in the bibliography. The "immature and inexperienced teacher" might easily gain the impression that a few simple and uncontrolled observations, followed by many clear and plausible inferences, are the surest guide to final generalisations upon the most complex problems of human and animal behaviour. Of its class, however, this book is undoubtedly one of the best.

(2) Mr. Winch's book upon "Inductive versus Deductive Methods," is the second he has contributed to Professor Whipple's admirable series of Educational Psychology Monographs. It is a record of a series of experiments, carried out in five London schools, to test the relative value of the two methods in teaching. When tested upon new material, it was found that in all the schools the children taught inductively did better than those taught deductively. When tested upon the old material that formed the medium of what they had been taught, the children did differently in different cases. In three of the schools they did better when working by the "deductive and memoriter" method. In other cases, especially where the children were older, the inductive method proved equally successful; and there were indications that, when the test was applied after a long interval, it was even more successful. The subject-matter of the investigation was geometrical definition; and although laboratory and introspective controls were perhaps of necessity omitted, in other respects the work may well serve as a model for further investigations dealing with other subjects of the school curriculum.

(3) Like the Journal that he edits, Prof. Whipple's series of monographs proposes to include problems of child hygiene as well as child psychology. Mrs. Noyes' contribution is the story of how she kept her baby well during the first two years of its life. As a record of physical health during this period, and as a statement of the means used to maintain it, her work is more complete than any that has yet been published. Once more we are presented with an excellent model for future observations. With a number of records as thorough as this, we should at last have a sound basis for a scientific description of the physical development of young children.

(4) Dr. Bridger's treatment of his subject is of a different character. In his book "Minds in Distress" he maintains that the origin of functional nervous diseases depends upon two fundamental principles: first, "that mental comfort depends upon a state of balance between two main factors," namely, "common sense" and "new impressions"; secondly, "that there are the 'masculine' and the 'feminine' types." Loss of balance in the "masculine" type results in such disorders as neurasthenia; loss of balance in the "feminine" type, in such disorders as hysteria. In a chapter on "Mental Formulæ" he gives, in quantitative

and tabular form, the composition of the mind in the various cases. Thus, in the "normal average masculine type of mind" we learn that 30 per cent. of the mental energy is distributed to "ideas relating to self," 15 per cent. to "ideas relating to others," and so on; in the "normal average feminine type of mind" the percentages are 20 and 5 respectively. His "elementary formulæ" Dr. Bridger admits are somewhat inexact. But his two fundamental propositions he believes to be "principles that are of universal acceptance, free of speculative theory, and reducible to the simplest terms." His proof throughout is "an appeal. . . to the common experience of humanity." The generalisations of James, Titchener and Wundt he dismisses on the first page as too metaphysical; and, for the rest, he does not refer to well-known writers on the subject, because, as he rightly says, "they all approach it from an entirely different point of view." CYRIL BURT.

RECENT BOTANICAL WORKS.

(1) *Paléontologie végétale. Cryptogames cellulaires et Cryptogames vasculaires.* By Dr. F. Pelourde. Pp. xxviii + 360. (Paris: O. Doin et Fils, 1914.) Price 5 francs.

(2) *Die Oekologie der Pflanzen.* By Dr. Oscar Drude. Pp. x + 308. (Braunschweig: F. Vieweg and Son, 1913.) Price 10 marks.

(3) *The Diseases of Tropical Plants.* By Prof. M. T. Cook. Pp. xi + 317. (London: Macmillan and Co., Ltd., 1913.) Price 8*s.* 6*d.* net.

(4) *Icones Orchidearum Austro-Africanarum Extra-Tropicarum; or, Figures, with Descriptions of Extra-Tropical South African Orchids* By Harry Bolus. Vol. iii. 100 plates. (London: W. Wesley and Son, 1913.) Price 30*s.* net.

(5) *Index Kewensis. Plantarum Phanerogamarum. Supplementum Quartum.* (1906–1910.) Ductu et Consilio D. Prain. Pp. 252. (Oxford: Clarendon Press, 1913.) Price 36*s.* net.

(1) DR. FERNAND PELOURDE, préparateur at the National Museum of Natural History, is publishing, under the auspices of the Encyclopédie Scientifique, an account of palæobotany in accordance with present knowledge. In this, the first volume, he deals with cellular and vascular cryptogams; in two subsequent volumes he will deal with gymnosperms and angiosperms, and will also formulate general conclusions from botanical and geological points of view. M. R. Zeiller, to whom the volume is dedicated, has written the preface. The text comprises a short introduction on the methods of preservation of fossil plants and a classified list of geological strata. The great plant-groups are then studied in order beginning with bacteriaceæ, including reference to their work in formation of coal. The chapter on the cellular cryptogams occupies only twenty-two pages, but the reader is referred to numerous papers dealing especially with fossil algæ. The groups of vascular cryptogams are considered in the following order: equisetales, sphenophyllales, lycopodiales, filicales. The little volume, which presupposes some knowledge of general botany, especially anatomy, gives a somewhat condensed review of the subject, but will enable the student of botany to form an idea of the present position of our knowledge of the groups considered so far as concerns extinct forms. A useful feature is the bibliography which follows the subject matter.

(2) Dr. Oscar Drude's handbook on the ecology of plants forms one of the "Die Wissenschaft" series of volumes on natural science and technique. In 1904 Dr. Drude was invited to lecture before the International Science Congress at St. Louis on the development and position in modern science of botanical ecology and the present volume is an outcome of the work done in that connection. The subject is considered under four headings. Section I. is entitled "Die physiognomischen Lebensformen der Pflanzen." The author first gives a historical review of the attempts to classify plants according to their "physiognomic"—a term originated by Humboldt—relations, that is to say, their general structure and manner of growth as determined by the external conditions to which they are subjected. After discussing the principles underlying such a system, he proposes a system of classification of plants based on their habit. Vascular plants are arranged in two great groups: I. Aerophytes, and II. Hydrophiles and Hydrophytes. The former includes thirty-eight classes, beginning with (1) monocotyledonous "Schopfbäume"—the palm, pandanus, and xanthorrhœa type, embodying a pillar-like stem bearing a crown of leaves followed by (2) palm-bush type and palm lianes, (3) short-stemmed dwarf palms, (4) tree-ferns and cycads, (5) conifer-type, followed by the various types of dicotyledonous woody plants, climbers, epiphytes, perennial and short-lived herbaceous types, etc., concluding with saprophytes and parasites. Waterplants include six classes and cellular plants twelve.

Section II., entitled climatic influences, periodicity, and leaf-character, deals with nutrition as a function of the leaf, and periodicity in plant-life as an adaptation to climatic phases. Section III., "Physiographic Ecology," discusses briefly various factors which determine the formation of

plant-communities and associations, with a classification of types of vegetation as ultimate physiographical units. Section IV., "Ecological epharmosis and phylogeny," includes a brief discussion of the relation or absence of relation between plant-habitat and natural relationships, eurychory and stenochory, the behaviour of nearly-allied species in the fight for space, and similar questions, with finally a short discussion on mutation of species and evolution. Explanatory notes and a bibliography are appended to the first section, and also in the form of a general appendix at the end of the book, and the eighty block illustrations form a helpful addition to the text-matter.

(3) The purpose of Dr. Cook's work is to direct attention to some of the most common and most destructive diseases of tropical plants; to give as practical a knowledge as possible of plant diseases in general and their causes; and to give the most common remedies and methods of prevention. Since the eastern and western tropics have each their own peculiar problems, the writer notes that his own experiences have been restricted entirely to the American tropics. The first chapter deals with the nature and symptoms of diseases; the second contains a very brief account of the general structure of a seed-plant, and of fungi as sources of disease, and their modes of reproduction. Chapter III. is a classified account of the fungi which cause plant disease; in chapter iv. other causes of plant diseases are briefly considered, whether due to plant- or animal-organisms or physical environment. These chapters are brief and admittedly very general. The most important part of the book is a description of the diseases which attack the various plants cultivated in the tropics, with suggestions for prevention or cure. The book closes with two short general chapters on prevention and control of disease and fungicides and spraying apparatus, followed by a useful classified bibliography.

(4) The third volume of the late Dr. Bolus's figures and descriptions of South African orchids has the appearance of a posthumous work. The nature of the authorship is explained in the preface by Mrs. H. M. L. Bolus who, as Miss Kensit, was intimately associated with Dr. Bolus in his botanical work; but for bibliographical purposes her share in the work might appropriately have been indicated on the title-page. The volume represents the fulfilment in part of a trust bequeathed by the author of the previous volumes. Of the hundred plates, thirty-six have already appeared in the "Orchids of the Cape Peninsula," now out of print, nine have been drawn by Mr. F. Bolus, and the remaining fifty-five are from finished or incomplete drawings by Dr. Bolus; in the latter case, additions having been made by his son, Mr. F. Bolus. The form of the book is uniform with that of previous volumes; the descriptions are in both Latin and English, and the plates include full and clear analyses of the flowers with careful indications of the colour of the parts. The announcement that Mr. and Mrs. Bolus propose to proceed with the illustration of African orchids is a most welcome one.

(5) It is not extravagant praise to say that no botanical publication is more eagerly expected, or more keenly welcomed on its appearance, than the five-yearly supplement of the *Index Kewensis*. The working systematist has now ready to hand a record of the names of the genera and species of flowering plants from the initiation of the binominal system in 1753 to the end of 1910, a record which only those who remember the time when there was no Kew Index can fully appreciate. The present supplement marks a great improvement on the earlier-issued portions of the work in that the date of publication has been added to the citations. We note also a considerable number of references to species which have previously been overlooked. New combinations as distinguished from newly described species are indicated by reference to the earlier name. Further, the names indexed are all in the same type; presumed synonyms are not printed in italics: the book admirably fulfils its obligations as an index, but botanical discrimination is properly left to the worker. In view of the periodical appearance of supplements the question naturally arises as to the intercalation of the supplements with the original work; a question which must, without doubt, have occurred to those responsible for the compilation. But it is also matter for consideration whether the onus of such a work and its continuation indefinitely—a work of such supreme importance to the whole botanical world—should be the unaided task of the Director of Kew and his willing staff. A. B. R.

OUR BOOKSHELF.

The Childhood of the World. A Simple Account of Man's Origin and Early History. By E. Clodd. New edition, re-written and enlarged. Pp. xiii + 240. (New York: The Macmillan Co.; London: Macmillan and Co., Ltd., 1914.) Price 4*s.* 6*d.* net.

A BOOK which has maintained a large and uninterrupted circulation for forty-one years, which has been printed in Braille character for the use of the blind, and translated into Dutch, French, German, Italian, Sekwana, and Swedish, well deserves the honour of a revised edition.

It falls into three parts: "Man the Worker," a record of the origin and life of early man; "Man

the Thinker," describing the evolution of his religious belief; "Man the Discoverer and Inventor," treating of the progress of science. The treatment is essentially popular, and the wide knowledge of the writer, his pleasant style, and his skill in weaving into the narrative a store of interesting allusion and anecdote, render it an admirable introduction to the study of anthropology in its varied aspects. A series of well-selected illustrations, including the recently discovered frescoes in the French caves, with a useful bibliography, adds to its interest and value.

The present revision of the book is, on the whole, satisfactory. Detailed discussion of the complex problems of the past and future of man cannot be expected in a manual. But when mention is made of "the most ape-like" Piltdown skull, we might have anticipated at least a reference to the discoveries at Galley Hill and Ipswich. Some of the derivations, like those of "ship" and "gold" might be improved from Sir J. Murray's Dictionary. If he supposes that the modern Naga tribe in India are, like their forerunners of the same name, serpent worshippers, he is mistaken; and the taboo on the use of dry wood as fuel does not extend to the people of Berar, but to a single sacred grove. A curious press error gives the name of the Hindu sun-god Surya as "Sueya."

On the whole, this veteran anthropologist is to be congratulated on a book which, in its revised form, is certain to secure a new lease of popularity.

The School and College Atlas. One hundred and three maps, physical, political and commercial. Index. (London: G. W. Bacon and Co., Ltd., n.d.) Price 3*s.* 6*d.* net.

THIS Atlas is curiously unequal, for it contains a mixture of old style and new style maps; some maps are overcrowded with names, others are of striking simplicity. The summary maps dealing with temperatures are in some cases much too complicated. The colour-printed maps, showing relief on the layer system, indicate by the defective fit of the contours how difficult such cartographic work really is. For an atlas of this size the index is much too small.

The vegetation, annual and seasonal rainfall maps should prove of value, and the isotherms for the British Isles are based on actual temperatures and embody the latest official figures of the Meteorological Office. B. C. W.

The British Revolution. By Dr. R. A. P. Hill. Pp. xii+116. (Cambridge: University Press, 1914.) Price 2*s.* net.

THE most striking feature of most political discussions is, Dr. Hill considers, an entire lack of first principles, and he proceeds to enunciate a "synthetic" principle," which he claims stands alone in uniting individualism and socialism, home rule and imperialism, actuality and the ideal, and many other opposed views. He also remarks that one of his objects is to supplant Herbert Spencer's synthetic philosophy, or rather to supplement it by the principles of the German school.

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.*]

Dynamical Units for Meteorology.

IN the current number of the Quarterly Journal of the Royal Meteorological Society I have put forward a proposal for a name for a unit of acceleration, and shown how the introduction of such a unit leads up to the unit of potential which is required in the discussion of certain problems in aerodynamics. It has been suggested to me that as the proposal does not concern meteorologists alone it should be canvassed in a journal which is read by other physicists. I have written the following notes in the hope that you will be able to find room for them in NATURE.

The convenience of special names for such units as the *radian,* the *erg,* and the *volt,* is universally admitted. No apology is therefore needed for bringing forward a proposal for the adoption of a special name for a unit of acceleration. The particular unit for which a name is, I think, required is one decametre per second per second. This unit is slightly greater than the acceleration due to gravity at any point on the earth's surface, but so slightly that there is no difficulty in getting a clear conception of it. In this way it compares favourably with such units as one centimetre per second per second, or one foot per second per second. In accordance with the custom of honouring the pioneers of science by attaching their names to the units which occur in the branches which they discovered, it would be natural to name the unit of acceleration after Galileo. Unfortunately so long a name could not be used in forming compound names; I propose, however, to preserve the association of ideas by calling the unit a "leo." Accordingly I define the *leo* as the acceleration one decametre per second per second.

The acceleration of a falling body due to gravity and the earth's rotation is less than one leo by about 2 per cent.; the magnitude of the acceleration for various latitudes is shown in terms of the leo in the following table:—

Acceleration	at the equator	0·9780 leo.
,,	in latitude 45°	0·9806 leo.
,,	at London	0·9812 leo.
,,	at the poles	0·9832 leo.

Smaller accelerations may be expressed in terms of the same unit or in terms of smaller derived units; thus a vehicle which attains a velocity of 10 metres per second in 10 seconds from rest has an average acceleration 0·1 leo or 1 decileo. The unit of the c.g.s. system, 1 cm./sec.^{2} is, of course, identical with the millileo.

Turning to units of *force,* we find it natural to call the force which gives an acceleration of one leo to the mass one gram, a *leogram.* The leogram is identical with the kilodyne, but the new name makes the unit easier to realise, as it is seen to be slightly greater than the weight of one gram. In the same way the names, leokilogram and leoton, speak for themselves much better than megadyne and kilomegadyne.

For *pressure,* units with simple names, the bar and its sub-multiples exist already, but it is not very easy for meteorologists who have not devoted much attention to theoretical dynamics to realise the meaning of the standard definition 1 bar=1 megadyne per sq. cm. Perhaps the phrase 1 leokilogram per sq. cm. will be found easier to grasp. The millibar, which

is the most convenient unit for stating barometric pressures, is 1 leogram per sq. cm. The c.g.s. unit of pressure is the microbar, which is equal to 1 leo-milligram per sq. cm.

Prof. McAdie, in the issue of NATURE of March 19, 1914, referred to the use by chemists of the word bar as a name for this c.g.s. unit of pressure. The bar of the chemist is the millionth part of the unit, mentioned in the last paragraph, which has been taken into use by Bjerknes and other meteorologists under that name. I do not wish to discuss here the merits of the question raised by Prof. McAdie. It is perhaps a matter for some international assembly attended by representatives of both chemistry and meteorology.

Coming now to units of work, we see that there is no difficulty in defining the leogrammetre as the work done by a leogram when its point of application moves through a metre. Names of this sort can be used in explaining the terms which are in use already for quantities of energy. Thus the leomilligramcentimetre is identical with the erg, the c.g.s. unit. The theoretical unit of electric energy, the joule, is 1 leo-kilogramdecimetre, whilst the commercial, or "Board of Trade" unit, defined as 1 kilowatthour, is 3600×1000 joules, or 360 leotonmetres.

Finally, we have to consider units of gravitational potential. The usual definition of potential is potential energy per unit of mass. The change of potential of 1 gram moved through one metre against a field of force sufficient to produce in it an acceleration one leo is one leogrammetre per gram, or briefly, one leometre. The difference in potential between two horizontal surfaces a metre apart depends on the latitude; it is 0·9780 leometre at the equator, and 0·9832 leometre at the poles.

The name leometre is proposed as an alternative to Prof. Bjerknes's "dynamic metre"; accordingly, it may not be out of place to conclude this letter by quoting the professor's note from the Quarterly Journal of the Royal Meteorological Society:—

"Names may be attacked from many points of view, and, even if left in peace during six years, they may be attacked in the seventh. Therefore a change in terminology contains a great risk. Still, I am willing to take the risk, if some guarantee can be obtained securing the prospects of the new terminology. I therefore take this opportunity to request everyone intending to attack the 'leometre' not to postpone the attack, but to execute it at once."

F. J. W. WHIPPLE.

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Aristotle's Physics.

THE review of Prof. Duhem's new book, "Le Système du Monde," over the initials, J. L. E. D., in NATURE of May 28, contains what purports to be a correct and intelligible summary of Aristotle's dynamics. It begins with the surprising words, "In his dynamics the idea of mass does not enter," and speaks loosely of motion as though Aristotle was treating of a varying velocity.

Sir George Greenhill and I both wrote to you on January 2, 1914 (vol. xcii., p. 584), pointing out that Aristotle throughout treats only of the motion of projectiles, and of that only in a resisting medium, and then only of that part of the vertical motion when the projectile has attained that constant speed known to ballisticians as "terminal velocity," which can be as readily observed in rising smoke as in falling rain.

The equation on which Aristotle really bases his ballistics is:—

$$H = f\left(\frac{wg}{A\tau k}\right),$$

where H is the Newtonian terminal velocity, w is the weight of the projectile, A is the cross section of the projectile, τ is the density of the medium, k is the coefficient of shape.

In modern ballistic tables we write for the unit projectile:—

$$p = \frac{k}{g} v^n$$

Aristotle put n equal to unity.

We now know that there can be no simple equation for vertical motion in a resisting medium except by assuming that $n = 1$ or 2.

Whilst he was in England last week for the Roger Bacon celebrations at Oxford, I mentioned this subject to Father David Fleming, O.F.M. He gave me permission to say that during his tenure of the chair of philosophy at the Franciscan House of Studies in the University of Ghent, he taught the equation as I have given it as the obvious and only true meaning of Aristotle's own words. J. H. HARLCASTLE.

Phenomena of the Conscious and Unconscious.

NOT very long ago the province of psychology was supposed to be confined to the study of the phenomena of consciousness. Recently, however, its narrow limits have been allowed to be transcended; but even now the vast majority of psychologists is so exclusively occupied in inquiring into the effect of the conscious on the unconscious that scarcely any amount of justice has been done to the study of the influence of the unconscious on the conscious. Yet this latter inquiry is by no means insignificant. In fact, it counts for more and more. It is not merely that some actions, unconscious in the beginning, gradually become conscious through the constant interference of volition, and *vice versâ*. It is that the entire range of conscious activity is in essence reflex. The conscious, which is the superstructure of our mental life, has for its underground substratum the unconscious which moulds its shape and guides its course. Thus the conscious, which, superficially viewed, seems to control and modify reflexes is, in fact, itself a species of reflex.

The bare statement of this doctrine may look rather crude; but the grounds which substantiate it are rather of a speculative nature, and to dwell on them would not be quite appropriate in this journal. My aim, however, is different. I am not unaware of the rival theory which maintains that all human actions are essentially voluntary and have become reflex only by practice in the lifetime of the individual or of the race. What I desire by publishing this letter in NATURE is to elicit the opinions of physiologists as to the merits of the latter theory. To expect exact scientific evidence here is, of course, absurd. But are there even the remotest indications in the human and animal organism that favour this theory?

ABDUL MAJID.

Gola Gunj, Lucknow, India.

THE NATIONAL PHYSICAL LABORATORY IN 1913–14.

THE annual report of the National Physical Laboratory for 1913–14 was presented to the general board at the visitation day of the Royal Society on June 19. The report forms another and a conspicuous testimony to the remarkable growth of the laboratory and the importance and volume of the work with which

it has to deal. In its early career the existence and future of the laboratory were a source of some anxiety to its supporters, but no one can now deny the position it has won. It will be readily conceded by those who have followed its fortunes how much the laboratory owes to its director, Dr. Glazebrook, to whose ability and energies the great success of the institution will be a lasting monument. A notion of the present extent of the laboratory buildings may be got from the panoramic view shown in Fig. 1. The laboratory staff now approaches 200 in number, of whom more than 60 have had a university training.

We observe that during the year under review the income of the laboratory amounted to more than 43,000*l*, an increase of more than 11,000*l*. on the previous year's working. Excluding a special grant of about 5000*l*., which is ear-marked for aeronautics research, and is separately administered, we notice that only 7000*l*. is contributed by the State towards this income; the greater part is derived from fees for tests, of which nearly 65,000 were carried out during the year, this total including all classes of work large and small. Some idea of the magnitude and importance of this work may be gathered from the fact that the value of the goods sent in for test approached 300,000*l*. for the year.

It is not without grave concern that the Royal Society views the financial responsibilities attendant on sums of this magnitude, but it is a tradition of political life in this country, and one unfortunately not frowned at by public opinion, that parsimonious State support should be given to public institutions which, however useful, do not by their very nature lend themselves to political aggrandisement. But he who runs may read, and the briefest scrutiny of the report before us offers abundant evidence of the intimate relations of the laboratory not only with the general public, but with the various departments of the Government itself. The board of control of the laboratory will have the warm approval of our readers in its efforts to get the grant-in-aid from the Treasury increased from 7000*l*. to a modest 12,000*l*. per annum.

There is an over-abundance of work waiting to be done, of problems to be solved, and it is both expedient and proper that much of this investigatory work should be financed by public funds rather than by levying a burdensome toll on the fees which the routine test-work affords.

There are many who urge that a National Physical Laboratory should act as a sort of headquarters for each and every branch of inquiry in physics, and that while its primary object is the application of science to industry, it should be prepared to lead the way in exploring new fields which are possibly and quite probably not immediately remunerative. But all these things cost money, and if public support is inadequate, it is the pure investigatory side which suffers rather than the utilitarian problems set by industry and commerce. The marked superiority of the State support in Germany and the States has greatly

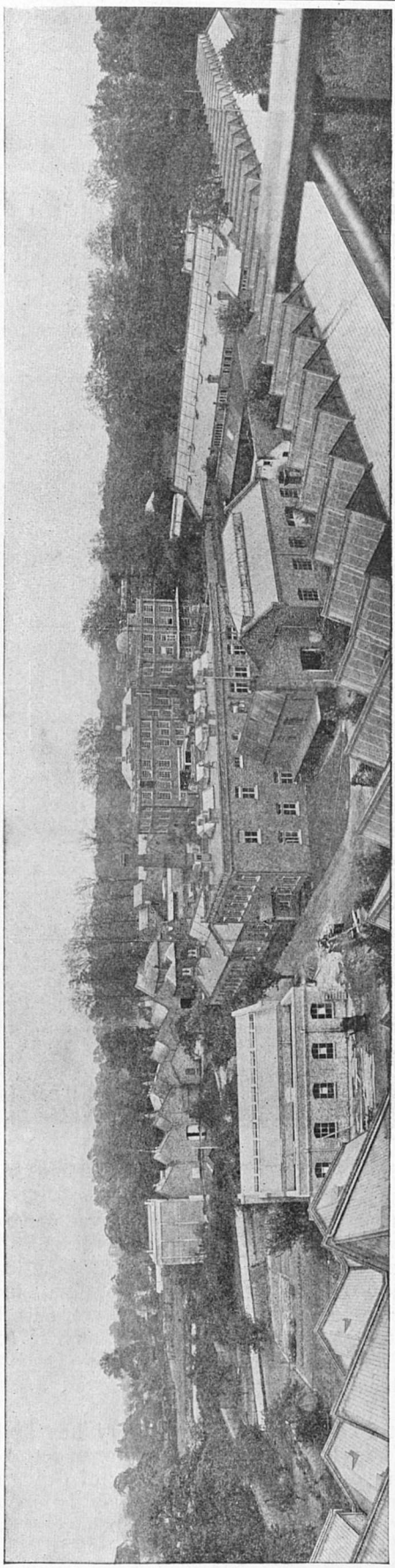


FIG. 1.—General view of the National Physica Laboratory. In the foreground appears the long weaving-shed roof of the Tank Building. Behind this, in the centre, is the Wernher Building (Metallurgy), while on the left (North) is the small new building erected for experiments in the rolling of alloys. To the South (right) is the Metrology Building. In the rear of these again are, on the North, the Engineering Buildings, extending from the building for the 7-ft. air channel to the engine room chimney; the Electrotechnics Building, partly visible only behind the southernmost portion of the Engineering Buildings; the new Buildings opened by Mr. Balfour in June, 1913, for Administration and Optics (with Observatory Dome); and South-east of this and largely hidden behind the new Buildings, the original main Laboratory Building of Bushy House. The grounds of Bushy House extend to the South of the Buildings.

fostered the development of research in their respective national laboratories.

The National Physical Laboratory has taken part during the year in various international matters, such as the establishment of a practical scale of high temperature, the standardisation of screw-threads, and the questions underlying photometric measurements. The director served on Lord Parker's committee, which advised the Government on systems of long-distance wireless telegraphy; he is also a member of the committee appointed by the Postmaster-General to deal with the question of organised research in telegraphy and telephony. The new wireless laboratory which this committee has recently recommended should be established at Teddington, will work in close association with the National Physical Laboratory. In addition, the laboratory has taken a prominent part in the investigatory work incidental to the Home Secretary's committee (of which the director is chairman), which is concerned with the lighting of factories and workshops.

As mentioned above, the laboratory has been called on largely during the year to undertake important investigations for a number of Government departments. Among these may be mentioned an inquiry into the viscous behaviour of oil fuels for the Admiralty, and an investigation (for the Local Government Board) into methods of preventing glare from motor-car headlights. The work conducted for the Board of Trade and the Admiralty on ships' lights has been continued, while observations on the vibrations of St. Paul's Cathedral were made for the Home Office. Other investigations were carried out for the War Office, the Post Office, the India Office, the Crown agents, and the various Colonial Governments.

To turn to the research side of the work, Mr. F. E. Smith has completed a very important investigation on the absolute measurement of electrical resistance by means of an elaborate apparatus of the Lorenz type. The final value he obtains is that the ohm in the usual mercury units has a length of $106{\cdot}245 \pm 0{\cdot}004$ cm., which is distinctly less than the mean of previous results. Mr. Campbell has overcome with his well-known skill a number of difficult problems of measurement associated with the high frequencies used in wireless telegraphy, for an account of which reference must be made to the report. Mr. Paterson and Mr. Dudding have completed an inter-comparison of the photometric standards of the principal standardising laboratories of the world.

The heat division has contributed a series of interesting papers on the subject of the electric

FIG. 2.—The new library of the National Physical Laboratory; a memorial to the late Sir William White.

emissivity and disintegration of matter at high temperatures. An inquiry into the thermal and secular behaviour of various well-known thermometer glasses has been carried out, and some experiments on the thermal conductivities of certain highly insulating materials, which have been in progress for some time, are approaching completion.

Among the work of the metrology division we note some measurements on the silica standard metre constructed a few years ago. These fully bear out the high hopes which were originally entertained of this substance for the purpose.

An important new departure is the testing of radium preparations. The new department, which has been placed in charge of Dr. Kaye, has already proved a boon to the radium-buying public.

The engineering department has completed the work on wind pressure, and Dr. Stanton and Mr. Pannell have published a comprehensive and important paper on the frictional flow of fluids in pipes. In this work the authors have been able to rationalise the results over a wide range of velocities (20–6000 cm. per sec.) and for fluids with viscosities so far apart as those of air and water. The well-known index-law of frictional resistance was found to be inadequate over the large range of velocities employed.

The work of Mr. Bairstow and his colleagues in the aeronautical division has proved of the utmost value. The researches on stability and the gradual development of an aeroplane of complete stability (see NATURE, June 11, p. 388) have excited great popular interest and approval. A rolling-mill to deal with light alloys and a large 7-ft. wind-channel are approaching completion.

The results obtained in the laboratory of the road-board have already justified its existence. Some useful mechanical and endurance tests on various types of road mixtures have been carried out under many conditions.

The record of the metallurgical department is one of continued progress. The work on alloys research has proceeded apace, and much attention has been paid to the installation of the new equipment. We notice the proposed use of a kathode-ray furnace as a means of melting metals free from contamination.

The year has seen a great increase in the utilisation by various shipbuilders of the facilities offered by the national tank. It is gratifying to learn that the alterations in design suggested by the tests resulted in a considerable diminution in the power required, amounting on an average to 10 per cent. or more in the seventy odd models tested.

It is impossible in a short notice of this character to give anything more than the merest indication of a few of the fifty or more original papers which are reviewed in this report. Many of these are incorporated in the forthcoming eleventh volume of the "Collected Researches" of the laboratory. We notice an attractive list of researches proposed for the next twelve months' work.

ROYAL COMMISSION ON THE CIVIL SERVICE.

THE report (Cd. 7338, price 1*s.* 4*d.*) of Lord MacDonnell's Commission on the Civil Service is now published, and its chief recommendations were referred to in our issue of April 16 (p. 180); they may be summarised as follows:—

(1) That boys should be recruited only for permanent service, and no longer as temporary boy clerks.

(2) That in certain cases for which competitive examination is unsuitable, the appointment should be made by a selection committee.

(3) That a greater number of women should be employed, their appointment to be made by suitable means distinct from that used for men of similar grade.

(4) That the method of open competition should be maintained, and more closely coordinated with the educational system of the country.

The second of these recommendations concerns scientific and other professional appointments; though patronage is often wisely exercised, such appointments will in future be made by a suitably and regularly constituted committee. The Commission expresses no opinion as to whether the co-ordination of examinations and education will give increased weight to science. For the lower examinations the matter is left to the Treasury and the Civil Service Commissioners. For the Class I. examination the appointment of a committee is recommended to consider the coordination of the examination with university studies.

On the plan of the Commission there will be the following four

Methods of Appointment.

1. OPEN COMPETITION.—To be applied to most of the clerical posts (the higher among them to be now called Administrative Posts), and to professional appointments when the appointing age is less than twenty-seven. This involves some extension of the method in the case of professional and technical appointments. There is a nut for the Civil Service Commissioners to crack in the recommendation that character is to be tested by written examination—or perhaps the recommendation implies an interview.

2. DIRECT APPOINTMENT BY THE CROWN.—This method is at present used for high administrative posts and for some professional posts. Under the proposals of the Commission, only high administrative posts will be filled in this way, and when such a post is filled by the appointment of a man from outside the Service, the appointing minister will lay before Parliament a statement of his name and qualifications.

3. APPOINTMENT BY SELECTION COMMITTEE.—This method will be applied to professional posts when the appointing age is more than twenty-seven. There will be public advertisement of the vacancy, a picked number of the applicants (or perhaps all the applicants if the number is small) will be interviewed by an appropriately constituted committee, and the most suitable thereby

selected. This method is adopted by the Commission from the Board of Trade, which used it for the recruitment of the Labour Exchanges. In the circumstances it is curious that instead of acknowledging their debt the Commissioners find fault with the method adopted for the Labour Exchanges.

4. QUALIFYING EXAMINATION.—This method is used for subordinate posts for which educational attainments are of less importance than other qualities, postmen for instance. More than half of the posts in the Service are filled in this way, a greater number than by open competition. The Commission proposes that the Treasury should consider how to ensure that the patronage necessarily involved in the selection of these men shall be suitably exercised.

The General Civil Service.

A problem with which many have struggled is the finding of employment for the ex-boy-clerk, a problem which has resulted from a desire to spare the pocket of the taxpayer without sufficient regard to other circumstances. The boy is at present taken on and employed for a few years and then, in many cases, turned adrift. Many civil servants have laboured to find employment for the ex-boy-clerk. Their labours have, however, effected only an alleviation of the evil, and it is satisfactory to have the Commission decide that, in future, boys must be taken on only with a view to permanent employment provided their work proves satisfactory.

An aggravation of the evil was that in spite of the published regulations, many boys and their parents imagined that a boy selected by open competition for the Civil Service was made for life. The boy-clerk method of recruiting is to be replaced by a new class to be called the Junior Clerical Class, who will be recruited at the age of sixteen for permanent service. These boys are thus made for life in some sense, since provided they give satisfaction they may remain in the service and attain to a salary of 200*l*. It ought, however, to be made quite clear to this Junior Clerical Class that the bulk of them will be hewers of wood and drawers of water all their lives and never pass the 200*l*. limit. The staff posts to which these men may be promoted and the rare chances of promotion to a higher class will be small in numbers compared with the total numbers of the Class, and the bulk of the Class should be discouraged from looking forward to such promotion. Even so it will be difficult for a man who attains his maximum salary at thirty-six years of age to work on contentedly for thirty years more on that salary.

The General Civil Service will in future be recruited in three classes:

1. The Junior Clerical Class, appointed at sixteen at the close of the Intermediate School Course,

2. The Senior Clerical Class, appointed at eighteen at the close of the Secondary School Course.

3. The Administrative Class, appointed at the close of the University Course.

As already stated, the chief change is in the first-mentioned class which replaces the temporary boy-clerks. In course of time, when the Second Division Clerks have ceased to exist, their work will doubtless fall to the Junior Clericals. The second and third classes mentioned above are practically the Intermediate Class and the Class I. Clerks under new names. In all three classes, the conditions as to age and subjects are to be coordinated more closely than at present with the corresponding school epoch. It is, for instance, high time to abolish the test in copying manuscript which now stands in the examination schemes of the Boy Clerks and Second Division Clerks. The importance of the test to the Departments must be much reduced now that good handwriting is required of the Class I. Clerks.

MR. ROOSEVELT IN BRAZIL.

AT a special meeting of the Royal Geographical Society on Tuesday, June 16, Mr. Roosevelt gave an account of his recent journey in Central Brazil. In his opening remarks he alluded to the excellent work of the Telegraphic Commission under Col. Rondon in exploring the sandstone plateau which, under different names, extends west-north-west through northern Matto Grosso towards the cataracts of the Rio Madeira, and separates the drainage basins of the Paraguay and the Guaporé from those of the Xingu, Tapajos, and some of the tributaries of the Madeira. To the west of the affluents of the Juruena, the western fork of the Tapajos, they met with two considerable streams which they named the Ananaz and the Duvida; the ultimate courses of these were uncertain, hence the name, meaning "doubt" given to the latter. Beyond was another stream, which was descended and demonstrated to be the Gi-paraná, which enters the Madeira a little below San Antonio.

On Mr. Roosevelt's arrival in Brazil it was arranged that he and Col. Rondon should conduct an expedition down the Rio Duvida. Besides the two leaders, the *personnel* included Mr. Kermit Roosevelt, two American biologists, a Lieutenant of the Brazilian Engineering Corps, who determined the positions by astronomical observations, and a Brazilian army surgeon.

The expedition started in dug-outs from the bridge constructed by the Commission across the river, and for the first four days good progress was made, but then a succession of cataracts was met with, and forty-two days were occupied in covering one degree of latitude. All the cataracts had to be reconnoitred before they were negotiated, and in some cases the canoes had to be transported by land. At two points where low ranges of hills were traversed in narrow gorges the canoes had to be warped through with ropes. If, as was no doubt the case, these dug-outs were of the same type as those with which the writer was familiar on the Paraguay near its source,

any craft less suited for descending rapids could scarcely be imagined. Mr. Roosevelt recommended future explorers to use Canadian birch-bark canoes in their place. When the last cataract had been left behind, about latitude 10° 50′ S., the first rubber worker was soon encountered, and others were met with at intervals down the river to its junction with the Madeira about latitude 5° 20′ S.

Mr. Roosevelt remarked on the fact that, though this was by far the most important tributary of the Madeira below the junction of the Beni and Mamoré, it did not appear on any map, except as a short and unimportant creek. It remains to be seen whether the whole of the water of the river takes this course. It seems quite possible that, when the river is high, some may pass into the Madeira by other routes, or may find an outlet into the Amazon by way of the Canumá channel, a lateral branch of the Madeira.

There is no doubt that the expedition has accomplished a valuable piece of work, and has, in Mr. Roosevelt's own words, placed a river comparable in size to the Elbe for the first time on the map. It is probably the most important achievement in river exploration in tropical South America since 1880, when Heath descended the Beni from Rurenabaque and showed that it united with the Manutata (Madre de Dios) and Mamoré to form the Madeira.

The collections made by the expedition should prove of interest, especially the rocks of the cataracts, which are on the line of strike of the crystalline rocks of the Madeira cataracts described by the writer. It was in descending the rapids that Mr. Roosevelt contracted fever, so that they appear to have the same malarial character as many other cataracts in South America, presumably because they offer facilities for the breeding of Anopheles in rock pools.

JOHN W. EVANS.

NOTES.

THE list of honours conferred on the occasion of the celebration of the King's birthday on Monday, June 22, includes the names of a few men of distinguished eminence in the scientific world, and of others who, while belonging to various departments of the public service, have done notable work for science. Among the new peers is Sir Leonard Lyell, Bart., a nephew of Sir Charles Lyell, and formerly a professor of natural science in the University College of Wales. Colonel S. G. Burrard, F.R.S., Surveyor-General in India, has been appointed a K.C.S.I., and Mr. R. A. S. Redmayne, C.B., Chief Inspector of Mines, Home Office, has been promoted to the rank of K.C.B. The new knights include:—Dr. J. G. Frazer, author of "The Golden Bough"; Dr. W. P. Herringham, Vice-Chancellor of London University and physician to St. Bartholomew's Hospital; Dr. W. H. St. John Hope, archæologist; Dr. W. Milligan, known by his investigation into the connection of human and animal anthrax; Lieut.-Colonel Leonard Rogers, Indian Medical Service, professor of pathology, Medical College, and bacteriologist to Government, Calcutta; Dr. T. Kirke Rose, chemist and assayer to the Royal Mint; Dr. S. J. Sharkey, lecturer on medicine at St. Thomas's Hospital; and Mr. J. F. C. Snell, president-elect of the Institute of Electrical Engineers. The honour of Knight Bachelor has been conferred upon Dr. Douglas Mawson, the Antarctic explorer, and Prof. T. P. Anderson Stuart, dean of the faculty of medicine at Sydney University. Mr. R. Meredith, Director of Telegraphs, India; Mr. A. Howard, imperial economic botanist at Pusa, Bengal; Major E. D. W. Greig, assistant director, Central Research Institute, Kasauli; Dr. T. Summers, late Bombay Public Works Department; and Mr. R. H. Tickell, chief engineer, Central Provinces, have received the honour of C.I.E. Dr. H. R. D. Spitta, bacteriologist to his Majesty's Household, has been appointed M.V.O. (Fourth Class).

AT the meeting of the London Mathematical Society on June 11 it was announced that the de Morgan medal had been awarded to Sir Joseph Larmor.

BY the will of Sir David Gill, the Royal Astronomical Society is bequeathed the sum of 250*l.* to be employed by the council of the society in aid of astronomical research in remembrance of the like sum paid out of the funds of the society in aid of his expedition to Ascension in 1876.

WE learn from the *Lancet* that the Emile Chr. Hansen prize for 1914, which consists of a gold medal and 2000 kroner (approximately 100 guineas), has been awarded to Prof. Jules Bordet, director of the Institut Pasteur of Brabant, in recognition of his original medical work in microbiology.

THE president of the British Science Guild (the Right Hon. Sir William Mather), and Lady Mather, have arranged to give a garden party to the members of the British Science Guild on Wednesday, July 8, at the Garden Club of the Anglo-American Peace Centenary Exposition, Shepherd's Bush.

THE work done on behalf of tropical medicine by Mr. Joseph Chamberlain and Mr. Austen Chamberlain has been commemorated by placing their portraits in bronze relief in the Albert Dock Hospital of the Seaman's Hospital Society. The tablets were unveiled on Tuesday by Mr. Harcourt, Secretary of State for the Colonies.

MR. G. A. HIGHT writes from Samer, Pas de Calais, giving particulars of the storm experienced on June 14. The rainfall measured at Samer during the storm between 12.50 and 2.45 p.m., was 3·86 inches, and nearly all fell before 2.15 p.m. The most remarkable feature of the storm was its local character, for in villages only two or three miles to the south of Samer there was no rain. During the storm the temperature fell from 70° to 61° F.

ACCORDING to a Reuter telegram from Copenhagen, Mr. Ole Olsen, the Danish millionaire, has offered to place sufficient funds for the fitting out of a north pole expedition at the disposal of M. Knud Rasmussen, the Danish explorer who has travelled much in Green-

land and among the Eskimo. The expedition, which will take provisions for two years, will be provided with all modern appliances, and will be accompanied by a scientific staff. The base will be at Cape York, in Greenland. The expenses are estimated at about 15,000*l*. A start will probably be made in the summer of 1915.

OUR contemporary, the *British Journal of Photography*, is this year celebrating its diamond jubilee. The journal has been published continuously since 1854—that is, from the very early days of the wet collodion process—so that in its pages the history of photography is recorded as the events took place, with the exception of the still earlier daguerreotype period. It is fitting, therefore, that the diamond jubilee number, just issued, should contain a short history of the journal with portraits of its successive editors, and portraits of twelve "veterans of photography," the qualification for which class is an age of seventy or more, and a lifelong association with photography. With the special number is included a twenty-four page supplement, which gives an excellent summary of the history of photography, with many portraits and other interesting illustrations. Among the portraits is one of two of the "veterans," Sir William Crookes and Mr. John Spiller, taken fifty-nine years ago.

THE council of the Aeronautical Society of Great Britain has awarded the gold medal of the society to Prof. G. H. Bryan, F.R.S., for the great services he has rendered to aeronautics by his development of the theory of the stability of aeroplanes. Prof. Bryan is an old member of the society, to which in 1903 he communicated, in conjunction with Mr. Ellis Williams, a paper on the longitudinal stability of aeroplane gliders, containing the beginnings of the theory of stability he has since developed and published in his monograph, "Stability in Aviation" (1911). The previous recipients of the gold medal of the society, which is the highest award of British scientific aeronautics, are Wilbur and Orville Wright (1909), and Octave Chanute (1910). The official presentation of the medal to Prof. Bryan will take place next session at a date to be announced later.

THE nineteenth International Congress of Americanists (for the study of the ethnology and archæology of the Americas), will meet at Washington, October 5–10, under the patronage of the President of the United States and with the cooperation of the Smithsonian Institution, the universities, and other learned bodies. A full programme has been issued of the meetings, entertainments, and of a highly interesting excursion for the foreign members, to last rather more than two weeks. The principal cities and their museums will be visited and also New Mexico for the cliff-dwellings and pueblos. The Universities of Oxford and Cambridge have appointed delegates, and it is hoped that Great Britain may be fully represented, especially as the eighteenth congress was held in London, May, 1912. Members' fees, 1*l*., and associates, 10*s*., may be sent by money order to Dr. A. Hrdlička, National Museum, Washington, D.C., U.S.A. The proceedings will be issued to members only.

IT is proposed to erect, by international subscription a monument to the memory of Nicolas Louis de la Caille, at Rumigny (Ardennes). Among astronomers who have contributed substantially to the advancement of knowledge of the universe, de la Caille claims a distinguished place. He was the principal collaborator with the third Cassini in the measurement of the arc of meridian from north to south of France, with the view of settling the question as to whether the figure of the earth was oblate or prolate. He went on a mission to the Cape of Good Hope, and while there determined the positions of ten thousand stars, measured an arc of meridian in South Africa, thus starting the triangulation to connect the Cape with Cairo, his observations, combined with those of astronomers in the northern hemisphere, giving increased accuracy to the determination of the moon's distance. His work, completed in less than four years, was commemorated by the Royal Society of South Africa in 1901 by the erection of a tablet on the house in which he lived in Cape Town. He was one of the leading lights of the eighteenth century, and his work merits the monument which it is proposed to erect. The president of the executive committee which is appealing for subscriptions is M. Baillaud, director of the Paris Observatory, and the members of the honorary committee include many distinguished astronomers in France and elsewhere.

THE International Fire Service Council's executive held a series of meetings in London on June 15–19, at the invitation of the British Fire Prevention Committee. The meetings have been honoured by his Majesty wishing the council success; the delegates have been received on behalf of his Majesty's Government, who have entertained them at luncheon, when the Earl Beauchamp, presiding, took the opportunity to express his appreciation of their work and its beneficial influence, and the London County Council has entertained the visitors and afforded them numerous facilities. The work of the International Council, which was presided over by Commandant Meier, of Amsterdam (president of the council), included the technical arrangement of the proposed International Fire English-French-German Dictionary of 5000 technical terms, which the council will now be able shortly to issue, thanks to the liberality of an English donor who has offered to bear the cost of its production. Arrangements were made for the holding of a full meeting of the council and an International Fire Congress at Copenhagen in 1915, when questions relating to celluloid dangers, fire on board ship, petroleum dangers, and the formation of county or district motor fire brigades are to be under consideration.

LAST Saturday, June 20, the Physical Society held a meeting at Cambridge. A party of about one hundred travelled from London, and proceeded to the works of the Cambridge Scientific Instrument Co. After inspecting the works, the members and their friends were entertained by the company at a luncheon in the hall of St. John's College. The president, Sir J. J. Thomson, in expressing the thanks of the society for the company's hospitality, directed attention to its

excellent work, and to the part it played in putting into a commercial form the crude ideas of the pure physicist in developing new instruments. Mr. Horace Darwin, chairman of the company, in responding, remarked that it aimed at turning out not only well-finished instruments, but also instruments that would last owing to good design. In referring to the president of the society, Mr. Darwin directed attention to the remarkable succession of professors at the Cavendish Laboratory, namely, Clerk Maxwell, then Lord Rayleigh, and now Sir J. J. Thomson. He concluded by thanking the master and fellows of St. John's College for permitting the lunch to be held in the hall. After a reply by Dr. G. D. Liveing, the members visited some of the colleges and proceeded to the Cavendish Laboratory, where Sir J. J. Thomson read a paper on the production of very soft Röntgen radiation by the impact of positive and slow kathode rays, and Mr. F. W. Aston read a paper on the homogeneity of atmospheric neon. This was followed by tea by invitation of Sir Joseph and Lady Thomson, and experimental demonstrations in the laboratory.

DR. WOLBACH and Mr. Binger describe two new spirochæte organisms (*S. elusa* and *S. biflexa*) from pond-water. The former was cultivated in hay infusion; it is very minute, and is filterable through a Berkefeld filter (*Journ. Med. Research*, vol. xxx., No. 1, 1914).

BULLETIN No. 92 of the U.S. Department of Agriculture gives an account of experiments by Dr. White on the destruction of germs of infectious bee diseases by heat. Temperatures of 63° C. for European foul brood, 98° C. for American foul brood and 58° C. for sacbrood and Nosema disease, with an exposure for ten minutes, were found effective. These data may be of practical service in preventing the ravages of these diseases.

IN the Memoirs of the Department of Agriculture in India (Veterinary Series, vol. ii., No. 3, 1914) Major Holmes details tests of the curative value of iodine and of carbolic acid on hæmorrhagic septicæmia and rinderpest, two important cattle diseases, in which the mortality is about 90 per cent. Iodine treatment reduced the mortality in hæmorrhagic septicæmia to about 50 per cent., and in rinderpest to about 67 per cent. Of ten rinderpest animals treated with carbolic acid, three survived, a mortality of 70 per cent. Potassium permanganate was found to have no curative value in either disease.

IN the *Quarterly Journal of Microscopical Science* for June (vol. lx., part 2), Prof. Arthur Willey gives a description of the blastocyst and placenta of the beaver, having been fortunate enough to obtain much younger stages than any hitherto known. In the same number Prof. G. C. Bourne describes a remarkable new type of Alcyonarian, to which he gives the name *Acrossota liposclera*. The specimen was collected by Prof. Willey near British New Guinea, and differs from all other known Alcyonarians in the possession of simple, unbranched tentacles. The tentacles are, however, always eight in number, and in other respects also the species is typically Alcyonarian. A new family, the Acrossotidæ, is proposed, and placed in the order Stolonifera of Hickson.

EXCELLENT photographs illustrative of the breeding habits of the pratincole and the Kentish plover form one of the striking features in the June number of *Wild Life*.

WE are indebted to Dr J. Ritchie for a copy of an article in the May number of the *Scottish Naturalist* on early references to the occurrence of four-horned sheep in Scotland. The earliest of these is in a work on Scottish affairs by Bishop Leslie, published in Rome in 1578.

THE care of home aquaria is one of two titles given to a small illustrated pamphlet by Dr. R. C. Osburn, published by the New York Zoological Society. In the United States small aquaria, both marine and fresh-water, appear to be much more common at the present day than they are in this country; and the tract is intended for the use of beginners in the cult. Dr. Osburn emphasises the importance of a proper balance between animal and vegetable life in the tank, and, when this is established, the harmfulness of frequent change of the water.

MR. O. A. M. HAWKES has devoted a large amount of time and labour to the study of the relative lengths of the first and second toes of the human foot, from the point of view of occurrence, anatomy, and heredity, the results of which are published, with a number of sciograph and other illustrations, in the April number of the *Journal of Genetics*. Three chief types are noticeable, in the first and most common of which the "great" toe is longer than any of the others; in the second type the maximum length occurs in the second toe, while in the third, and rarest, type, the first and second toes are equal in length and longer than any of the other three.

AT the Monaco International Zoological Congress it was resolved that a certain number of well-known generic names of animals which, on grounds of priority or for other reasons, are liable to replacement, might be submitted to the International Commission on Nomenclature for retention by "fiat." A list—signed by Messrs. K. Andersen (Denmark), E. Lönnberg (Sweden), A. Cabrera (Spain), R. Lydekker (England), P. Matschie (Germany), O. Thomas (England), and E. L. Trouessart (France)—of sixteen mammalian names recommended for conservation in this manner has now been drawn up with the view of presentation to the commission. The scheduled names are Anthropopithecus (chimpanzi), Cercopithecus (guenon monkeys), Chiromys (aye-aye), Cœlogenys (paca), Dasypus (six - banded armadillos), Dicotyles (peccaris), Echidna (spiny ant-eater), Galeopithecus (flying-lemur), Gazella (gazelles), Hapale (marmosets), Hippotragus (sable and roan antelopes), Lagidium (mountain chinchilla), Manatus (manatis), Nycteris (certain African bats), Rhytina (Steller's sea-cow), and Simia (orang-utan). Hyrax (rock-conies) might well have been added. It is to be hoped that not only will the commission issue the "fiat," but that naturalists will

make a point of accepting the names thus legalised. In many instances their rejection involves the transference of names from one genus to another (as, for instance, Simia from the orang-utan to the chimpanzi, and Cynocephalus, so long used for the dog-faced baboons, to the flying-lemur), which is the worst of all evils in zoological nomenclature. Echidna will have to be disused in ichthyology.

AMONG recent additions to the Natural History Branch of the British Museum, the following specimens are of general public interest:—The skeleton of the thoroughbred stallion, "St. Simon," presented by the Duke of Portland, which is not yet on exhibition, but is, we understand, to be placed alongside the skeleton of his son, "Persimmon," presented by his late Majesty King Edward VII. "St. Simon" was foaled in 1881, and was never beaten on the Turf. Another highly interesting skeleton is that of the Egyptian Eocene two-horned ungulate, Arsinoëtherium, which has just been set up in the fossil mammal gallery. As a matter of fact, this skeleton is a restoration in plaster, but as nearly all the elements have been modelled from actual bones, it is practically as good as if an original. As mounted, the skeleton is about 11½ ft. in length from the muzzle to the root of the tail, a striking feature being the very wide interval between the limbs of opposite sides. The precise affinities of this strange beast are still unknown. In the upper mammal gallery the attention of the public has been riveted on a gigantic specimen of the eastern race of the gorilla (*Anthropopithecus gorilla beringeri*), from the neighbourhood of Lake Tanganyika, recently presented by the Rowland Ward Trustees. In addition to its huge size, this race is characterised by the great development of long black hair on the head, shoulders, and buttocks, and the restriction of the grey band on the back to the loins. On entering the museum the visitor should inspect a segment of the trunk of a fossil conifer from the Trias of Arizona, presented by Mr. Arthur Pearson, and placed by one of the pillars on the right side of the hall. This specimen, which weighs about 2½ tons, has an adventitious interest on account of the brilliant colours presented by the silicified wood, as is admirably shown in the polished upper surface.

THE report of the Sonnblick Society for the year 1913 contains, in addition to the usual meteorological observations at the summit of the Sonnblick, Salzburg (3105 metres), and at other alpine stations, two papers of considerable interest. The first deals with the force of gravity on the Sonnblick, and with general considerations on the earth's gravity, by Major L. Andres. It was intended that General v. Sterneck, who was greatly interested in the subject, and had made numerous determinations in various parts, and had also designed a simple, portable pendulum instrument, should superintend the work, but this was prevented by his death in 1910. The second paper relates to recent scientific research at the Hochobir Observatory (2043 metres) in connection with the determination of the effect of difference of height on the magnetic elements, and with experiments on atmospheric electricity. Good results are here being obtained with pilot balloons, which can be followed to very great heights, owing to the clearness of the air.

SINCE 1783 there has been no great eruption of the Asama-yama, and chief volcano of Central Japan, though the minor explosions and frequent earth-tremors of the last few years seem to point to an approaching period of activity. During the summer months the tremors are recorded at the observatory of Yuno-taira, which lies 1900 ft. below the summit on the south-west slope of the mountain. Prof. Omori, who has studied these records (Bull. Imp. Earthq. Inv. Com., vol. vi., 1914, pp. 149–226), shows that the tremors belong to two classes. Those of the first group (1065 in number, of which one in six were sensible) consist of quick vibrations, are generally of short duration, and never occur during eruptions. The tremors of the second group (1688 in number) consist of slow and always insensible movements, which are of comparatively long duration, and invariably accompany eruptions. In 1911 the average daily number of tremors was eight, and in 1912 eleven.

LA SOCIÉTÉ BELGE DE RADIOLOGIE has issued (L. Severeyns, Brussels, price 6 francs) a series of articles on the medical applications of radio-activity by Prof. J. de Nobele, University of Ghent, MM. Paul Giraud, Jacques and Gaston Danne, and Dr. Henri Coutard, of the Laboratoire de Radio-activité de Gif, près Paris, entitled "Conferences de Radiumbiologie; faites a l'Université de Gand en 1913." The publication deals chiefly with the work at M. Danne's private laboratory at Gif, and is provided with numerous illustrations of the laboratory and the various apparatus there employed. A number of sufficiently striking illustrations, in M. Giraud's article, show the healing of various growths successfully treated with radium. Dr. Coutard contributes a very full and valuable bibliography dealing with the biological side of radio-activity, which occupies sixty pages.

IN the *Verhandlungen* of the German Physical Society for May 15. Dr. E. Gumlich describes a modification of the isthmus method of testing the magnetic qualities of iron in fields of the order of 7500 gauss, which has been found to work very well at the Reichsanstalt. The specimen to be tested consists of a cylindrical rod 0·6 cm. diameter, 35 cm. long, which passes through the 0·6 cm. diameter central holes in two soft iron cylinders of 2·5 cm. outer diameter and 17 cm. length. Between the two cylinders the testing coils, 1·2 cm. wide, are placed. These coils are wound in four layers, so that from the throw given by a ballistic galvanometer connected either to the inner layer or to two consecutive layers in opposition, the induction or the magnetising field outside the specimen can be determined. A slight modification of the arrangement allows transformer sheet to be tested in the same way, the magnetising coil necessary to provide the magnetic flux through the yoke connecting the two cylinders in either case being comparatively small.

WE learn from the *Engineer* for June 19 that a very large installation of Humphrey gas pumps has been ordered by the Egyptian Government for the

drainage of Lake Mareotis at Mex, near Alexandria. When completed, there will be eighteen pumps, each capable of delivering 100,000,000 gallons a day through a lift of 20 ft. The present order comprises the first ten pumps, together with the necessary gas producers, Venturi meters, etc. The great size of the pumps may be judged from the fact that their capacity will be between two and three times that of the pumps installed at the Chingford Reservoir. The combustion chambers will have a maximum internal diameter of 8 ft. 8in., and a height of 14 ft. approximately. Each water valve box will be 8 ft. 8 in. in diameter, and 7 ft. high, and will have 100 valves of the hinged type, specially designed to enable any valve to close upon an obstruction without throwing undue stress upon the hinges. On the next stroke, when the obstruction has been removed by the rush of water, the valve will readjust its position automatically and close fairly upon its seat.

THE accidental subsidences which occurred in Paris a few days ago on one of the Paris Metropolitan lines now in course of completion form the subject of an article in *Engineering* for June 19. The driving of the new underground line appears to have been the immediate cause of the catastrophe. The existing masonry sewers seem to have been shored up over the tunnel driven to take the line; they appear to have broken down at parts during the violent storm of June 15, and the water, by flowing into the tunnel, led to undermining and to the caving-in of the tunnel arch by carrying away the earth and stone on which the arch rested temporarily, and also by carrying away at intervals the masonry walls which formed its final support. It is quite evident that the excavation work, which the construction of the new lines involves, is surrounded with most serious difficulties, carried out as it is in the very soft earth which constitutes the subsoil of Paris, amongst a most complicated network of sewers and pipes, and very frequently through bodies of underground water. It is too early to draw conclusions from the disaster, but one point would seem to stand out clearly, and this is to the effect that no precaution and no reasonable amount of timbering should be deemed superfluous when driving a large network of tunnels in a treacherous subsoil like that of Paris.

OUR ASTRONOMICAL COLUMN.

COMET NOTES.—Zlatinsky's comet (1914*b*) is gradually becoming fainter and getting further south, but the following ephemeris, calculated by Prof. Schwassman (*Astronomische Nachrichten*, No. 4739) of Bergedorf, will permit of it being followed with larger instruments :—

		R.A. (true) h. m. s.		Dec. (true) ° ′ ″		Mag.
June 24	...	9 24 16·2	...	−9 3 15	...	8·8
25	...	25 49·9	...	9 36 3		
26	...	27 20·2	...	10 7 29		
27	...	28 47·6	...	10 37 41	...	9·1
28	...	30 12·2	...	11 6 44		
29	...	31 34·4	...	11 34 42		
30	...	32 54·4	...	12 1 41		
July 1	...	9 34 12·2	...	−12 27 46	...	9·4

The comet discovered by Kritzinger (1914*a*) is a circumpolar object due to its large positive declination. An ephemeris is published in *Astronomische Nachrichten*, No. 4739, by M. P. Chofardet, and the following are the positions for the current week :—

	R.A. h. m. s.	Dec. ° ′
June 25 ...	22 0 50 ...	+44 49·8
27 ...	5 35 ...	44 50·3
29 ...	10 2 ...	44 48·0
July 1 ...	14 12 ...	44 43·7
3 ...	22 18 4 ...	+44 36·7

Elements and ephemeris for Delavan's comet (1913*f*) are also given in the same number of the *Astronomische Nachrichten*. This comet is now about the 9th magnitude, and is brightening up considerably, but cannot yet be observed owing to its nearness to the sun. It will be picked up, however, somewhere about the latter end of July.

LARGE TELESCOPES.—Mr. H. P. Hollis publishes (*Observatory*, June) a very interesting list of large refractors and reflectors, either under construction or already set up in observatories. In the case of refractors, the lower limit of aperture of the object glass is taken as 20 in., and the same limit is also taken in the case of the reflecting telescopes. Of the thirty-eight refractors about which details are given, the largest objective is that of 49·2 in. made for the Paris Exhibition of 1900. As this is out of use, the largest working objective is that of the Yerkes Observatory at Wisconsin, U.S.A. Of the refractors under construction the following may be mentioned :—A 32-in. for the Nicolaieff Observatory, Russia; a 26-in. for the Union Observatory, Johannesburg; three 24-in. for the following observatories: Argentine National Observatory, Cordoba, Chili National Observatory, Santiago, and the Detroit Observatory, Michigan, U.S.A., and a 20-in. for the Chabot Observatory, Oakland, California. The Earl of Ross's 72-in. reflector holds the field for the largest reflector (metallic speculum), while Dr. Common's 60-in. (silver on glass), now at the Harvard Observatory, U.S.A., comes second. Of those under construction, two giants are in hand, namely, one of 100 in. for the Mount Wilson Solar Observatory, and one of 72 in. for the Dominion Observatory, Canada. Others under construction are a 40-in. for the Simeis Observatory, Crimea, and two of 30 in., one for the Helwan Observatory, Egypt, and the other for Mr. D'Esterre's observatory, Surrey, England. It is interesting to note that the number of instruments in each list is about the same, namely, thirty-eight refractors and forty reflectors.

A PLANET BEYOND NEPTUNE.—Mr. H. E. Lau contributes to the June number of *L'Astronomie* a short account of his researches on the perturbations of Neptune and Uranus leading him to suggest a case for a planet beyond Neptune. He produces some interesting and suggestive curves showing the apparent irregularities of the movement of Uranus according to the errors of the tables after Newcomb, Gaillot, and himself. As regards the conclusions he draws at the end of his article he states that they should only be accepted with extreme reserve. The researches made by M. Gaillot and himself, "établissent seulement que l'hypothèse des deux planètes transneptuniennes n'est pas en *conflit* avec les faits observés de sorte qu'il *peut exister deux ou plusieurs grosses planètes au dela des limites actuelles du système solaire.*"

RECENT PROGRESS OF ASTRONOMY.—In the *Annuaire de l'Observatoire Royal de Belgique* for 1914 Prof.

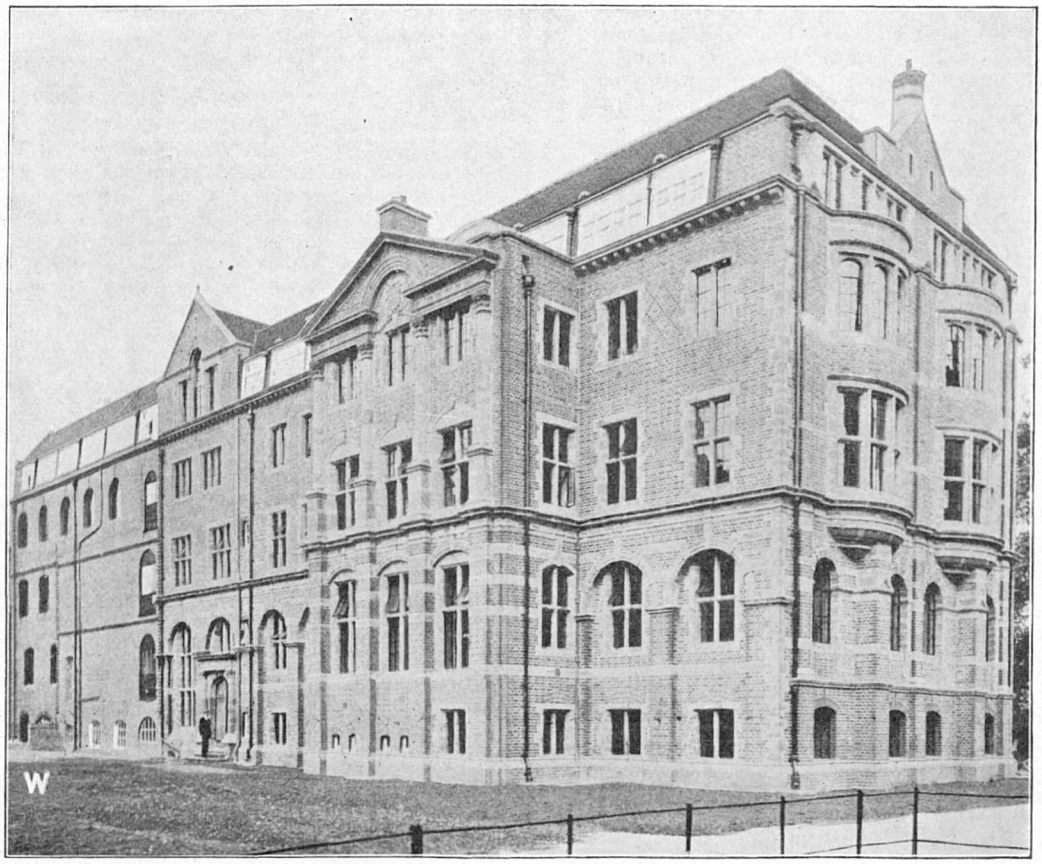
Paul Stroobant contributed a large section dealing with the progress of astronomy during the year 1912. This section has now been issued in a small book form, and will be found very handy and useful for reference.

NEW PHYSIOLOGY SCHOOL AT CAMBRIDGE.

ON June 9, H.R.H. Prince Arthur of Connaught opened the new physiological laboratory erected by the Drapers' Company, and presented by it to the University of Cambridge. A comparison of the old laboratory with the new illustrates the remarkable increase in complexity that has taken place in recent years in physiological investigation. The old laboratory, the last part of which was built in 1891, was for some years amongst the best in the country, yet it had no electrical supply, and the research rooms simply afforded space without any adaptation for special purposes. The following account of the chief features of the new laboratories will show how the conditions have altered. The building is 162 ft. long and 44 ft. broad. The eastern half consists of five storeys, the western half has the fourth and fifth storeys thrown together to form one large room with a gallery. Electric light is throughout. The rooms are supplied with 4-volt and 110-volt current from a storage battery, and in many of the rooms the current can be taken from plugs hanging from the ceiling. The battery has a capacity of 480 ampere-hours; it is charged from an external power station, and the current can be taken direct from this when arc lamps are in use.

Compressed air is supplied to the research rooms, at a pressure of 25 lb. to the sq. in.; the compressor has an automatic switch which starts the motor when the pressure drops to 12–15 lb. to the sq. in. The compressed air, besides its other uses, is employed for aerating the water in the tanks of a small room fitted up as an aquarium. Some of the tanks contain sea-water for marine animals, and by the method employed, the sea-water only requires renewal about once in three months.

There is a special boiler for supplying hot water to the sinks, and a destructor for burning animals killed in the laboratories. On the ground floor is a refrigerator plant keeping a small room above it on the first floor at 0°–3° C.



New Physiology School, Cambridge. View from N.W. The large lecture room and the biochemical department will form a wing on the E. side of the entrance door.

Two rooms are fitted up for research in electro-physiology, each having a dark room, so that photographic records of the electrometer, and string galvanometer, can be taken. These are on the ground floor, which is 5 ft. below the surface; the stone slabs on which the instruments rest are practically devoid of vibration. Two rooms on the same floor are arranged for thermo-electric research, and a continuous record can be taken of the heat given out by small animals over a period of several days. Two communicating rooms are designed for surgical operations; one of these, and some of the experimental rooms, have a special arrangement of hot-water pipes for heating to 75° C. Adjoining these are experimental rooms with kymographs. There are three dark

rooms, one for developing photographs, one for visual observations, and one for X-rays. The ordinary table for X-ray observations has been modified for work on anæsthetised animals. An ultra-microscope is installed in the room devoted to research on colloids. On the north side of the second floor are rooms for microscopic and experimental neurology. Three rooms are specially fitted for blood gas analysis. The laboratory also contains a large library well supplied with physiological books and periodicals.

The class-rooms occupy the fourth and fifth floors; there are two large experimental rooms, one for elementary and the other for advanced work, and a histology room with places for 150 students. Adjoining is a small demonstration room, holding about fifty, and on the first floor is a larger demonstration room, holding about eighty. This latter room has dark blinds, moved up and down by a motor, which can be set in action from the lecturer's table. It is fitted with epidiascope and with kinematograph.

The architect of the building is Sir Thomas Jackson. In the wing to be built later on the north side will come the large lecture room and some additional rooms and offices.

ORNITHOLOGICAL NOTES.

TO the February number of *British Birds* the Rev. F. C. R. Jourdain and Mr. Clifford Borrer contribute an article on erythrism in the eggs of British species, that is to say, eggs in which the normal type of colouring has been replaced by one in which the markings are of various shades of red or reddish-brown; in other words, those in which the pigment consists solely of oörhodein; but the range of colour-variation in the species includes eggs coloured with bile-pigment (biliverdin), either alone or with other pigment, to form the various greens and blues. For this reason the eggs of the Accipitres, which, although really erythristic, seldom show traces of other colouring matter, are excluded. As might have been expected, the erythristic variation generally extends to the entire clutch. Whether individual birds which lay erythristic eggs in one season, do so always, is a point to which no reference is made.

In the *Selborne Magazine* for February members of the Committee for the Economic Preservation of Birds direct attention to species of which the plumage may be used without involving any destruction other than would normally occur, as in the case of game-birds, or without any destruction at all, as in the case of the ostrich, rhea, and, it is said, the peacock. On the other hand, it is urged that the slaughter of mischievous species, like many of the grain-eating parrots, is justifiable, and therefore that their plumage may be worn.

The feature of the winter number (1913) of *Bird Notes and News* is a coloured plate by Mr. Lodge of some of the species most severely persecuted by the plumage-trade. Statistics of the numbers of skins of various species offered at the London auctions are given, in connection with the Plumage Bill.

Bird-Lore (D. Appleton and Co., Harrisburg and New York) for January and February is a good number, containing two coloured plates, and the fourteenth annual census of the local migrations of well-known American species. One of the results is to show that during the past season "chickadees," which seldom come so far south as Massachusetts, reached Rhode Island, Connecticut, and Rhinebeck.

From a paper by Mr. H. Victor Jones in the February number of the *Zoologist* on certain parasites of birds, we learn that while rooks and the diurnal birds-of-prey—probably owing to the strength of their gastric juices—are practically free from intestinal infestations of this kind, curlews show, on the average, no fewer than 49·5 per head. As there seems to be a connection in many species between the numbers of external and internal parasites, it is suggested that some of the former may serve as hosts for the latter during the earlier stages of their development.

As one of the results of bird-protection, there are hopes that kites may soon be seen in districts from which they have long since disappeared. During the last few years these birds have increased considerably in numbers in Wales, and it is probable that the pair recorded by Messrs. Hale and Borrer in the March number of *British Birds* to have bred in Devonshire in the spring of 1913 were emigrants from that colony. Kites are also recorded in the same issue, on more or less satisfactory evidence, to have been seen during 1913 in Somersetshire, Derbyshire, and Buckinghamshire.

According to the January number of the *Emu*, it is expected that an Act for the reservation of 300 acres to serve as a bird-sanctuary in Kangaroo Island will be passed by the Commonwealth Government next session. Lyre-birds, formerly abundant in very similar country in the Blackall Ranges, would probably flourish there. It is also recorded that at the annual congress of the R.A.O.U. a resolution was unanimously carried calling on the Government to pass a local Act on the lines of the British Plumage Prohibition Bill.

In the *Field* of March 28 Mr. Seth Smith directs attention to the remarkable cry uttered by the king penguin in the Zoological Gardens. The bird is shy of going through the performance, but if gently stroked on the throat by its keeper will gradually raise its head and stretch its neck to the utmost, then, throwing out its chest, it emits a series of loud, trumpeting sounds which last for some seconds; the bird on the utterance of the last note suddenly drops its head, as if bowing to the audience. The "song" and the concluding gesture are probably the "display" of the penguin, for in bowing it exhibits to the best advantage the brilliant golden patches on the sides of the head. As these patches are not confined to the male sex, it is probable that both sexes "display."

The feeding habits of the South African ground-hornbill (*Bycanistes buccinator*), as exemplified in a pair of tame specimens, form the subject of a note by Mr. C. F. M. Swynnerton in the Journal of the South African Ornithologists' Union for December, 1913. Their extreme voracity, the lightning-like rapidity with which they would seize rats in a barn, and the small size of many of the insects upon which they fed, were some of the most noticeable features of these great birds. After devouring half a score of rats at one meal, these birds would be ready for a second meal an hour later; and they would seize and eat house-flies with the same apparent zest as they devoured rats.

The beaks of crossbills are not always crossed in the same manner, the upper half in some individuals crossing to the bird's own right, while in others the reverse condition obtains. Examination of 171 specimens has enabled Mr. Miller Christy to state, in the April number of *British Birds*, that, so far as this evidence goes, the numbers of the two types are approximately equal—eighty-four of one type and eighty-three of the other, with four specimens indeterminable. This, it is suggested, is an indication that the crossing of the beak is of recent origin, and therefore probably not a Mendelian feature.

The following extract is from a letter received by the editor from the London correspondent of the *North Queensland Gazette*, relating to an alleged remarkable habit on the part of those birds of paradise commonly known as rifle-birds (Ptilorhis):—

"The birds collect sloughed snake-skins for use in connection with their nests. When the construction of the nest is finished, they place these skins around the outside of the structure in such a natural manner as to convey the impression to a casual observer that a living snake is coiled there. . . . A hawk, eagle, or crow, observing what it takes to be a nest with a snake coiled about it, is not likely to desire closer acquaintance." R. L.

THE ROYAL CANADIAN INSTITUTE.

ESTABLISHED in 1849 at Toronto, then Upper Canada, through the energy and activity of a rising young engineer, Mr. (now Sir) Sandford Fleming, as secretary, the "Canadian Institute" was incorporated by Royal Charter on November 4, 1851, and the title "Royal" has recently been conferred upon it. From the first this institute discussed questions and published memoirs of world-wide interest, under the able guidance of men of the type of Sir Sandford Fleming, Kivus Tully, Sir William E. Logan, E. Billings, Henry Youle Hind, Thomas Ridout, J. C. Browne, and others.

The objects of incorporation included the encouragement and general advancement of all the sciences, arts, and manufactures; in fact, for promoting all branches of knowledge dealing with the resources and development of a new country, not forgetting industrial productions and commerce, besides the establishment of a museum to promote the purposes of science and the general interests of the society. For sixty-five years these objects have been pursued by the institute, and with a membership of sixty-four in 1850, the number has increased to nearly 400. The institute has published volumes of Transactions that are a credit to its good name, both in its earliest days and of recent date. The institute has also materially assisted Sir Sandford Fleming in his publications on the zone system of time reckoning, which has been adopted the civilised world over. In its library there is found excellent reference material in many departments of special research work. In 1913 the number of exchanges received by the Royal Canadian Institute was 2180, whilst the publications received annually now reached 4000. Weekly meetings take place during the season, when leaders of thought in science, history, and literature are invited to take part in the reading of papers, and delivery of lectures. These meetings are open to the public.

It was on April 2 of this year that the title "Royal" was conferred on the Canadian Institute of Toronto by his Majesty King George V., recognition of the same having been intimated to the institute through his Royal Highness Field-Marshal the Duke of Connaught, Governor-General of Canada. Besides sending a personal message to his Honour, Sir John Gibson, Lieutenant-Governor of Ontario, conveying his warmest congratulations to the Royal Canadian Institute on the recognition and honour conferred upon them by H.M. the King, his Royal Highness showed his interest in the institute and its progress by accepting the post of patron. A communication was read from Sir Sandford Fleming (Ottawa), and congratulatory speeches and addresses were given, in which Sir Edmund Walker, President Falconer, Principal Peterson, Dr. Coleman, F.R.S., and the presiding officer, Mr. Frank Arnoldi, K.C., took part. Sir Sandford Fleming was unanimously elected honorary president of the new "Royal Canadian Institute," and his three sons, Sandford, Walter, and Hugh, were formally elected members under the new title.

H. M. AMI.

THE CAMBRIDGE "PREVIOUS" EXAMINATION.

THE syndicate appointed by the Senate on May 9, 1913, to "consider what changes, if any, are desirable in the regulations relating to the Previous Examination, in the mutual relations of the Previous Examination and the examinations held by the Highest Grade Schools Syndicate and the Local Examinations and Lectures Syndicate," has reported on somewhat drastic lines.

The syndicate has considered carefully the regulations and arrangements for the existing Previous Examination, and other examinations which are accepted as exempting from the Previous Examination, and has consulted the representatives of the Board of Education, the Headmasters' Conference, the Incorporated Association of Headmasters, and the Assistant-masters' Association, as well as certain members of the University of Oxford, who are concerned with analogous inquiries.

Two hundred headmasters of public and secondary schools sent replies to questions which were addressed to them by the syndicate. The syndicate is of opinion that the existing Previous Examination is an unsatisfactory test, and is not adapted to the present situation in secondary education, and it therefore recommends the introduction of changes, both administrative and educational.

The administrative change advocated is the establishment of a new syndicate which shall be called the Examinations Syndicate, which would take over the work of the present Local Lectures and Examinations Syndicate, so far as examinations are concerned, and of the Highest Grade School Examinations Syndicate. The new syndicate would control the whole of the "pass" examinations of the University.

The educational changes, proposed in the report, endeavour to coordinate the examinations which qualify for study at the University with the entrance examinations to the various professions; and throughout the deliberations the scheme of the Board of Education which is designed to assist such coordinations has been kept in view.

The syndicate proposes to abolish the distinction which now exists between the examination for candidates for honours and that for the "pass" degree. The additional subjects will be done away with.

The compulsory subjects which remain are divided into three groups, each of which may be taken separately. The first group consists of languages; two papers will be set in each of the following:—Latin, Greek, French, and German. Greek is no longer to be compulsory, but Latin must be one of the languages offered.

The second group consists of mathematics and science: algebra and arithmetic, geometry, physics, and chemistry, or experimental mechanics.

The third group consists of English: essay and précis writing, selected books, and outlines of English history.

The examination will be held four times a year at Cambridge only.

The report will be discussed by the Senate at the beginning of the October term. So far as can be gathered, the resident opinion is in general favourable to its findings, though there is sure to be some criticism as to detail by the much-enduring college tutors who will find the task of entering their pupils complicated.

THE GULF STREAM.[1]

MANY theories have been advanced to account for ocean currents in general and for the Gulf Stream in particular. Their causation has been attributed by various writers to:—(1) Differences in the temperature and density of the sea in widely separated geographical positions. (2) Differences in level due to inequalities in different regions of evaporation and precipitation; and to the outflow of great rivers. (3) To convection currents. (4) To the rotation of the earth on its axis. (5) To the direct action of persistent winds.

Wind is the prime cause of all currents; persistent winds the motive power to which all the great ocean streams may be assigned. If anyone be in doubt as to the fact, let him place tracings of maps on which the direction of the principal currents of the globe in the different months or seasons of the year are indicated, over maps on the same scale on which wind distribution, referable to the same months or seasons, is shown; and it will be seen how closely the currents follow the direction of the wind, and how quickly the former respond to changes in the direction of the latter.

In this connection the course of the equatorial current of the Indian Ocean, on the western side of the Arabian Sea, may be cited as a striking example. During those months when the north-east monsoon prevails the current in that region turns to the southward and joins the Mozambique current, but as soon as the change in the direction of the wind occurs, and even before the south-west monsoon is established, the current swings round and flows in the new direction of the wind, to the northward and eastward.

All winds by friction cause some movement of the water surfaces over which they blow, while the waves, and even the wavelets they raise, add impulse to the motion; the stronger the wind the greater being its effect at the time. This surface movement caused by wind is gradually imparted to the water layer below it, and when the wind persists in the same direction for long, the motion is transmitted from layer to layer to a considerable depth.

Under the influence of the trade winds, the currents when nearing equatorial regions probably extend to a depth of from 200 to 400 ft.

Although the principal currents are produced and maintained by the action of persistent winds, their direction is largely controlled by the rotation of the earth on its axis and by variation in temperature and in density, also in evaporation and precipitation in different geographical positions, but these exert only slight local modifying effects. Moreover, as regards the Gulf Stream and its causation, it was found by the officers of the United States Coast Survey that the Atlantic Ocean at Sandy Hook was 3 to 4 ft. lower than the waters of the Gulf of Mexico at the mouth of the Mississippi. This difference of level, which is said to have been ascertained by accurate measurements, doubtless is caused by the heaping up of water in the gulf by the equatorial current; and the power requisite for maintaining the constant flow of the Gulf Stream through the Strait of Florida must in a large measure be attributed to this agency.

The warm, relatively high salinity water which undoubtedly exercises an ameliorating effect upon the climate of our islands and upon that of north-western Europe generally is mainly of equatorial origin, and is directly attributable to the agency of the Gulf Stream.

In support of this belief, let me refer you, in the first place, to a chart of surface temperature of the North Atlantic in order to show what evidence the distribution of mean annual surface temperature will reveal.

The effect of the collision between the Gulf Stream and the cold Labrador current is boldly marked by the steep temperature gradient from 40° to 46° N. Now trace the course of the isotherms onward. The isotherm of 50°, which on the 50th meridian is in 43° N. lat., on the 28th meridian is in 60° N.; the isotherm of 52°, which on the 50th meridian is situated only a few miles south of the 50° isotherm, on the 10th meridian is in 57° N.; but the isotherm of 60°, which on the 50th meridian is in about 41½° N., reaches the coast of Portugal, after making a curve northward, in about the same latitude. In other words, the surface temperature of the Atlantic between the 43rd and 60th parallels, and the 4th and 32nd meridians is the same as that which is found on the 50th meridian between the 41st and 43rd parallels, where the Gulf Stream and Labrador current meet.

Now let us see what corroborative evidence a chart of average salinity will afford.

The northern portion of the North Atlantic, the southern portion of the Greenland sea, and the part of the Barents Sea which are enclosed by the 35 and 36 isohalines, are filled with water of the same salinity as that which we find in the Gulf Stream between Cape Hatteras and its place of meeting with the current from the north.

Whether the relatively warm saline stream or any part of its waters which flows north-eastward from the region south of the Great Bank is derived from that stream which issues for the most part from the Gulf of Mexico, or, as some aver, is an independent stream which takes its origin in the former locality, is a question which must remain unsettled until the results of further investigations are available. This, at the least, we know, that from the Strait of Florida northward and north-north-eastward to the edge of the Bank; thence north-eastward, as well as eastward, across the ocean, aided, no doubt, by the prevailing westerly and south-westerly winds, there exists throughout the year a continuous flow of warm saline or relatively warm saline water to the north-easterly branch of which these islands owe much of their salubrity.

The salubrity of our climate is, of course, largely due to its comparatively mild and even temperature. The relatively small annual range of temperature that obtains normally results from our insular position; the warmth we owe also in a large measure to the surrounding sea, which receives much of its heat from that ocean stream, the course of which we have been following.

I will endeavour to show you by means of diagrams the somewhat frequent correlation of sea temperature with the air temperature over our islands during the decade 1903–1912. In order to confine within manageable limits that portion of the inquiry which relates to sea-surface temperature, the North Atlantic is represented by a broad zone situated between Florida Strait and Valencia in the south-west of Ireland. It happens that the changes in surface temperature, which may be regarded as of premier importance in this connection, occur in this zone.

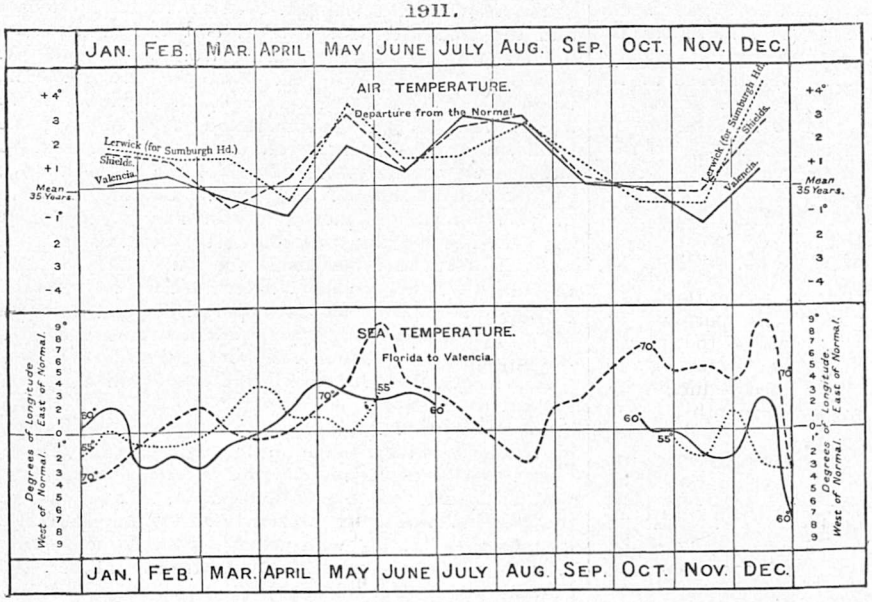
In the diagrams relating to sea temperature in this Florida-Valencia zone, the excess or defect in the surface temperature is expressed by the number of degrees of longitude in which the 70°, 60°, and 55° isotherms are east or west of their average limit for the month.

Air temperature over our islands is represented, roughly it must be admitted, by the temperature

[1] From a lecture delivered before the Royal Geographical Society on May 21, 1914, by Commander M. W. Campbell Hepworth, C.B.

registered at three stations, widely separated: Valencia, Sumburgh Head, in the Shetlands, and North Shields. The curves exhibiting changes in

1911.



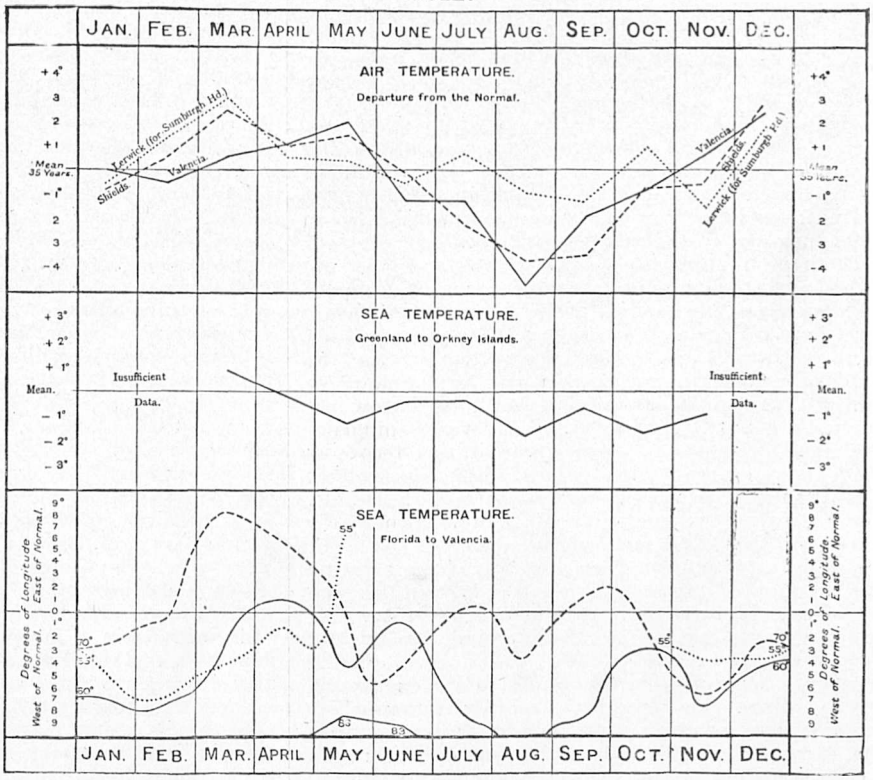
temperature at these places show departures from the normal in degrees Fahrenheit, by reference to the scales above and below a line which represents the average of numerous observations extending over a period of thirty-five years.

The salient features exhibited in the years 1911 and 1912 are as follows:—

Sea temperature in the northern half of the ocean is shown to have been slightly in excess of the normal in January; but, as indicated by the 70° isotherm, in defect, but increasing, in the southern half. Subsequently it increased to above the normal in the south-western Atlantic until the end of February, and declined to the north-eastward during that month. The conditions were reversed in March, a fall in temperature taking place to the south-west, and a rise to the north-eastward. Over the area represented by the 60° and 70° isotherms temperature rose in April, but declined to the north-eastward. After April sea temperature was in excess of the normal until October, except in the south-west portion of the ocean, when the 70° isotherm retreated to the west of its average limit in August. The temperature in this part, however, quickly recovered, the 70° isotherm, which was nearly 9° of longitude to the east of its average limit at the end of May, again advanced, and was 7° east of it in October, and 9° in December; but retreating rapidly towards the close of the month. Increased activity of the Labrador Current in the two closing months of the year reduced the sea temperature for the most part below the normal in the northern portion of the ocean, although south of the 44th parallel it temporarily rose more than 2° above.

As regards air temperature during the year 1911, in the months of January and February, from the close of April to the close of September, and again in December, the temperature of the air over Great Britain and Ireland was in excess of the average; moreover, during the months of May, July, August, and December it was greatly in excess. In October the temperature was about the same as the average, and in March, April, and November only can it be said to have been in defect.

1912.



Throughout the greater part of the year 1912 the curves of air temperature resemble, in a marked degree, those relating to sea-surface temperature.

Sea Temperature.—The temperature of the sea surface, which fell below the normal at the close of the previous year, continued in defect during the first three months of the year under notice, except in the south-western portion of the North Atlantic, where it rose above the normal after the middle of February. The temperature then increased so quickly that in less than a month the 7° isotherm was charted 8° to the east of its average limit for March. In the more northern portions of the ocean, the surface temperature, although in defect until after March, rose from the middle of February until April, and in that month the charted results exhibited, for the most part, an excess of temperature over the North Atlantic generally. The abnormally warm water, of equatorial origin, that was advancing north-eastward, and had been most noticeable in the south-western Atlantic in March, and between the 40th and 50th parallels of latitude in the following month, reached the north-eastern Atlantic in May, flooding the coastal waters off our southern shores, while a decided reduction of surface temperature was taking place in other parts of the ocean.

At the end of May, and in the beginning of June, the 7° isotherm had retreated 6° to the west of its average limits for those months, but a slight temporary recovery of temperature was observed between the 40th and 50th parallels up to the middle of the latter month, when under the cooling influence of the Labrador Current the surface temperature rapidly declined; the 6° isotherm in August having retreated as much as 13° of longitude to the west of its average limit. In the south-west arm of the ocean the temperature rose during June and July, reaching the average towards the close of the latter month, when it declined, but recovered in September. It again declined during the two months that followed, in the latter of which it became considerably in defect; and, although the sea surface temperature increased in the second half of November, it continued to be below the normal to the end of the year.

To the north-eastward the isotherm of 6°, and subsequently that of 5°, indicated a decided defect in surface temperature to the end of the year: albeit fluctuations are shown which harmonise with the temperature of the surface water to the south-westward, as indicated by the 7° isotherm.

For the zone between South Greenland and the Orkneys sufficient data are wanting for the purpose of comparison with normal results, until March, when the surface temperature is shown to have been slightly above the normal. It declined during the following two months, when it stood 1½° below the normal; but it rose to, and remained, ½° below the normal in June and July; fell under the influence of the East Greenland Current in August; recovered somewhat in the month following; and exhibited similar fluctuations as those which obtained in August and September during the two remaining months, for which sufficient data are available.

The air temperature over the British Isles during the summer and autumn of 1912, in contrast with that prevailing during the same seasons of the previous year, is found, therefore, to have been below the normal in June to November inclusive, except at the northern station in July and October and at the south-western station in November, at which places it rose slightly above in the respective months. It was above the normal in February to May inclusive, except at Valencia, when the excess did not obtain until March; equal to, or nearly equal to, the normal in January, and above in December; at Valencia above in November also.

There appears to be no justification for the assumption that important changes have taken place in the circulation of the North Atlantic during historic times. The velocity and volume of the Gulf Stream exhibit modifications that are non-periodic as well as seasonal—modifications that may occur during any month in any year. When the Stream is abnormally active, its resistance to the Labrador current is probably carried farther north than usual, with the result that its north-easterly branch pursues its course in higher latitudes than obtains normally, and its relatively warm saline waters penetrate to the north-westward of their average limits. When, on the other hand, the Gulf Stream is weaker than is usual, according to the season, the converse happens; the north-easterly branch of the Stream commences its new course after its collision with the arctic current, in lower parallels than those in which it commonly starts, and, possibly, the easterly branch is augmented at the expense of the former; so that the influence of the Stream may be restricted in two ways.

In connection with an investigation undertaken at the Meteorological Office, having for its object a comparison of the changes in the strength of the trade winds of the Atlantic[2] with average results, and of changes in the surface temperature of the North Atlantic with normal values, there was found to be some evidence to prove that departures from the average strength of the two trade winds during a series of months, and at times during even so short a period as one month, were roughly reflected in deviations from the normal through the agency of the equatorial current and Gulf Stream in the average distribution of surface temperature in the North Atlantic in the corresponding series of months or month, as the case may be, of the succeeding year, notwithstanding the existence of many other causes affecting the temperature of the surface water, which must tend towards masking the appearance of such connection.

Proof may, therefore, be claimed, resting on a chain of evidence, that many of the climatic changes to which our islands are subject owe their origin to modifications in the trade winds of the Atlantic, communicated through the agency of the equatorial current and its giant offspring the Gulf Stream.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—Mr. F. E. E. Lamplough, of Trinity College, has been appointed an additional demonstrator of chemistry for the five years ending September 30, 1919.

The Special Board for Biology and Geology has approved a grant of 100*l.* from the Balfour Fund, made by the managers to Mr. George Matthai, of Emmanuel College, in aid of his research entitled, "A Revision of the Meandroid Astræidæ."

EDINBURGH.—Important changes are imminent in regard to several of the chairs in the University. At the present moment three chairs are vacant owing to the resignations of Prof. Niecks (music), Prof. Donald Mackinnon (Celtic), and Prof. Geikie (geology). Prof. James Geikie became professor in 1882 in succession to his brother, Sir Archibald Geikie, who was its first occupant. During the last twenty years, since the subject was included in the recognised curricula for degrees in arts and science, it has gained in importance, and attracts every year large numbers of students of pure science and of engineering, agriculture, and forestry. It must assume a still greater importance when the new degree in mining has been

[2] "The Trade Winds of the Atlantic Ocean."

fully established. Prof. Geikie's contributions to the literature of geology are of the highest value, and in his translations of Heine's lyrics he has shown literary gifts in quite another direction. It is believed that, freed from the official duties of a university chair, he will be able to carry out further literary work which he has had in his mind for some years. The filling up of the vacancy created is in the hands of the Crown. The music chair is in the patronage of the University Court, and the chair of Celtic language and literature in the patronage of the curators.

LONDON.—A resolution was adopted by the Senate on June 17 requesting the Vice-Chancellor to inform H.M. Government that the Senate, having considered various sites which have been suggested for the headquarters of the University, is of opinion that it is undesirable to proceed further with such consideration unless, and until, H.M. Treasury intimate its willingness to provide accommodation more suitable in situation, more convenient in character, and on terms not less advantageous as regards tenure, etc., than those attaching to the present occupation at South Kensington.

Official information has been received that the Government cannot contemplate the diversion of Somerset House, which has been suggested as a possible headquarters for the University, from its present purposes.

Prof. A. W. Crossley, F.R.S., has been appointed to the University chair of chemistry, tenable at King's College.

Following the resignation of Prof. J. M. Thomson, Prof. H. Jackson has been appointed head of the chemical department at King's College, with the title of Daniell professor of chemistry in the University.

The D.Sc. degree in chemistry has been granted to Mr. A. J. Ewins, South-Western Polytechnic Institute and Goldsmiths' College; and to Mr. R. T. Colgate, Mr. E. H. Rodd, and Mr. E. E. Walker, of the City and Guilds College; and the D.Sc. degree in botany to Mr. H. F. Wernham, an external student.

At the meeting of the council of the East London College, held on June 22, it was announced that the Court of the Drapers' Company had resolved to defray the cost of the erection and equipment of the new chemical laboratories of the college. The cost will amount to approximately 15,000*l.*, and it is hoped that the laboratories will be available for the use of students at the commencement of the new session in October next.

DR. H. J. S. SAND, of University College, Nottingham, has been appointed lecturer on chemistry at the Sir John Cass Technical Institute, London, E.C., in succession to the late Dr. Harry Burrows.

AT the Convocation of McMaster University, Toronto, held on May 6, the honorary degree of Doctor of Laws was conferred upon Mr. David Hooper, late economic botanist of the Botanical Survey of India, and curator of the industrial section, Indian Museum, Calcutta.

THE trustees of the Beit Scientific Research Fellowships, founded and endowed by Mr. Otto Beit, in September, 1913, have elected three fellows for the ensuing year, namely, Mr. R. S. H. Boulding, Mr. L. H. Parker, and Mr. L. N. G. Ramsay. The fellowships are tenable at the Imperial College of Science and Technology, South Kensington. Mr. Boulding is a post-graduate student in engineering at the City and Guilds (Engineering) College, and the joint author of a paper on the shape of the pressure wave in electrical machinery. Mr. Parker is a research student in chemistry at the Imperial College, joint author of a paper on the interaction of sodium amalgam and water, and author of papers on the action of variously treated waters on sodium amalgam, and reactions by trituration. Mr. Ramsay is an assistant in zoology at the University of Aberdeen, and the author of "Note on the Oviposition of Rhyssa," "Polychæta (Nereidæ) of the Scottish National Antarctic Expedition," "Ornithology of the Scottish National Antarctic Expedition," and other papers.

AN anonymous donor has made a gift of 10,000*l.* to the general endowment of the Royal Technical College, Glasgow, on condition that another sum of 15,000*l.* is promised within a year. A good beginning is thus made to the endowment of the college for, or towards, research purposes, which are specifically mentioned in the letter announcing the gift, and it is hoped that other benefactors will come forward to increase the funds available for the furtherance of research to such an extent as to place the college in a position in this respect comparable with that of like institutions in the United States and Germany. During the last couple of years, for example, the Massachusetts Institute of Technology has received gifts amounting to more than one and a half million pounds; and the benefactions to university and technical education in the United States reach nearly five million pounds a year. No college completely fulfils its function unless it can make suitable provision for research and retain the services of men and women capable of undertaking it. We hope, therefore, that the sum of 10,000*l.* promised to the Royal Technical College will be a nucleus which will attract to itself many similar gifts until it grows to a substantial sum for the promotion of technical education in its best sense, namely, the creation of new knowledge.

NEW buildings for the Hartley University College, Southampton, were opened by Lord Haldane on June 20. In the course of his address, Lord Haldane said the four universities in Scotland to which the democracy sends the children have sent out all over the world a large number of young men and a good many young women who have been able to help themselves to the cream because of superior skill in getting at it. The old notion that capital is a monopoly of the few and that the working classes never can get access to it has all gone. The real monopolist is the man who has got a trained brain. It is the workman who is educated who gets the best wages. The new class that is growing up is an educated class, and if the democracy wishes to get its share in the new things that are going, then the democracy will have to take advantage of the chances of education. To insist on equality of opportunity in education is the great way to solve the problem of labour and capital. Later, Lord Haldane said:—"I have never known a town or city develop its university without finding something quite new and different come to it. Places that do that add a cubit to their stature. I am not in the least afraid of the invasion of German arms, but I am very much afraid of the invasion of people who have been trained in the German universities and schools. It is time we woke up if we are to keep the position we hold in commercial supremacy."

As a result of the debate in the House of Commons on Friday last on the report stage of the Children (Employment and School Attendance) Bill, it may fairly be said that Lancashire as represented by its textile industry blocks the way of any advance in respect of measures having for their object the satisfactory education of the children of the nation. It will neither consent to the permissive extension of the school age until fifteen by local authorities, nor

to the abolition of by-laws which permit a child to leave school so early as twelve, and in the rural districts even earlier, to work as a half-timer. In view of the factious opposition the Bill has evoked, it is clear that only a Government measure will meet the necessities of the case and provide for the raising of the whole-time school age until the age of fourteen, and for the continued effective education of the pupil on leaving school, and within the normal working hours, until at least the completion of his seventeenth year. Only by measures of this kind can the great expenditure on elementary education be justified and its fruits assured. Nothing short of this will enable the country to maintain its position amongst civilised nations. The remarkable industrial and commercial advance of Germany has been secured under conditions of an extended whole-time school age far beyond those prevailing in this country, together with provisions for continued compulsory education within the normal hours of employment on leaving school up to the age of eighteen, of the most effective character. The measures proposed in the Bill have had the strong support of the Manchester Chamber of Commerce and of the Manchester and Salford Trades and Labour Council, and of experienced educationists and social reformers. No so-called industrial exigencies ought to stand in the way of the welfare of the children.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, June 18.—Sir William Crookes, president, in the chair.—Sir D. **Bruce,** Major A. E. **Hamerton,** Captain D. P. **Watson,** and Lady **Bruce**: (1) Trypanosome diseases of domestic animals in Nyasaland. *Trypanosoma caprae,* Kleine. Part III. —Development in *Glossina morsitans;* (2) trypanosomes found in wild *G. morsitans* and wild game in the "fly-belt" of the Upper Shiré Valley; (3) the food of *G. morsitans*; (4) infectivity of *G. morsitans* in Nyasaland during 1912 and 1913.—Dr. C. W. **Andrews**: A description of the skull and skeleton of a peculiarly modified rupicaprine antelope, *Myotragus balearicus,* Bate. *M. balearicus,* Bate, is a peculiarly modified rupicaprine antelope, remains of which were discovered by Miss D. M. A. Bate in cavern deposits in Majorca and Minorca. The dentition is very remarkable. Instead of having three incisors and a canine on each side of the mandibular symphysis, as is usual in the Bovidæ, the canines and the two outer pairs of incisors are wanting, while the median incisors are enormously enlarged rodent-like teeth, growing from persistent pulps. The premolars are reduced in number and the molars have very high crowns. The feet are remarkable for the shortness and stoutness of the metacarpals and metatarsals, which are quite similar to those of the Takin (Budorcas). The animal seems to have been adapted for climbing on steep crags and cliffs, and probably lived on very hard vegetation.—E. T. **Halnan** and F. H. A. **Marshall**: The relation between the thymus and the generative organs, and the influence of these organs upon growth. With a note by G. U. **Yule.**—H. E. **Roaf**: The vapour pressure hypothesis of contraction of striated muscle. Two objections have been urged against muscular contraction being due to movements of water from one portion of the muscle fibre to another. These are: (1) that an osmotic model of muscle cannot cause a sufficient degree of shortening; and (2) that the movement of water would require a longer time than the muscle takes in contracting. The extent of contraction possible for an osmotic model and the time required for this contraction has been calculated for structures of the dimensions of frog's sartorius. It is found that the extent of contraction can be explained by the osmotic model, and that the time required is less than 0·03 sec., and frog's sartorius requires at least 0·04 sec. for complete contraction.—A. N. **Drury**: The validity of the microchemical test for the oxygen place in tissues. Experiments were made to show that the microchemical test with rongalit white, used by Unna to fix the position of the oxygen place in tissues, could be obtained on a surface entirely free from oxygen. A further extension of the work showed that the condensation of a solute on to a surface is markedly influenced by the previous treatment of, or by the gas condensed on, that surface.—Prof. J. S. **MacDonald**: Man's mechanical efficiency. The rate of heat-production, Q, associated with cycling at a uniform rate but with varied performances of mechanical work, is expressed in the following form, $x+Ey=Q$, where x represents the heat-production associated with the uniform rate of movement, y the rate of work-performance. It is shown that E varies inversely with $W^{2/3}$. It follows that, putting on one side x, the energy-transformation entailed by the movements *per se,* the additional energy-transformation required for any definite rate of work-performance is less the greater the weight, W, of the worker; and the mechanical efficiency measured in this fashion varies directly with $W^{2/3}$. It is also shown, however, that x varies approximately with $W^{3/2}$, and thus that the energy-transformation associated with the mere production of movement is much greater the greater the weight.—Dr. A. **Holt**: The colouring matters in the compound Ascidian, *Diazona violacea,* Savigny.—Prof. W. B. **Bottomley**: Some accessory factors in plant growth and nutrition. Plant growth-stimulating substances are formed in sphagnum peat when it is incubated with a liquid culture of certain aerobic soil bacteria for a fortnight at 24° C. These substances are soluble in water and in alcohol, and are active in very small amounts, two applications of water-extract of 0·18 gram treated peat doubling the size of *Primula malacoides* seedlings over untreated plants in six weeks' time. They appear to be similar to so-called accessory food substances essential for nutrition of growing animals, first studied in connection with the deficiency diseases beri-beri and scurvy. The production of these substances appears to be associated with formation of soluble humates in peat by bacterial action. They are not formed when peat is treated with alkalies. Cultures of *Azotobacter chroococcum* grown with extract of "bacterised" peat gave an increase of 18 milligrams of nitrogen in eight days, whilst extract of chemically-treated peat gave no increased fixation. The active substance is precipitated from aqueous solution of alcoholic extract of "bacterised" peat by phosphotungstic acid, and can be further separated by decomposing with baryta, reprecipitating with silver nitrate and decomposing with hydrogen sulphide. Wheat seedlings in sand culture with Detmer's complete food solution gave an increase of 22·7 per cent. with the phosphotungstic fraction, and 17·7 per cent. with the silver fraction. Water-culture experiments with wheat seedlings in Detmer's solution prepared from pure salts in physiologically pure distilled water showed that these substances are essential for assimilation of inorganic food constituents.—Prof. H. B. **Dixon,** C. **Campbell,** and W. E. **Slater**: A photographic analysis of explosion-flames traversing a magnetic field. The authors have carried out a suggestion made by Sir J. J. Thomson that the explosion-wave in gases should be photographed on a rapidly moving film while it traverses a strong magnetic field, to determine whether the emission of electrons in front of the wave "prepares the way" by ionising the gases. Using a very powerful magnet lent them by Sir E. Rutherford,

the authors have photographically analysed the explosion-wave in different mixtures of gases before it enters, while traversing, and as it leaves, the magnetic field. In no case did the magnetic field alter the character or velocity of the flames.

Geological Society, June 10.—Dr. A. Smith Woodward, president, in the chair.—E. B. **Bailey**: The Ballachulish fold near the head of Loch Creran (Argyllshire). The purpose of the present paper is to direct attention to two phenomena strikingly illustrated by the local evidence:—(1) The complexity of the slides affecting the Ballachulish Core, and the correlated (quite exceptional) occurrence of more groups towards the close of the fold, south-east of the River Creran, than towards the gape, north-west of the same; (2) the intense secondary refolding of the Ballachulish Fold, and the resultant sinuous outcrop of the Ballachulish Core.—Dr. Douglas **Mawson**: Geology and glaciation of the Antarctic regions.

Mathematical Society, June 11.—Prof. A. E. H. Love, president, in the chair.—R. H. **Fowler**: A problem of diophantine approximation.—G. H. **Hardy**: Some theorems by Mr. S. Ramanujan.—G. H. **Hardy** and J. E. **Littlewood**: Proof of the general Borel-Tauber theorem.—Prof. E. W. **Hobson**: Theorems relating to functions defined implicitly, with applications to the calculus of variations.—J. G. **Leathem**: The differentiation of a surface-integral at a point of infinity.—R. E. **Powers**: Mersenne's numbers.—J. **Proudman**: Free and forced longitudinal tidal motion in a lake.

DUBLIN.

Royal Irish Academy, May 8.—Dr. R. F. Scharff, vice-president, in the chair.—R. **Southern**: Free-living Nemathelmia, Kinorhyncha, and Chætognatha (in connection with the Clare Island Survey). A large number of new free-living nematoda were described, belonging to the families Anguillulidæ, Desmoscolecidæ, and Chætosomatidæ. One species of Gordius was found on Clare Island. Of the Kinorhyncha (Echinoderes) five species were described, two being new species. Two species of the Chætognatha were found in the plankton of Clew Bay.—J. N. **Halbert**: Acarina (in connection with the Clare Island Survey). In this paper are recorded certain of the terrestrial and marine Acarina collected during the Clare Island Survey. The following families are represented:—Gamasidæ, Oribatidæ, Halaconidæ, and the Trombididæ. Some new species are described, including interesting forms found between tide-marks on the seashore.—G. P. **Farren**: Notes on marine plankton (in connection with Clare Island Survey). The plankton of the Clare Island district is boreal neritic, and may be subdivided into three groups: open-sea plankton, plankton of the intermediate offshore region, and plankton of the bays and harbours. The open-sea is characterised by the comparatively small number of species, a few of which, notably *Calanus helgolandicus*, occur at times in very great abundance. The number of species in the bays and harbours is large, many of them being only temporarily planktonic forms derived from the bottom. The intermediate region contains elements derived from both the other groups, but a few species, *e.g. Aurelia aurita*, find optimum conditions in it.

PARIS.

Academy of Sciences, June 13.—M. P. Appell in the chair.—A. **Haller** and R. **Cornubert**: Syntheses by means of sodium amide. The alkyl*cyclo*pentanones obtained by the addition of hydrogen to unsaturated derivatives. Details of the reduction in presence of nickel as catalyst of dibenzylidene-β-methyl*cyclo*pentanone and βα′-dimethyl-αaa′-triallyl*cyclo*pentanone. The paper concludes with a summary of the results obtained on the substituted *cyclo*pentanones and published in this and preceding communications.—J. **Boussinesq**: The calculation by successive approximation of the continuous velocities in a uniform state by polynomials, in a prismatic tube of square section.—Charles **Richet**: The non-hereditary accommodation of micro-organisms in slightly nutritive media. The lactic bacillus can be grown accustomed to poisons, but becomes weakened by generations of growth in media deficient in food. Such weakened strains supplied with a normal amount of food are still less vigorous than the ordinary strain of bacillus.—M. **Considère**: Measurement of the contraction, strains, the elasticity, and the resistance of the concrete in reinforced concrete constructions.—R. de **Forcrand**: The preparation of the hydrates of manganese sulphate.—V. **Grignard** and Ch. **Courtot**: Derivatives of *cyclo*pentadiene and its dimer. *Cyclo*pentadiene in toluene or petroleum ether solution reacts with magnesium methyl iodide, giving methane and a magnesium compound. The latter compound is very reactive, but the substances obtained are mostly derivatives of the dimeric $C_{10}H_{12}$.—J. **Renaut**: The isochromaticity of the hard segregation grains of rhagiocrine connective cells and the figured collagen formations of the conjunctive tissue.—M. **Angelesco**: A generalisation of Hermite's polynomials.—P. **Appell**: Observations on the preceding communication.—Charles N. **Moore**: The relation between certain methods for the summation of a divergent series.—Leonida **Tonelli**: A direct method in the calculus of variations.—Paul **Renard**: The mode of construction of flexible airships.—Jules **Baillaud**: A simple arrangement for recording rhythmic time signals. A heavy pendulum is arranged to make an electrical circuit, arranged to produce taps in the telephone receiving the wireless signals, and these are brought into exact coincidence by displacing the contact-maker.—M. **Maldiney**: A colour reaction exhibited by solid hydroquinone. Solid hydroquinone and potassium carbonate, rubbed together, give a characteristic blue coloration.—Paul **Jégou**: An arrangement for studying the strength of the oscillations received in wireless telegraphy. An electrolytic detector without any external electromotive force is used in conjunction with a transformer with movable coil. The detector is of low sensibility but high constancy in its indications, and hence is not easily affected by parasitic waves. A series of twelve measurements taken every two hours throughout the day clearly shows the favourable action of darkness on the wave propagation.—Maurice de **Broglie**: Direct spectrum analysis by the secondary Röntgen rays.—R. **Ladenburg** and F. **Reiche**: The distribution of energy in the D lines of sodium.—Daniel **Berthelot**: The various modes of photolysis of oxalic acid by the ultra-violet rays of different wave-length. Solid oxalic acid with ultra-violet rays of middle and very short wave-length gives carbon dioxide and formic acid as the primary products of decomposition, some carbon monoxide and hydrogen being present as secondary products, probably arising from the action of the rays on the formic acid. In aqueous solution the secondary products appear in larger proportion.—F. Leprince **Ringuet**: The limits of inflammability of marsh gas. A study of the influence of moisture, pressure, diameter of the explosion tube, and direction of the explosion (from above or below) on the explosive properties of mixtures of methane and air.—O. **Honigschmid** and Mlle. St. **Horovitz**: The atomic weight of lead from pitchblende. According to recent theories the final disintegration product in the uranium radium series, known as Radium-G, and isotopic with lead, should possess a different atomic weight. The average result of a series of atomic weight determinations carried out on a sample of lead

extracted from pitchblende was 206·74, or 0·4 less than the atomic weight of ordinary lead. This figure confirms the theoretical indications.—E. **Berger**: The reduction by hydrogen of the oxides of copper and nickel in presence of a dehydrating agent. The reduction of these oxides is strongly accelerated when the water vapour is removed as fast as it is formed. The reduction of copper oxide is continuous, but there are indications of the existence of a nickelous oxide, Ni_2O.—Jacques **Joannis**: The oxidation and reduction of copper.—L. **Gay**, F. **Ducellier**, and A. **Raynaud**: The bromination of benzene and its homologues. The catalytic action of manganese. Metallic manganese exerts a marked accelerating action in the bromination of benzene and toluene. If the reagents are dry the metal is unchanged.—Marcel **Godchot**: Thujone and thujamenthone. The direct passage from one to the other. Thujone and hydrogen in the presence of nickel give a good yield of thujamenthone.—Léo **Vignon**: The synthetic preparation of a coal gas. A scheme for the conversion of a mixture of coal gas and water gas, or water gas alone, into a gas possessing approximately the heating value of ordinary coal gas and free from carbon monoxide. It is based on the use of lime, nickel, and other catalytic agents.—Georges **Friedel**: A layer of iodargyrite in France. This rare mineral has been found in cavities in a vein of campylite at Les Montmans, near Echassières. G. **André**: The velocity of hydrolysis and of displacement by water of the nitrogenous and mineral materials contained in leaves.—Charles **Nicolle** and Georges **Blanc**: Are the spirillæ of recurrent fever virulent during the successive stages of their evolution in the flea? Demonstration of their virulence at an invisible stage.—J. E. **Abelous** and C. **Soula**: Modifications of the cerebral action in anaphylaxy. An experimental study in the changes in the cerebral metabolism resulting from the injection of a non-fatal dose of urohypotensine.—Auguste **Lumière** and Jean **Chevrotier**: The vitality of cultures of gonococcus. It would appear from the experiments described that the poisonous substance to which the rapid sterilisation of gonococcus cultures is due is an oxidation product of the exotoxines secreted by the organism. Consequently by working under anaerobic conditions the vitality of gonococcus cultures can be increased.—Louis **Roule**: The deep-water fishes belonging to the family of the Eurypharyngideæ.—Gabriel **Bertrand** and M. **Rosenblatt**: The thermo-regeneration of the various diastases of yeast.—S. **Sécerov**: The influence of ultra-violet light on the coloration of the fur of rabbits and guinea-pigs. The white fur of these animals becomes yellow or reddish under the action of ultra-violet light.—H. **Bierry** and Mlle. Z. **Gruzewska**: The estimation of sugar materials in the liver.—M. de **Lamothe**: The ancient alluvial sheets and terraces of the Rhône and Isère, near Valence.—G. **Gardet**: New fossiliferous horizons in the upper Muschelkalk in the neighbourhood of Bourbonne-les-Bains.—M. de Montessus de **Ballore**: The probable epirogenic origin of earthquakes in New Zealand.

BOOKS RECEIVED.

Canada. Department of Mines. Geological Survey Branch. Memoir 31: Wheaton District, Yukon Territory. By D. D. Cairnes. Pp. x+153. Memoir 43, No. 36, Geological Series: St. Hilaire (Beloeil) and Rougemont Mountains, Quebec. By J. J. O'Neill. Pp. vi+108. Memoir 52, No. 42, Geological Series: Geological Notes to accompany Map of Sheep River Gas and Oil Field, Alberta. By D. B. Dowling. Pp. ii+26. (Ottawa: Government Printing Bureau.)

Beiträge zur Naturdenkmalpflege. Band iv., Heft 2. Ueber den Schutz der Natur Spitsbergens. By H. Conwentz. Pp. 65–138. (Berlin: Gebrüder Borntraeger.)

Odontologische Studien II. Die Morphogenie der Primatenzähne. By Prof. L. Bolk. Pp. viii+181. (Jena: G. Fischer.) 7 marks.

Philosophical Transactions of the Royal Society of London. Series B., Vol. 205: Some Notes on Soil Protozoa. By C. H. Martin and K. R. Lewin. Pp. 77–94. (London: Royal Society.)

The Leather Trades' Year Book. Edited by M. C. Lamb and J. G. Parker. Pp. 210. (London: Anglo-American Technical Co., Ltd.) 3*s*.

Storied Windows. By A. J. de H. Bushnell. Pp. xi+338+plates. (Edinburgh and London: W. Blackwood and Sons.) 15*s*. net.

Morocco the Piquant. By G. E. Holt. Pp. xi+242. (London: W. Heinemann.) 6*s*. net.

A Natural History of Bournemouth and District. By the Members of the Bournemouth Natural History Society. Edited by Sir D. Morris. Pp. xiv+400. (Bournemouth: The Natural Science Society.) 2*s*. 6*d*. net.

The Fauna of British India, including Ceylon and Burma: Orthoptera (Acridiidæ). By W. F. Kirby. Pp. ix+276. (London: Taylor and Francis.) 10*s*.

Simplification Studies. I.: Stellar Aberration. Part i. By M. Niles. Pp. 100. (Brunswick, Maine: Brunswick Publishing Co.)

The Theory of Relativity. By Dr. L. Silberstein. Pp. viii+295. (London: Macmillan and Co., Ltd.) 10*s*. net.

A First School Calculus. By R. Wyke Bayliss. Pp. xii+288. (London: E. Arnold.) 4*s*. 6*d*.

Berichte der Naturforschenden Gesellschaft zu Freiburg i Br. Zwanzigster Band 1913 u. 1914. Heft 2. Edited by Prof. W. Schleip. Pp. v+182. (Naumburg.)

Livingstone College Year Book, 1914. Pp. 136. (Leyton: Livingstone College.)

Board of Agriculture and Fisheries. Fishery Investigations. Series II. Sea Fisheries. Vol. i., Part i., Report on Market Measurements in relation to the English Haddock Fishery during the years 1909–1911. Pp. iv+133. (London: H.M.S.O., Wyman and Son, Ltd.) 4*s*. 6*d*.

The Romanes Lecture, 1914. The Atomic Theory. By Sir J. J. Thomson. Pp. 39. (Oxford: Clarendon Press.) 1*s*. 6*d*. net.

Roger Bacon: Essays contributed by various writers on the occasion of the Commemoration of the Seventh Centenary of his Birth, collected and edited by A. G. Little. Pp. viii+426. (Oxford: Clarendon Press.) 16*s*. net.

Der Säugetierorganismus und seine Leistungen. By Prof. E. T. v. Brucke. Erster Teil. Pp. 192+plates. Zweiter Teil. Pp. 173. (Leipzig: P. Reclam, jun.) Two parts in one volume. 1.75 marks.

The Unconscious. By Prof. M. Prince. Pp. xii+549. (London: Macmillan and Co., Ltd.) 8*s*. 6*d*. net.

The Essence of Astronomy. By E. W. Price. Pp. xiv+207. (New York and London: G. P. Putnam's Sons.) 10*s*. 6*d*. net.

Studies in Economic and Political Science. Edited by Hon. W. Pember Reeves. Kinship and Social Organisation. By Dr. W. H. R. Rivers. Pp. vii+96. (London: Constable and Co., Ltd.) 2*s*. 6*d*. net.

Studien in der Geophysik und der Kosmischen Physik. By O. Pettersson. Pp. 31. (Berlin: E. S. Mittler und Sohn.)

Ancient Egypt. By Prof. E. J. Rapson. Pp. viii+199. (Cambridge: University Press.) 3*s*. net.

Smithsonian Institution. U.S. National Museum. Bulletin of the U.S. National Museum. No. 50, The Birds of North and Middle America. Part vi. By

R. Ridgway. Pp. xx+882+xxxvi plates. (Washington: Government Printing Office.)

University of Pennsylvania. The Museum Anthropological Publications. Vol. iii. No. 3. Excavations in Eastern Crete Vrokastro. By E. H. Hall. Pp. 75–185+plates xvii–xxxv. (Philadelphia: University Museum.)

Smithsonian Institution. U.S. National Museum. Bulletin 84. A Contribution to the Study of Ophiurans of the United States National Museum. By Prof. R. Kœhler. Pp. vii+173. (Washington: Government Printing Office.)

The Journal of the Institute of Metals. Edited by G. Shaw Scott. Vol. xi. Pp. ix+437. (London: Institute of Metals.) 21*s*. net.

International Meteorological Committee. Report of the Tenth Meeting, Rome, 1913. Pp. 98. (London: H.M.S.O.; Wyman and Sons, Ltd.) 2*s*.

Les Coordonnées intrinsèques Theorie et Applications. By Dr. L. Braude. Pp. 100. (Paris: Gauthier-Villars et Cie.)

An Introduction to the Study of Organic Chemistry. By Dr. H. T. Clarke. Pp. viii+484. (London: Longmans and Co.) 6*s*. 6*d*.

The Theory of the Solid State. By Prof. W. Nernst. Pp. viii+104. (London: Hodder and Stoughton.) 2*s*. 6*d*. net.

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

Australasian Fossils. By F. Chapman. Pp. 341 and map. (Melbourne: George Robertson and Co., Ltd.; London: Dulau and Co., Ltd.) 7*s*. 6*d*. net.

Die Pendulations-Theorie. By Prof. H. Simroth. Zweite Auflage. Pp. xv+597. (Berlin: K. Grethlein.)

Naturwissenschaftliche Bibliothek für Jugend und Volk: Vulkane und Erdbeben. By Prof. R. Brauns. Pp. vi+168. Aus Seen und Bächen die niedere Tierweldt unserer Gewässer. By Dr. G. Ulmer. Pp. ix+149. Der deutsche Obstbau. By F. Meyer. Pp. v+207. (Leipzig: Quelle und Meyer.) 1.80 marks each.

The Life and Work of Roger Bacon: An Introduction to the Opus Majus. By J. H. Bridges. Edited, with Additional Notes and Tables, by H. G. Jones. (London: Williams and Norgate.) 3*s*. net.

The Beginner's Garden Book. By A. French. Pp. viii+402. (London: Macmillan and Co., Ltd.) 4*s*. 6*d*. net.

Native Tribes of the Northern Territory of Australia. By Prof. Baldwin Spencer. Pp. xx+516. (London: Macmillan and Co., Ltd.) 21*s*. net.

Greek Philosophy. Part i. Thales to Plato. By J. Burnet. Pp. x+360. (London: Macmillan and Co., Ltd.) 10*s*. net.

The British Empire Beyond the Seas. By Dr. M. I. Newbigin. Pp. xii+351. (London: G. Bell and Sons, Ltd.) 3*s*. 6*d*.

The Future of Education. By F. C. C. Egerton. Pp. 303. (London: G. Bell and Sons, Ltd.) 3*s*. 6*d*. net.

An Introduction to Celestial Mechanics. By Prof. F. R. Moulton. Second edition. Pp. xvi+437. (London: Macmillan and Co., Ltd.) 15*s*. net.

The Rose of the Winds: the Origin and Development of the Compass-Card. By Prof. S. P. Thompson. Pp. 31+6 plates. (London: H. Milford.) 4*s*. net.

A New Analysis of Plane Geometry, Finite and Differential. By A. W. H. Thompson. Pp. xvi+120. (Cambridge University Press.) 7*s*. net.

Bird Studies. By W. P. Westell. Pp. xii+152. (Cambridge University Press.) 2*s*. 6*d*. net.

DIARY OF SOCIETIES.

THURSDAY, JUNE 25.

ROYAL SOCIETY, at 4.30.—The Spectrum of Elementary Silicon: Sir W. Crookes.—Note on Mr. Mallock's Observations on Intermittent Vision: Prof. S. P. Thompson.—Attempts to Produce the Rare Gases by Electric Discharge: T. R. Merton.—The Analysis of Gases after Passage of Electric Discharges: O. C. G. Egerton.—Dilute Solutions of Aluminium in Gold: C. T. Heycock and F. H. Neville.—The Variation of Electrical Potential across a Semipermeable Membrane: Prof. F. G. Donnan and G. M. Green.—The Potential of Ellipsoidal Bodies and the Figures of Equilibrium of Rotating Liquid Masses: J. H. Jeans.—The Twenty-seven-Day Period in Magnetic Phenomena: Dr. C. Chree.—Electrification of Water by Splashing and Spraying: J. J. Nolan.—Effect of Pressure upon Arc Spectra. V.: W. G. Duffield.—Measurement of Alternating Electric Current of High Frequency: A. Campbell and D. W. Dye.—*And other Papers.*

FRIDAY, JUNE 26.

PHYSICAL SOCIETY, at 5.—Atmospheric Refraction and its Bearing on the Transmission of Electromagnetic Waves Round the Earth's Surface: Prof. J. A. Fleming.—Atmospheric Electricity Observations made at Kew Observatory: G. Dobson.—Thermal and Electrical Conductivities of some of the Rarer Metals and Alloys: T. Barratt.—The Measurement of the Temperature Coefficient of Young's Modulus for Metallic Wires, with Special Application to Nickel: Prof. E. P. Harrison.—Some Investigations on the Arc as a Generator of High Frequency Oscillations: F. Mercer.

THURSDAY, JULY 2.

ROYAL GEOGRAPHICAL SOCIETY, at 5.—Lithological Map of the British Isles: Alan G. Ogilvie.

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