

THURSDAY, JULY 4, 1912.

STATISTICS OF MAGNETIC CHANGE.

Studies in Terrestrial Magnetism. By Dr. C. Chree, F.R.S. Pp. xii+206. (London: Macmillan and Co., Ltd., 1912.) Price 5s. net. (Macmillan's Science Monographs.)

THE title of this monograph would enable many of those interested in the subject to give a shrewd guess at the author's name. During the nineteen years of Dr. Chree's superintendence of Kew Observatory he has published several laborious investigations as contributions towards the elucidation of the cause and manner of the different periodic variations of terrestrial magnetism. A reasoned *résumé* of his previous conclusions forms the basis of the present work, which also touches on some of Prof. Birkeland's suggestions, and indicates in what directions the author looks for further advance.

We must confess at the outset, however, that we look in vain for any touch of picturesque imagination to relieve the solemnity of physical facts and mathematical analysis, and perhaps attract an uninterested reader. The subject is one that offers a field for speculation quite as wide as, say, the "canals" of Mars; but Dr. Chree is not like Prof. Lowell. We cannot imagine the latter writing in reference to any of his *dicta*:—"It will probably, however, be generally conceded that it at least creates a strong presumption that the accuracy attained is highly satisfactory" (p 82).

We find practically no attempt at any physical hypothesis to account for the various phenomena that emerge from the scrupulous analysis to which the recorded magnetic movements have been submitted. Prof. Birkeland's classification of magnetic storms is quoted without explanation, so that we infer that Dr. Chree is not satisfied with it, or, at any rate, has not thought it worth while to work on those lines.

The first chapters are elementary and, of course, quite sound, explaining the apparatus used for obtaining magnetic records and what is meant by secular change. Non-cyclic change, on which the author has previously laid stress, occupies a chapter to itself. There is no hint as to which side he would take in the controversy as to whether a magnetic storm is the discharge of a slowly charged "Leyden jar," or a sudden charge which slowly dissipates afterwards. From the analogy of certain curious meteorological "non-cyclic" effects, it is probable that the caution here is not misplaced.

Diurnal inequality on "quiet" and "disturbed" days, and also on "ordinary" days, fill three more

chapters. It may be remarked that there is a great opening for "personal" error in the want of a uniform system of "smoothing" disturbed days. The author as usual lays stress on Fourier analysis of the diurnal inequalities, but is satisfied to leave to the imagination of the reader what the physical meaning of the shorter period waves may be. Absolute daily range is to a certain extent accidental, and seems to add very little to the information obtainable from "smoothed" curves, but it is quite right to include a chapter on this, as data are regularly published by several magnetic observatories.

Some of the most interesting chapters in the book deal with Antarctic magnetic results, and several examples are given showing how very much more disturbed the Antarctic curves are than those of lower latitudes. In some cases Arctic curves are also available for comparison.

There is a chapter on "Sudden Commencements," but Dr. Chree does not deal with the work of Mr. Faris on the rate of propagation, in which he is probably influenced by the great gulf between what he considers the probable accuracy of time determination from a magnetogram, and the decimals of a second employed by the Americans.

The latter part of the book is devoted to the relations between sunspots and terrestrial magnetism. It is accepted as beyond question that these are related phenomena, though it is not so clear whether the relation is simply that of "cause" and "effect." It is unfortunate, perhaps, that there is nothing approximating to commensurability in the various time units involved, the rotations of the earth and sun, the revolution of the earth, the periods of the moon, and the so-called sunspot period. But we must take strong exception to the concluding paragraph. The author should have known that astronomers have for some years been in the habit of classifying sunspots in different stages of their life-history, and "active" and "quiescent" spots are quite as definite as "quiet" days. The spotted area and its conventional measure, the "sunspot number," seem to be regarded by Dr. Chree as the last word in sunspot analysis, so that in this particular he is apparently behind the times. W. W. B.

INTRODUCTION TO THE STUDY OF HEREDITY.

Allgemeine Vererbungslehre. By Prof. V. Haecker. Pp. x+392. (Braunschweig: F. Vieweg & Sohn, 1911.) Price 14 marks.

IN the last few years there has been, not unnaturally, a succession of "Introductions" to the study of heredity, but none better than Prof.

Haecker's. It differs from several of its analogues in being successfully comprehensive, dealing with the cytological, the experimental, and even the statistical methods of studying the hereditary relation. It says most about the first, as one would expect from the fact that most of the author's researches have been concerned with the germ-cells, and least about the last, so difficult to expound in a general treatise; but it is a well-balanced book, and it displays competence and carefulness conspicuously throughout. It is surely an achievement to write an effective introduction to the science of genetics, for it implies familiarity with the three lines of attack already referred to, and it cannot be done satisfactorily by one who is not equally at home with botany and with zoology. The difficulty is increased by the rapid growth of the study; important researches follow on the heels of one another faster than most of us can read them. Nor is it always easy for one who has not been working at the subject to get a grip of the technical papers—whether cytological, Mendelian, or biometric. Hence the welcome that must be given to a book like this before us, in which the author moves with a firm step and guides us discriminatingly to the more essential facts.

The book begins with illustrations of the facts of inheritance, and with a warning about the difference between rules and laws (the latter being as yet very few). Then follows a short account of statistical methods. The second section of the book deals with the material basis of inheritance—the history of the germ-cells, their maturation and fertilisation, the chromosomes and their behaviour. The third section is devoted for the most part to Weismann's contributions—his theory of the continuity of the germ-plasm, and his scepticism as to the transmission of somatic modifications. The fourth section is experimental, that is to say, it deals with Mendelism. The fifth section is of great interest, dealing with debated questions more or less bound up with the question of the material basis of inheritance. Prof. Haecker deals in a masterly way with such subjects as the individuality of the chromosomes, the processes of reduction, the chromosomes as vehicles of inheritance, the existence of sex-determining chromosomes. The last chapter expounds a cytological theory of the process of Mendelian segregation. Appended to each of the thirty-three chapters there is a carefully selected bibliography.

To our thinking, Prof. Haecker's book is a remarkable success—it is clear, comprehensive, and fair-minded. The author is a teacher as well as an investigator, and he has known what to

leave out as well as what to put in. The device of numerous short chapters is very effective; the illustrations are admirable and always of real service; and the temper of discussion is scientific throughout.

MINERAL LOCALITIES.

Mineralien-Sammlungen. Ein Hand- und Hilfsbuch für Anlage und Instandhaltung mineralogischer Sammlungen. By Dr. W. Brendler. ii. Teil. Pp. viii+700. (Leipzig: W. Engelmann, 1912.) Price 20 marks.

IN the first part of this work, which we noticed three years ago, Dr. Brendler described, mainly for the benefit of the amateur collector of minerals, the characters by which the various species may be discriminated, and the most suitable methods for housing and displaying a mineral collection, and for registering and labelling the specimens. The section dealing with the care of the specimens was particularly useful, because the subject is not referred to in text-books of mineralogy. The present volume, which forms the second and concluding part of the work, covers more familiar ground, and treats systematically of the mineral species, the classification being the same as that adopted by Prof. P. von Groth in his "Tabellarische Uebersicht der Mineralien." Under each species are given the chemical formula, the system in which it crystallises, the hardness and specific gravity, the streak and colour, and a full list of the prominent localities at which it has been found, reference to the list being facilitated by the use of heavy type for countries or large districts and of spaced type for the actual places.

The information is therefore an abstract of that contained in Dana's "System of Mineralogy" or Hintze's "Handbuch der Mineralogie"; but, although it might have been usefully expanded by some description of typical crystals and some account of the association of the several species, it will suffice for the ordinary requirements of most collectors. At the same time, it should be noted that the volume is very much cheaper in price and handier in form than these large treatises, and, moreover, it possesses a very great advantage in an index of localities as well as one of species, a good topographical list being most useful to a collector. The names of places in Greenland have been carefully revised, and the meanings, in German, of the words are stated.

The intention of the book is good, but the execution is less praiseworthy. Making every allowance for the difficulty of collecting and bring-

ing up to date such a mass of data, it is scarcely satisfactory that an appendix of thirty-seven pages should be required to a text of 471 pages; even this does not suffice, and thirteen further pages of additions and corrections are called for. In the list of literature given on p. 520, which presumably represents that consulted, we do not find the *Mineralogical Magazine*. The fact that the appendix contains data which appeared in that journal no fewer than ten years ago suggests that the author did not till the eleventh hour become aware of the work which had been done in this country.

MICROSCOPIC ANATOMY.

Text-book of Microscopic Anatomy. By Prof. E. A. Schäfer, F.R.S. Pp. xiv+739. ("Quain's Elements of Anatomy." Eleventh edition. Editors: Prof. E. A. Schäfer, F.R.S., Prof. J. Symington, F.R.S., and Prof. T. H. Bryce. In four volumes. Vol. ii, Part i.) (London: Longmans, Green and Co., 1912.) Price 25s. net.

IT is with very mixed feelings that the anatomist will contemplate this new part of the eleventh edition of the so-called "Quain's Elements of Anatomy." Since the last edition appeared this part has tripled its size, quadrupled its illustrations, and attained the dignity expressed in its subsidiary title, "Text-book of Microscopic Anatomy"; and both the author and the publishers are to be congratulated on the wealth and beauty of its illustration, even though so many of them have been borrowed from familiar text-books. One might perhaps have wished for fuller information in regard to certain tissues, such, for example, as the Purkinje-fibres of the heart; but considered as a whole it is the standard work on microscopic anatomy in our language.

The chief criticism one feels bound to make arises from the very excellence of the work, which, by helping to stereotype a stupid subdivision of anatomy into gross, microscopic, and fetal, will hinder that reform in anatomical teaching which is felt to be urgent by the leading teachers throughout the world. By continuing to cut asunder and put into separate volumes the information concerning the structure of the body that can be acquired by examination respectively with and without the help of a lens, or a system of lenses, the editors are perpetuating a drag on medical education that is fraught with infinite harm both to students and teachers. Moreover, the developmental history, the chief use of a knowledge of which is to explain the complexities of the adult structure and its varia-

tions, is also separated from the rest. The editors of "Quain" missed a great opportunity when they declined to take part in this reform of anatomical teaching which is now in active progress; and I believe they have in some measure lessened the value of this famous book, if they have not intensified the forces of reaction, by refusing to move with the times.

One might also have expected on the part of the distinguished physiologist who has written this treatise on anatomy fuller reference to the functional significance of the organs and tissues under consideration, which obviously plays so large a part in determining their structure.

A more serious attempt has been made in this volume to supply a bibliography than was the case in the other volumes issued; and for this reason, as well as for its greater accuracy of statement and quotation, this part is likely to be used more widely as a work of reference.

G. E. S.

MECHANICS AND THEORETICAL PHYSICS.

- (1) *Theoretische Mechanik.* By Prof. Robert Marcolongo. Autorisierte deutsche Bearbeitung von Prof. H. E. Timerding. Zweiter Band: "Dynamik und Mechanik der deformierbaren Körper." Pp. vii+344. (Leipzig and Berlin: B. G. Teubner, 1912.) Price 10 marks.
- (2) *The Practical Science of Billiards and its "Pointer."* By Col. C. M. Western. Pp. iv+153. (London: Simpkin, Marshall and Co., Ltd., 1911.) Price 3s. 6d. net.
- (3) *Physical Significance of Entropy or of the Second Law.* By Prof. J. F. Klein. Pp. xx+98. (New York: D. Van Nostrand Co., 1910.) Price 1.50 dollars net.
- (4) *Populär-wissenschaftliche Vorlesungen.* By Prof. E. Mach. Vierte Auflage. Pp. vii+568. (Leipzig: J. Ambrosius Barth, 1910.) Price 6.80 marks, or 7.50 marks bound.
- (5) *Thermodynamique et Chimie.* By Prof. Pierre-Duhem. Seconde Édition. Pp. xii+580. (Paris: A. Hermann et Fils., 1910.) Price 16 francs.
- (6) *Kant's gesammelte Schriften.* Herausgegeben von der K. Preuss. Akad. der Wissenschaften. Band xiv. Pp. lxii+638. (Berlin: Georg Reimer, 1911.) Price 19 marks.

(1) THE feature to which objection was taken in the review of the first volume of Marcolongo and Timerding's "Theoretical Mechanics" (the advanced character of the early portions and the elementary character of the later ones) is not shared by the second volume. It

deals with particle and rigid dynamics, theory of the potential, analysis of stress and strain, and the equations of hydrodynamics. This book, therefore, belongs to a class, of which we have seen previous examples, in which it is sought to condense into one volume the fundamental principles of several portions of applied mathematics, the detailed study of each of which would occupy a volume to itself. As Dr. Timerding points out, this necessitated careful pruning down of the subject-matter, and he expresses the hope that the selection will suffice for the object in view. The kind of reader who will really profit by a book of this character is the student of modern physics who requires to acquire this particular knowledge in his undergraduate days, and who subsequently proposes a course of training in research. For him the book should be very useful.

(2) It would have been a great improvement if Col. Western had arranged for a few hours' coaching with a modern graduate in mathematics or physics before attempting to enlighten the public on the practical *science* of billiards. His graphical constructions for the deviation of a billiard ball after impact are all right, but it would have been greatly conducive to lucidity if he had explained the dependence of the result on the coefficient of restitution. A more serious defect is that the author speaks of the "forces of a ball" when that ball may be moving with uniform velocity in a straight line. This is a misuse of the term "force" which is quite unnecessary, and calculated to prejudice the scientific reader against the book. The author's explanation of the curved path of a ball on p. 75 is also on the face of it unsound. Nevertheless, he claims to have invented a "pointer," which enables a beginner to find where to place his balls, and where to aim when attempting any particular stroke, and this appears to be correct in principle, and to enable allowances to be made for differences in strength or mode of playing, as well as for other factors which may affect the result.

(3) In "The Physical Significance of Entropy" Prof. J. F. Klein has attempted to present the general conclusions arising from the investigations of Boltzmann and Planck, the former dealing mainly with molecular systems, and the latter with radiation phenomena. Planck's treatise was reviewed some time ago in NATURE. The particular aspect of the problem here dealt with is the connection of the second law with probability considerations. In separating the conclusions from their analytical proofs, Prof. Klein has given the unmathematical reader a statement of results which he must accept on the authority of Boltz-

mann and Planck unless he is prepared to study up the original difficult mathematical investigations. The trouble is that these books fall into the hands of readers with whom a little knowledge is a dangerous thing, and who without troubling to study the matter thoroughly rush into print with theories of their own, in which the most conspicuous feature is the flagrant misuse of elementary physical terms.

Although these statistical considerations have certainly been successfully applied to the interpretation of current physical events, it must not be forgotten that they possess one important difficulty. While the theory of probability shows that the entropy of a system tends to a maximum, the same arguments appear to indicate the extreme improbability that the entropy should ever deviate from this maximum, and we are thus required to postulate an initial state of the universe, the improbability of which becomes increasingly difficult to understand as we go further and further back in the scale of time.

It should be stated that Prof. Klein makes no claims to originality, and his book is well suited to specialists in other branches of science who want to know the gist of what has been done in this particular subject.

In connection with this review, mention may be made of a recent paper by Planck in the *Annalen der Physik*, 37 (1912), on the foundation of the law of black-body radiation, in which the statistical method is again employed.

(4) Prof. E. Mach's "Popular Scientific Lectures" is a miscellaneous collection of twenty-six articles averaging rather under twenty pages in length, dealing with varied questions in physics, philosophy, physiology, and psychology, and including music, photographs of flying bullets, binocular vision, space and time, relative value of different educational studies, elements of electrostatics, energy and entropy, and other subjects equally diverse in character. It is the kind of book to be read in leisure half-hours by a business man who is interested in science but has no time for extended study. Under "symmetry in music" we notice an interesting experiment which may easily be reproduced by reversing a music-roll and playing it with the bass end towards the treble.

(5) It would be unnecessary to refer in detail to the latest edition of Prof. Duhem's "Thermodynamics and Chemistry," since this work has now become a recognised text-book, and the English translation, which appeared in 1903, is largely read both in this country and in America. Since the first edition science has lost Willard Gibbs, Van der Waals, and Bakhuis Roozeboom;

on the other hand, the work on metallic alloys by Gustav Tammann and several other investigations, including a discussion of quadrivariant systems by Schreinmakers and De Baat, are new, and are included in this volume. Another change that has been gradually taking place has been the growing importance attached to the phase rule and its applications in the chemical industry, where many firms employ experts engaged in making theoretical calculations and not experiments only.

(6) Volume 14 of Kant's collected works, issued under the auspices of the Prussian Academy of Sciences, is the first of a new series dealing with Kant's manuscript relics. The first thirteen volumes comprise Kant's principal works and correspondence, and this volume includes all those minor writings which refer to mathematics, physics, chemistry, and physical geography. A few of these, notably the mathematical ones, are what an examiner would describe as "rough work," and the editor has evidently been at much trouble to interpret some of the fragments in the copious notes which go far to make up the bulk of the volume.

OUR BOOKSHELF.

The Calorific Power of Gas: a Treatise on Calorific Standards and Calorimetry. By J. H. Coste. Pp. xvi+310. (London: C. Griffin and Co., Ltd., 1911.) Price 6s. net.

AN increasing proportion of coal-gas now manufactured is used for heating and power purposes, in which the value of the gas is directly measured by its calorific value. Of the gas used for lighting, the bulk of it is now burnt with incandescent mantles, and for this purpose the calorific value is a better measure of value than the direct photometric candle-power with an Argand burner. Hence the methods of measuring the calorific value of gas have assumed practical importance, and the present book supplies a distinct need.

Gas supply being in this country a practical monopoly, and the gas consumer being unable to gauge the quality of the gas supplied to him, from a very early date the testing of gas has been subject to statutory regulation, and in the opening chapters a clear and concise account is given of gas legislation. The relation between the present photometric standards and the equivalent calorific standards is then dealt with, and this is followed by a discussion of the changes in the mode of gas manufacture during the last sixty years as affecting the lighting and heating values. Then follow descriptions of the construction and mode of working of a considerable number of gas calorimeters of different types, special attention being given to those which have been most generally adopted.

The author has had practical acquaintance with

all the types of instruments in general use, and gives the results of his experience, in many cases not previously published. The discussion on the sources of error affecting the results of flow calorimeters is especially valuable, as is also the account of the various "net values" which have been proposed.

The work will be highly appreciated by gas engineers, gas examiners, and everyone concerned with the manufacture or testing of coal gas.

Catalogue of the Chiroptera in the Collection of the British Museum. Second edition. By Knud Andersen. Vol. i., "Megachiroptera." Pp. ci+854. (London: Printed by Order of the Trustees. Sold by Longmans and Co.; B. Quaritch, Dulau and Co., Ltd.; and at the British Museum (Natural History), 1912.) Price 2l. 10s.

THE present account of the Megachiroptera, although nominally a new edition of Dobson's Catalogue published in 1878, is in reality an original monograph, and the trustees of the British Museum have been fortunate in securing for this work the services of Dr. Knud Andersen, whose name alone is sufficient guarantee for a careful and accurate revision of the group.

In the introduction will be found a detailed discussion of the general characters, the interrelations of the genera, the geographical distribution, and a synopsis and key, the latter based on dental and cranial characters only.

The body of the work consists of new descriptions of 228 forms, and the subject-matter is divided for convenience of reference into specially marked paragraphs. The technical names are throughout fixed in strict accordance with the laws of priority.

The work appears to have been extremely well done, and the author and Mr. Oldfield Thomas, without whose support it could not have been attempted, deserve very warm congratulations on the appearance of vol. i., and good wishes for the completion of the whole catalogue.

The illustrations have been entrusted to A. J. Engel Terzi, and appear to be very satisfactory.

Icones Plantarum Formosanarum nec non et Contributiones ad Floram Formosanam; or, Icones of the Plants of Formosa, and Materials for a Flora of the Island, based on a Study of the Collections of the Botanical Survey of the Government of Formosa. By B. Hayata. Fasciculus i. Pp. iii+265+x1 plates. (Taihoku: Published by the Bureau of Productive Industry, Government of Formosa, 1911.)

PREVIOUS to 1897, when the Japanese took possession of Formosa, the botanical exploration of the island was almost entirely due to British enterprise, but the savage inhabitants had prevented travellers from penetrating the mountainous interior. Since their occupation the Japanese have been very active in the investigation of the natural products, and botanists have not been the least active. The botanical literature

is already considerable, and includes a "Flora Montana Formosæ" by the author of the work now under review, as well as a more comprehensive publication mainly compiled by Dr. Hayata at Kew.

Although bearing a primary Latin title, the present work is written entirely in English in a clear and idiomatic style. As we learn from the "Introduction," the *Icones* will contain 600 plates, illustrating nearly all the plants to be found in Formosa, and accompanied by descriptions. These will be issued yearly for fifteen years in separate numbers, each containing forty plates. Dr. Hayata's estimate of the total number of vascular plants now known to inhabit the island is 2660 species belonging to 836 genera and 156 families. There is a considerable endemic element in species, but the number of peculiar genera is relatively small.

The "*Icones*" are excellently drawn and engraved on copper, with ample floral analyses, and comprise the families Ranunculaceæ to Umbelliferae. In concluding this brief notice we strongly protest against the barbarous manner in which letterpress and plates are nailed together, with stout nails, a quarter of an inch within the margin. It was necessary, though difficult, to extract these already rusty nails before we could consult the book.

W. BOTTING HEMSLEY.

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.]

Hybrid Sea-urchins.

It may interest readers of NATURE to learn that this season we have been successful in crossing the two species of British sea-urchin, *Echinus nuharis* and *E. acutus*, at the Imperial College, and that we have reared the hybrid larvæ through their entire developmental cycle in our tanks, and have now hybrid sea-urchins creeping about.

Further, in a culture of the larvæ of *E. nuharis*, which was instituted as a control, a puzzling barrel-shaped organism turned up. Microscopic examination revealed the fact that this organism had been derived from a larva in which a water-vascular system, with all its outgrowths, had been developed on the right side, as well as on the left, and which had completed its metamorphosis. The right water-vascular system, though provided with the typical number of fifteen tentacles, was smaller than the left, and was not parallel with it so far as the plane of the water-vascular ring was concerned.

Last autumn I published an account of a fully developed larva of *E. esculentus*, which had two water-vascular systems, but that larva had not metamorphosed. The specimen which turned up this year has been suitably preserved, and an account of its anatomy will be published later.

E. W. MACBRIDE.

Royal College of Science, South Kensington,
London, S.W., June 21.

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July Meteor-showers.

THE following meteor-showers become due during the month of July:—

Epoch July 5, 15h. 30m. (G.M.T.), approximately fifth order of magnitude. Principal maximum, July 4, 11h. 35m.; secondary maxima, July 2, 15h., and July 3, 12h. 40m.

Epoch July 5, 20h. 30m., approximately twenty-third order of magnitude. Principal maximum, July 4, 14h. 40m.; secondary maximum, July 4, 5h. 50m.

Epoch July 8, 2h. 30m., twenty-first order of magnitude. Principal maximum, July 6, 8h. 10m.; secondary maximum, July 4, 21h. 50m.

Epoch July 8, 5h., twenty-seventh order of magnitude. Principal maximum, July 6, 18h. 30m.; secondary maxima, July 7, 17h. 15m. and 22h. 50m.

Epoch July 10, 20h., eighth order of magnitude. Principal maximum, July 9, 13h. 52m.; secondary maximum, July 9, 11h. 25m.

Epoch July 9, 3h., approximately twenty-fifth order of magnitude. Principal maximum, July 10, 10h. 10m.; secondary maxima, July 10, 11h. 35m. and 23h. 5m.

Epoch July 11, 10h. 30m., approximately seventh order of magnitude. Principal maxima, July 11, 10h. 30m., and July 13, 7h.; secondary maximum, July 12, 15h.

Epoch July 13, 15h., twelfth order of magnitude. Principal maxima, July 11, 10h. 30m., and July 13, 14h. 50m.; secondary maximum, July 12, 8h. 10m.

Epoch July 11, 5h., twenty-eighth order of magnitude. Principal maximum, July 11, 21h. 50m.; secondary maximum, July 11, 10h. 25m.

Epoch July 14, 13h., eleventh order of magnitude. Principal maxima, July 14, 20h. 5m., and July 16, 13h. 45m.; secondary maximum, July 15, 1h.

Epoch July 15, 18h. 30m., eighth order of magnitude. Principal maximum, July 16, 1h. 10m.; secondary maximum, July 17, 11h. 25m.

Epoch July 16, 2h. 30m., eleventh order of magnitude. Principal maxima, July 16, 3h. 10m., and July 17, 22h. 30m.; secondary maximum, July 16, 12h. 35m.

Epoch July 19, 10h., ninth order of magnitude. Principal maximum, July 20, 22h. 15m.; secondary maxima, July 19, 15h. 45m., and July 21, 8h. 15m.

Epoch July 21, 12h., approximately twenty-first order of magnitude. Principal maximum, July 22, 11h. 10m.; secondary maxima, July 22, 13h. 30m., and July 23, 0h. 55m.

Epoch July 29, 3h., approximately second order of magnitude. Principal maximum, July 28, 2h. 50m.; secondary maximum, July 27, 16h. 30m.

Epoch July 27, 21h., twenty-second order of magnitude. Principal maxima, July 28, 8h. 10m., and July 30, 3h. 35m.; secondary maximum, July 29, 20h. 50m.

An important maximum of the month is the first principal maximum, which takes place shortly before midnight on July 4. Another maximum calling for special notice becomes due on July 11, 19h. 30m. There is considerable meteoric activity on July 16, highly concentrated maxima occurring on July 16, 1h. 30m. and 13h. 45m. Three maxima, belonging to the weaker epochs, deserve also special mention: two of these occur on July 6 at 8h. 10m. and 18h. 30m. respectively, and the third, which is really stronger than either, on July 22, 11h. 10m.

Dublin, June 24.

JOHN R. HENRY.

PROF. GARSTANG'S EXCAVATIONS IN
NORTHERN SYRIA AND IN THE SUDAN.

I.

THE Hittite site of Sakje-Geuzi has already been described, both in this journal and in the *Liverpool Annals of Archaeology* for 1908. Some five or six large mounds are disposed in the form of a rough circle, and in the centre of these is a smaller one, which has proved to be the site of a royal residence. Work was begun in September, 1911, on the largest of them, called Songrus Eyuk. This, like others which have been examined, proved to be almost wholly artificial—the accumulation of ruined houses and *débris*. It rises to the height of 160 ft. above the plain, and is about 600 ft. by 500 ft. in greatest length and breadth, though the general appearance of its surface is more elongated than these figures suggest.

In the surface of the mound there were found some well-built fortifications, presumably of Seleucid origin. It was not until a depth of about 20 ft. was reached that traces of the Hittite occupation came to view. At 28 ft. the foundations of Hittite houses were laid bare, seemingly those of the latest Hittite period, being just previous to some dated objects of the twenty-sixth Egyptian dynasty. Hittite traces continued all the way down to a depth of 40 ft. A recognisable eighteenth dynasty object provided the much-wanted starting point for the dating of Hittite materials. It was not considered practicable to drive the sounding trenches to a deeper level; but around the slope of the mound examination disclosed the extensive fortification walls that had surrounded it at various periods, and three of these walls were of Hittite origin. That which corresponded to the eighteenth dynasty was double, like the main walls at the neighbouring royal site of Sinjerli. The entrance, at all times, seems to have been from the south, where the slope of the mound is less steep than elsewhere. Plans of the gate defences were obtained. Some instructive small objects were found in this excavation, including several seals and numbers of Syro-Hittite vases, some of familiar character, and others decorated in Hittite style. A terra-cotta Attis-head in "Phrygian hat" was rather striking, but probably post-Hittite.

The smaller mound, Jobba Eyuk, is also entirely artificial, but it rises only some 10 metres above the plain, and, unlike Songrus, it bore little trace of occupation in modern times. There were, however, a number of early and late Roman buildings, which interfered with the complete recovery of the original Hittite plan. The main wall, which is presumed to date from the ninth or tenth century, B.C., was generally 3 metres in thickness, with characteristic external buttresses at frequent intervals projecting a further metre. The form of the enclosure was generally quadrangular, 130 metres by 100. There was apparently only one main entrance, in the middle of the south-western wall. Here the excavators found the original position of that fine scene representing a royal lion-hunt,

the original of which was removed to Berlin some time ago. The royal palace was situated in the north-eastern portion of the enclosure, and, happily, the excavators have been able completely to recover its plan, together with that of the adjoining portion along the western side.

The palace portico, with its finely sculptured lion corner-stones and procession headed by the king, is already well known. It is being recon-



Bottom of a cutting in Jobba Eyuk, north Syria, showing Neolithic houses and burial cists.

stituted in facsimile in a new Hittite gallery in the Liverpool Public Museums. Passing beyond this, from the first hall there open out four doorways: that on the extreme right leads up, by a stairway of decorated stone slabs, to a room at a higher level; two doorways opposite give way to chambers, which, in their turn, lead on to others abutting on the outer wall. The fourth door to the left leads out of the main building to a cobb-

paved courtyard, and from a corner of this a flight of steps lead up on to the main wall, where presumably there was a walk along the ramparts. Without entering into details, the plan of the whole enclosure recalls, in general, that of the great palace at the foot of the Acropolis at Boghaz-Kevi, with a double series of rooms around, and an open space in the middle. From the main entrance a cobbled pathway, partly paved in late times with sculptured slabs, led directly towards the palace portico.

In construction the walls accord very well with what is already known of Hittite works in Syria. They were faced with irregular rough-faced stones, padded with rubble, while the upper courses were carried up in large bricks or brick slabs. In some cases the brick courses of the main wall were preserved to the number of nine or ten. The walls of the palace were of similar principle, though a proportionately smaller size of stones was employed, and only the foundations were of stone. The average thickness of the palace walls was considerable, being no less than $2\frac{1}{2}$ to 3 metres, and so well conserved was this portion of the enclosure, and so free from intrusion, that Prof. Garstang has been able to calculate that the original height of the building was about 5 metres.

This excavation was fortunately attended with much information as to details of Hittite archaeology. An instructive series of seals and small objects was recovered, and approximately dated. On the outer side of the enclosure, also, two student-members of the staff, Mr. Phythian-Adams and Mr. Hamilton-Beattie, carried on a minute examination of the nature and stratification of a great series of Hittite potsherds which had, through long ages, been accumulating at that point. It is hoped to assign definite dates to two, at least, of those strata, from the information secured in the neighbouring mound. At the bottom, instead of finding an undisturbed Neolithic floor, as was the case with Prof. Garstang's former experiment in 1908, they found the foundations and remains of Neolithic houses and burying places, a fact which it is instructive to compare with a recent discovery at Carchemish.

II.

Proceeding to Meroë at the beginning of December, work was at once resumed, with the help of a larger installation of machinery and about 500 native workmen, upon that part of the site which is called the Royal City. This is an enclosure about 1000 ft. by 500 ft., surrounded by a remarkably stout and well-built stone wall, and within this area, it will be remembered, last year there were found both the Bronze Head of Augustus, now in the British Museum, and a considerable hoard of gold treasure and royal jewels. Two royal palaces and several columned buildings had already been uncovered (see *Liverpool Annals of Archaeology*, 1911).

The higher portions of ground, representing, presumably, later periods than the average, were first examined. In this way, without describing the results too minutely, considerable traces of late

Greek and of Roman work were come upon, accompanied with fragments of imported pottery-ware, some with Græco-Egyptian potters' names. This was followed by a remarkably interesting discovery of a small prostyle temple, adhering closely in the details of construction to the strict classical model.

The most striking discovery, however, was that of the royal baths, a large building adjoining one of the royal palaces. This had been constructed with a certain sense of luxury, with cloisters and colonnades, its walls decorated with glazed tiles and frescoes, while numerous statues contributed to the effect. Two of its main chambers have been examined, the one, presumably, a sort of *tepidarium*, in which built-up seats, decorated with carved stone sphinxes and griffins, were arranged in a semi-circle. Near at hand was a large swimming-bath, into which the water was arranged to pour from numerous small cascades on every side. This result was contrived by means of aqueducts and storage cisterns, filled by patient labour from wells near at hand. The walls of this bath were decorated with frescoes, on which elephants and serpents may still be recognised. On the edge are still the figures of musicians, one playing the pipes, another the harp with a sleeping dog at his foot, while a third figure, that of a flute-player, was found in the excavation. All around were carved stone lions and bulls in alternation, while from between them the water gushed from the holes arranged in the walls for that purpose, eight or ten on a side. In the corners the water poured through the open mouths of lions. A flight of steps led down to the bottom, about $2\frac{1}{2}$ metres below the inlet of the water. It was here that the most remarkable discoveries were made, for, apparently to fill up the tank so that building might proceed over the spot in a later period, many of the statues and carved stones and other convenient objects near at hand had been collected and thrown down one after the other. A number of the statues are capable of complete restoration; they include a local Venus, a great reclining figure in the well-known pose of the Vatican God-of-the-Nile, the flute player, and other musicians just mentioned, and other sculptures of semi-classical motive. So far as possible everything was replaced in its original position, and steps immediately taken to preserve this important monument. Those sculptures and other objects to which no place could be assigned have been brought to England and will be exhibited in the rooms of the Society of Antiquaries at Burlington House during July. Amongst these are a number of glazed decorative tiles and medallions, many of which also remain in position upon the wall of the bath. There will also be on exhibition a new series of decorative Meroitic pottery vessels, which have been found this year in greater quantity. The exhibition will be opened by the Bishop of London at a private view on July 8.

Summarising the historical results, it can now be seen that the history of Meroë can be divided into three main periods. The first is that of its origin, when the stone-walled Royal City was built

in the age of Aspelut, about B.C. 700. In this period Egyptian influences predominated in art, as witness the small objects found in the Lion Temple and the building of the Temple of Isis. The Sun Temple must also be assigned to this period, as well as the foundations of the Temple of Ammon on the outskirts of the city. In the second period, which archaeology assigns to 300 B.C., the Egyptian motives gave way entirely to Greek, as witness a small cameo of galloping horses found last year, and the semi-classical statues and general design of the baths just described. This result would seem to accord entirely with what is told of Ergamenes by Diodorus. The third period begins, apparently, with the Christian era, and seems, so far as it has been developed, to have been dominated rather by Roman ideals, and it lasted, so far as determined, down to the middle of the 4th century, A.D., when there is a historical account of the invasion of a King of Axum.

The following axial bearings to magnetic north supplement those given by Prof. Garstang in his "Meroë," p. 26, n. 9:—

Royal Palace ...	294,	17° E.
Do. ...	295,	17° E.
Frescoed Hall ...	292,	25° 30' E.
Prostyle Temple ...	97,	29° E.
Royal Baths ...	195,	} 20° 30' E.
(East Wall)		
Royal City ...	290,	} 28° E.
(Main N.W. Wall)		

The magnetic deviation on December 27, 1910, was determined by observation of Betelgeuse and ε Pegasi as follows:—

Axis of Temple of Ammon, 260.

True Bearing :	294° 3' 51.9"
Magnetic Bearing :	297 — }

The latitude and longitude of a point in this axis on the east wall of the Royal City are as follows:—

Lat.	16° 57'
Long.	33° 42'

COMMITTEE ON SIGHT TESTS FOR SEAMEN.¹

THE Departmental Committee appointed by the Board of Trade, in June, 1910, has reported at considerable length on the questions submitted to it, and has, it may be hoped, brought the controversy concerning them to a conclusion. The Committee was appointed

"to inquire what degree of colour-blindness or defective form vision in persons holding responsible positions at sea causes them to be incompetent to discharge their duties, and to advise whether any and, if so, what alterations are desirable in the Board of Trade sight tests at present in force for persons serving or intending to serve in the Merchant Service or in fishing vessels, or in the way in which these tests are applied."

The Royal Society was represented on the Committee by Lord Rayleigh and by Profs. Gotch, Poynting, Rucker, and Starling, or, after the beginning of 1911, by Prof. Sherrington in the place of Prof. Starling; and the Committee

¹ Report of the Departmental Committee on Sight Tests. (London: Wyman.) Price 4½d.

examined a large number of men of science, of ophthalmic surgeons, and of practical seamen, and conducted a large number of experiments, some of them at Shoeburyness, where distant lights could be observed, and the essential conditions of actual service be reproduced.

The Committee obtained the assistance of colour-blind persons in these experiments, and profited by their mistakes; and it heard the evidence, and examined the apparatus, of Dr. Edridge Green and other gentlemen. Finally, in the wool test for colour vision, it recommends the substitution of a dark brown skein for the red one hitherto employed, and, in the conduct of the test, the division of the whole collection of skeins into as many groups as there are test skeins. Each group should be composed of a fixed number of skeins which resemble the test skein, and a fixed number of those which colour-blind persons are liable to confuse with it; and candidates should be required to divide each group into two parts, those which resemble the test skein, and those which do not.

As an addition to the test thus modified, the Committee recommends the use of a lantern designed for the purpose, and capable of showing either a single light, through a circular opening of 0.2 inch in diameter, or two lights, through holes each 0.02 inch in diameter, and separated by a distance of one inch. This lantern is placed at the level of the candidate's eyes, and the candidate and examiners stand alongside of it, and observe the lights as reflected in a plane mirror ten feet from the lamp. At this distance the angular magnitude of the large aperture is equal to that of a ship's light at 200 yards, and the angular magnitude of the two smaller apertures corresponds to that of a ship's lights at 2000 yards. These are sufficient to test imperfect vision, but are well within the limits of visibility of normal persons.

The Committee recommends that both this lantern and the modified wool test should be used in examining the colour vision of all candidates, and believes that it would be unnecessary to re-examine for colour vision any person who had passed them. It also recommends that the more rigid test for form vision ordered by the Board of Trade to come into operation in 1914 should be adhered to, that any officer holding a certificate whose visual acuteness in the better eye has fallen below half normal should be considered incompetent, and that steps be taken to impress upon parents and guardians, and upon shipowners taking apprentices, the desirability of submitting boys to an expert examination before they adopt the sea as a profession.

A highly important further recommendation is that, whenever judicial inquiries into the causes of shipping casualties are being held, witnesses who give evidence as to the nature and position of coloured signals or lights should always be tested for colour and form vision. The report is signed by all the Commissioners, but Sir Norman Hill appends a memorandum dissenting from certain portions of the recommendations with regard to form vision.

MR. BALFOUR ON FRANCIS BACON.

ON June 27, Mr. Balfour unveiled the statue of Francis Bacon, which has been erected in South Square, Gray's Inn, London. Before the actual ceremony of unveiling, a garden party was held in the gardens of Gray's Inn, at which art, science, law, literature, politics, and other professions were represented, among the guests being Sir William Crookes, O.M., Lord Rayleigh, O.M., Sir William Ramsay, and Sir Henry Roscoe.

The statue, which is the work of Mr. F. W. Pomeroy, A.R.A., is of bronze, and is erected on a pedestal of Portland stone.

In his discourse Mr. Balfour first dealt with Bacon as a politician, and afterwards went on to describe his private character and to comment upon his work as a writer, historian, and philosopher. We reprint from *The Times* the portion of the address in which Mr. Balfour regarded Bacon as a man of science.

What Bacon saw was the neglect of the scientific mind, engaged in verbal disputes, of the patient and childlike attitude of those who come to nature, not to impose upon nature their own ideas, but to learn from nature what it is that she has to teach us. Bacon is never tired of telling us that the kingdom of nature, like the Kingdom of God, can only be entered by those who approach it in the spirit of a child. And there, surely, he was right. There, surely, he really did much to correct the almost insolent futility of those philosophers who thought they could impose upon nature the hasty generalisations which they had picked up partly from their crude observations, partly from their own imaginations.

Many of his admirers speak as if his one claim to our gratitude was that if you examine nature impartially you will be always making useful discoveries. You can vulgarise his view of science and of discovery if you will, but you do great injustice to Bacon if you take that view. It is true that he always, as he said, looked on the estate of man with pity, and to improve the estate of man in succeeding generations was one of his great objects. As we are always talking of Social Reform, I presume that nobody will doubt that it was a great object. And surely that imagination which foresaw all that science could do for the estate of man was no imagination that crawled upon the ground, that could not look up to Heaven, could not see the magnificence of the prospect which was, as he believed, opening out to humanity.

On the contrary, I should like to ask those more competent than myself to decide the question how soon this prophecy of Bacon really began to be accomplished. Though dates cannot be fixed, I believe it will be found that it is relatively recently, say within the last three or four generations, that industry has really been the child of scientific discovery. Great scientific discoveries were made by Bacon's contemporaries, by his immediate successors, in every generation which has followed, but the application of scientific principles to the augmentation of man's power over nature is, I believe, relatively speaking, of quite recent growth. You may find examples here and there, but, broadly speaking, I would ask anybody to cast his eye over the history of discovery in such arts as those of medicine, in the general progress of industrial and agricultural discovery, and I believe he will come to the conclusion forced upon my mind, which is that the effect which science has had, and is now having, and in increasing measure is predestined to

have, upon the course of this world, did not declare itself in unmistakable letters until a century and a half or two centuries had passed since the death of the great man whose name is associated with the philosophy of induction.

You may say to me, "Well, all this is very fine, this prospect of Bacon looking over the Promised Land from Pisgah, but not entering therein (to quote the famous phrase of Cowley's), but what has Bacon done for science?" I say that he did all that a great philosopher and a great writer as distinguished from an investigator can do. He created the atmosphere in which scientific discovery flourishes. If you look at the great men of science who were his contemporaries; if you look at the estimate in which science was held, the fears of orthodoxy, the indifference of statesmen, the contempt of the multitude, you will see that no greater work can be done for science than to see this is one of the greatest tasks that lie before humanity; and if humanity will only set itself to work in the true spirit to deal with that subject they cannot fail to reap a harvest worthy, and more than worthy, of their efforts.

FLORIS OSMOND.

THE death of Floris Osmond at the little village of St. Leu about ten days ago ends the career of a very remarkable man, whose investigations and theories have furnished a solid foundation for our present knowledge of the structure and constitution of steel. The respectful sympathy of scientific metallurgists all the world over will go out to their French colleagues, particularly since Osmond died at the comparatively early age of sixty-three, when they might have hoped to profit for some time to come from the suggestions and inspirations of one who was an acknowledged leader in his field of work.

Osmond began his metallurgical career in the great works of Denain and Anzin at the time when the manufacture of steel was being introduced; a little later he went to Le Creusot, where he met M. Werth, and finally he retired from the metallurgical industry, and devoted himself to scientific investigations in Paris in 1884. Some four or five years ago, following upon the death of his brilliant young collaborator Cartaud, and as a result of increasing deafness, Osmond retired from active work, and took up a quiet rural life at St. Leu, merely remaining in touch with his scientific friends and their work by the medium of an active correspondence. As a result of this voluntary isolation, Osmond was practically alone when he died, and the funeral of a man whose name is honoured wherever scientific metallurgy is known was attended only by the villagers who were his neighbours and six scientific friends from Paris.

Osmond took up the microscopic study of metals seven years after Martens and twenty-one years after Sorby, yet to him is due the great impulse from which the modern science of metallography in its widest sense has sprung. Osmond's most striking work was the discovery of the upper critical points of carbon steel and their explanation by that brilliant "allotropic theory" around which controversy has raged so long. This theory in its

original form may ultimately prove to be inadequate, but so far it stands alone as affording any reasonably satisfactory explanation of the varied phenomena of steel. Its importance was recognised by the award to Osmond in 1897 of the Lavoisier medal of the Société d'Encouragement, and of the Bessemer medal of the Iron and Steel Institute in 1906.

More recently Osmond devoted himself to the study of the crystallography of iron in its various allotropic modifications, and to a study of the modes of plastic deformation of iron and steel. It was in this connection that the writer first came into personal contact with Osmond; divergent views led to a prolonged correspondence, at first of a controversial kind, but the controversy led not only to new experimental work on both sides, but resulted in producing substantial agreement and in building up a personal friendship. Osmond's unflinching courtesy and charm of manner and expression were typical of the man, while his fruitful mind filled all his utterances with thoughtful suggestions.

Osmond was one of the pioneer workers—perhaps the pioneer worker—of steel metallography; his work is naturally bounded by the limitations which hedge all the earliest workers in any new field of research, but however much the widening scope of the science may lead us away from some of Osmond's views, yet his fundamental work will always remain as a splendid monument—one of the foundation stones upon which the systematic scientific control of the great steel industry is being surely, if slowly, erected. It may be hoped that his French colleagues will give that monument a fitting shape by republishing in convenient form those numerous memoirs—more than eighty in number—which he contributed to the subjects with which his name will always be identified.

WALTER ROSENHAIN.

NOTES.

At a meeting of the Lawes Agricultural Trust Committee held on June 25, Dr. E. J. Russell, at present Goldsmiths' Company's assistant for soil investigations, was appointed director of the Rothamsted Experimental Station in succession to Mr. A. D. Hall, F.R.S.

At the extra meeting of the Chemical Society held on June 26, the president announced that the session for 1912-13 would open with a memorial lecture in honour of Antoine Henri Becquerel, late honorary and foreign member of the society, to be delivered by Sir Oliver Lodge, F.R.S., on October 17, and that further particulars would be given later.

An extra meeting of the Chemical Society was held at Burlington House on June 26, Prof. Percy F. Frankland, F.R.S., president, in the chair, when Sir William Tilden, F.R.S., delivered a memorial lecture in honour of Prof. Stanislo Cannizzaro, late honorary and foreign member of the society. A brief account of the early life and education of Cannizzaro was given, and reference made to the part played by him

in the political agitations of 1847 and 1860. In 1861 he was appointed to the chair of chemistry at Palermo University, and ten years later he was made professor of chemistry at the University in Rome, a position he held up to the time of his death on May 10, 1910. Sir William Tilden gave a sketch of the position in which science and education were held in Italy up to 1860, and dwelt at some length on Cannizzaro's valuable contributions to chemical knowledge; to the great part played by him as a teacher, and to the important public office held by him in the advancement of science and education. Sir William Ramsay, who proposed a vote of thanks, and Sir Edward Thorpe, in seconding it, gave personal reminiscences of Cannizzaro, as well as referring to his high scientific attainments.

At the annual general meeting of the British Academy, held in the rooms of the Royal Society on July 1, Dr. A. W. Ward (master of Peterhouse, Cambridge) was re-elected president, and Sir W. R. Anson, M.P., Mr. A. C. Bradley, Mr. D. G. Hogarth, Lord Justice Kennedy, and Prof. C. W. C. Oman were appointed members of council.

At the general meeting of the Faraday Society held on July 2, the following officers were elected:—*President*, Dr. R. T. Glazebrook, F.R.S.; *Vice-Presidents*, Dr. G. T. Beilby, F.R.S., Prof. K. Birkeland, Sir Robert Hadfield, F.R.S., Mr. F. W. Harbord, Prof. Bertram Hopkinson, F.R.S., Mr. Alexander Siemens, and Prof. James Walker, F.R.S.; *Treasurer*, Dr. F. Mollwo Perkin.

THE following have been elected as officers of the Royal Society of Medicine for the session 1912-13:—*President*, Sir Francis H. Champneys, Bart.; *Honorary Treasurers*, Sir William S. Church, Bart., K.C.B., and Sir Henry Morris, Bart.; *Honorary Librarians*, Sir Rickman J. Godlee, Bart., and Dr. Norman Moore; *Honorary Secretaries*, Mr. H. S. Pendlebury and Dr. E. F. Buzzard.

THE autumn meeting of the Iron and Steel Institute is to be held at Leeds on September 30—October 4. On October 1 the members will be welcomed by the Lord Mayor of Leeds, and a selection of papers read and discussed. Similarly, the mornings of the two following days will be devoted to the reading and discussion of papers. Several receptions and numerous excursions have been arranged.

THE Geologists' Association has arranged for the beginning of August next an excursion to West Mayo and the Sligo district. The excursion, which will be conducted by Prof. G. A. J. Cole and Mr. W. B. Wright, is planned to give a general view of the structure of central Ireland, and, in addition, to provide the opportunity for observations round Sligo. Those taking part in the excursion meet at Broadstone Station, Dublin, on July 31, and an itinerary has been arranged lasting until August 9.

THE Linnean Society has issued an appeal to its fellows and their friends for contributions towards the cost of production of a "Nomenclator animalium generum et subgenerum," in course of preparation

under the auspices of the Royal Prussian Academy of Sciences, and edited by Prof. F. E. Schulze, of the University of Berlin. The "Nomenclator" is expected to include 200,000 references gathered by specialists of different countries. The extreme limits of date are 1758 to 1910. The work is well in hand, but the costs are heavy and the editor needs about 1000*l.* to ensure publication at an early date. Cheques and postal orders may be made payable to "The Linnean Society," Burlington House, W.

THE Postmaster-General announces that reduced rates have been adopted for the transmission of the 10 a.m. Greenwich Time Signal over private wires to premises in the London telephone area. If the address to which the signal is to be sent is within half a mile in actual distance from a London town sub-post office, and telegraphic arrangements permit of the direct signals being sent to that office, the charge will be 6*l.* per annum, covering the provision of the necessary wires to the renter's address. If the address is more than half a mile from the telegraph office, the charges of 4*l.* per mile for wire on the roads, or 5*l.* per mile for over house or underground wires on existing routes, will apply to mileage in excess of the first half-mile.

A VIOLENT storm passed over the city of Regina, the capital of the province of Saskatchewan, at 5 p.m. on Sunday, June 30, causing the loss of thirty lives and great destruction to property. A Reuter message from Ottawa states that in the history of western Canada no such storm has been known. Before it entered the city the storm passed directly over the new Provincial Parliament buildings, south of Wascana lake, and did much damage there. The path of the storm to the north was over the Dominion gaol buildings, and it then struck the best residential section, where two hundred buildings were blown down. The storm passed over the Canadian Pacific Railway, taking down in its course half a dozen grain elevators. It then traversed that portion of the city lying north of the railway, and the residential district beyond, where a number of fine structures were demolished. The storm lasted only three minutes, and its path of destruction was about three hundred feet wide.

THE final shipment of the extensive natural history collection made by the Paul J. Rainey expedition in British East Africa has just been received at the U.S. National Museum. The collection includes some 4000 specimens, more than 700 of which are those of large game. Mr. E. Heller was the guest of Mr. Rainey on his African hunting trip, and accompanied the expedition for the purpose of preserving the animals secured. Mr. Rainey has given the entire collection to the Smithsonian Institution and the National Museum. The territory traversed by the expedition was mostly to the north and east of that covered by Colonel Roosevelt on the earlier Smithsonian expedition, and included the country lying between the northern part of British East Africa and southern Abyssinia.

THE oration delivered in the University of Glasgow on Commemoration Day on June 25 by Prof. F. O.

Bower, F.R.S., on the life and work of the late Sir Joseph Hooker, has been published by Messrs. MacLehose and Sons, of Glasgow. Hooker received his school and university education in Glasgow, and though after he left the city in 1839 he never returned to it as a resident, the University is rightly proud of her distinguished alumnus. Hooker's career has been dealt with so recently in these columns that it will be sufficient to commend Prof. Bower's eloquent and appreciative oration to the reader's attention as a scholarly account of the work of a great botanist by a distinguished worker in the same field. The last occasion when Hooker visited Glasgow was at the Jubilee celebrations of Glasgow University in 1901, when, with Kelvin and Lister, he appeared before the Chancellor to present an address on behalf of the Royal Society.

THE health conscience of the nation is awakening. We are realising the moral wrong, economic folly, and national loss entailed by a wilful or ignorant persistence in hygienic lawlessness. It is something to recognise an ill and sympathise with sufferers, but it is better to minimise the wrong and alleviate the afflicted, and, above all, it is best to prevent the errors, sins, and indiscretions which are the sources of suffering, delinquency, dependency, and human wastage. The recent Biennial Health Conference and Exhibition, held in cooperation with the National Health Society, under the patronage of H.R.H. Princess Christian, at the Royal Horticultural Hall, Westminster, and the adjoining L.C.C. Technical Institute, on June 24-27, has assisted in making us understand that an awakened conscience must be co-ordinated with an informed intelligence. Medical leaders, health visitors, sanitary administrators, and many thoughtful men and women working for the betterment of national life cooperated in discussing problems relating to the well-being of our people. A full and varied programme was provided. Papers were given and conferences held on infant consultations, tuberculosis and the child, the notification of births, the prevention of deafness in children, schools for mothers, housing, health-promoting agencies, the teaching of domestic economy in schools, the care and control of the feeble-minded, and much else of national service. Popular lectures were delivered, and there was an interesting exhibition.

JULY has opened with similarly wet weather to that which characterised the whole of June, and the aggregate rain in parts of London, as well as at many other places in the country, for the first two days of July is greater than the fall for the whole month last year. June was very wet this year over the entire country, and in most parts of England the rainfall for the first fortnight was in excess of the average for the whole month. The heaviest rains were generally in the western districts, and at Valencia the measurement for the month was 7'48 in., which is 222 per cent. of the average for June, and rain fell on twenty-three out of the thirty days. At Jersey the rainfall was 4'89 in., which is 234 per cent. of the average for the month. At Nottingham rain fell on twenty-six days out of thirty, yielding 3'29 in., which

is 1.01 in. more than the normal. The rainfall varied considerably over the London area, although it was everywhere in excess of the average; at Greenwich the measurement was 2.34 in., which is an excess of 0.40 in., at Kew the amount was 3.12 in., which is 0.87 in. in excess of the average, whilst at Camden Square the measurement was 3.22 in., and at Hampstead 3.59 in. The mean temperature for June at Greenwich was 59.8°, which is 0.5° above the average of the last sixty years, and is only 1° below the mean for June last year, whilst the rainfall this year was only 0.23 in. greater, and the duration of sunshine, 219 hours, is 37 hours more than the normal, and only 5 hours fewer than in June last year.

THE summary of the weather for the first six months of the present year, issued by the Meteorological Office, shows that the rainfall for the period is in excess of the average in all districts of the United Kingdom, with the exception of the north of Scotland. In the north-east of England the rainfall so far this year is 139 per cent. of the average, in the Midland counties 136 per cent., and in the south-west of England 130 per cent. of the average. In the south-east of England, which district embraces London, the rainfall for the six months is 123 per cent. of the average. The duration of bright sunshine for the first half of the year is in defect of the average, except in the south-east of England, where there is a slight excess.

IN *The Museums' Journal* for June, Dr. F. A. Bather describes an open-air folk museum recently established by the local schoolmaster of Bunge, a thinly inhabited parish in the north of the Baltic island of Gotland. Part of the meadow occupied by the museum contains a seventeenth-century farmhouse, which forms the nucleus of the collection. In the farmyard various primitive agricultural implements are exhibited, and in the adjacent smaller buildings representations of local industries now passing away are shown. One peculiar feature of the museum is a patch of ground containing models of various forms of burial practised in the neighbourhood from the first century B.C. to the fourth or fifth A.D., including a model of a stone monument in the shape of a Viking ship. Close by is a judgment circle of eight large stones, and in another part of the grounds is a thingstead, a circle of small stones with a mound for the speaker. The conception throughout is admirably practical, and the plan might well be adopted in some of our schools, the local character of the exhibition being carefully maintained.

THE first number (April 30) of a new serial published at Buenos Aires, under the title of *Boletín de la Sociedad Physis*, contains a biography, illustrated by a portrait, of the late Dr. Florentino Ameghino, by Mr. M. Doello-Jurado.

IN the report of the Museums Committee of the University of Glasgow for the past year, Prof. Graham Kerr states that the expenditure of a special grant during the last few years has resulted in a great improvement in the condition of the zoological collections, which are now beginning to meet the require-

ments of the teaching staff. There is, however, still urgent need of additional funds for this purpose.

IN vol. ix., pt. 2, of "Annals of the S. African Museum," Prof. H. H. W. Pearson records the botanical and meteorological observations made by the Percy Sladen Memorial expedition to the Orange River in 1910-11. August to October is the great flowering season in the districts traversed, and it is probable that many of these (southern) spring-flowering species are still unknown. Accidents to the instruments interfered with the meteorological observations. In a second article Prof. Pearson and Miss E. L. Stephens deal with the plants collected during the expeditions of 1908-9 and 1910-11.

THE first number of a new periodical, the *Zeitschrift für Gärungsphysiologie*, contains papers by S. Lwow, on the action of diastase and emulsin on alcoholic fermentation and the respiration of plants, C. Gorini, on certain bacteria bringing about proteolytic changes in cheese, and a long and useful summary by Dr. Löhnis of work done during 1910 and 1911 on the bacteriological changes in food materials, milk, &c. Altogether the new periodical promises to be very useful to all investigators of fermentation problems.

A WELL-ILLUSTRATED account of the New England trees in winter has recently been issued as Bull. No. 69 of the Storrs Agricultural Experiment Station, Connecticut, by Messrs. A. F. Blakeslee and C. D. Jarvis. As the authors truly observe, the study of trees in winter is one of the most interesting subjects of a nature-study course, and in order to facilitate it they have prepared descriptions with photographs of the tree, twig, fruit, and, in the case of evergreens, the leaf, of all the common trees of New England.

THE climatic limits of wheat cultivation in Canada have recently been determined by Dr. J. F. Unstead so far as is possible on the available information, and the results are issued in *The Geographical Journal* (vol. xxxix., No. 4). Two well-defined regions exist, the larger being in the west. The line bounding the regions skirts the Rocky Mountains to a point north of Fort Simpson, and within 400 miles of the Arctic circle, and then falls in a south-easterly direction to Lake Superior. From here it strikes northwards and then abruptly eastwards, skirting James Bay and coming out on the gulf of the St. Lawrence. In the eastern region the limiting factor is not entirely climatic, for the glaciation of the region around Hudson Bay has left a large proportion of the surface in such a condition that wheat cultivation is either difficult or impossible. The limits, so far as they are imposed by climate, are always liable to be set back somewhat as new varieties of wheat are bred suitable for cold regions, and a good deal of this work is going on in Canada.

MEASUREMENTS of the temperature of flowing lava are so rare that some made by Prof. G. Platania during the eruption of Etna last September possess considerable interest (*Rend. della R. Accad. dei Lincei*, vol. xxi., 1912, pp. 499-502). His observations were made with a Féry's radio-pyrometer on a stream of lava flowing from the lowest of a string of craters

in the neighbourhood of M. Rosso, a few days before the eruption ceased. The temperatures, in parts where the lava was still red, ranged from 795° to a maximum of 940° C.

THE last great eruption of Etna began on September 10, 1911, and, notwithstanding the extraordinary energy of the outburst, came to an abrupt end in thirteen days. The subterranean activity, however, continued in other forms, and Prof. A. Riccò, in a recent paper (*Boll. della Soc. Sismol. Ital.*, vol. xvi., 1912, pp. 9-38), describes as successors of the eruption the Fondo Macchia earthquake of October 15, the Maltese earthquake of September 30, and a series of earthquakes recorded at Mineo from October 17 to the end of December. Of these, the most interesting is the earthquake of Fondo Macchia, a village lying to the east of Etna. Though the disturbed area of this earthquake is only twenty-four miles long and eleven miles wide, it caused considerable damage to villages (resulting in twelve deaths) within a narrow band, four miles long and about a third of a mile wide, running from Fondo Macchia towards the S.S.E. Precisely the same district was the seat of a similar disastrous earthquake on July 19, 1865, when seventy-four persons were killed; and it is interesting to notice that this earthquake occurred eighty-eight days after the close of a violent eruption of Etna, while the recent shock occurred twenty-two days after the end of the last eruption.

MR. WARREN SMITH, head of the Department of Geology in the Bureau of Science which the American Government has established in the Philippines, has issued a report upon the mineral developments during the year 1910. The most valuable mineral products of the Archipelago are gold, coal, and iron, which yielded a total value of about 250,000 dollars. The remaining non-metallic minerals, including gravel, sand, lime, clay, and rough andesite, which is crushed for use as concrete, contributed a total yield of more than three times that value. The coal is of Miocene or Oligocene age, as it is overlain by a limestone containing the *Lepidocyclus insulaenatalis* of Chapman. Gold has been found in many provinces, and the chief yield has been from the alluvial deposits. One of the most interesting chapters in the report is Mr. Fanning's account of the goldfield of the Paracale-Mambulao district, which yielded more than half the total gold supply of the Philippines. There are indications of oil in the Philippines, but though the ground has been prospected, no very definite results were obtained during the year.

THE meteorological charts of the North Atlantic and Mediterranean for July, issued by authority of the Meteorological Committee, contain much useful information respecting North Atlantic ice. The earliest trustworthy date on which ice of any kind was observed each year from 1903 to 1911, and subsequently reported to the Meteorological Office, was March 6, February 9, January 18, January 2, February 2, January 1, January 24, March 2, and January 28 respectively. Drifting ice may be observed almost anywhere in mid-ocean north of 30° N.; and north of 35° N., about as far east as longitude 10° W. and

about as far west as longitude 75° . A tabular statement shows that both icebergs and field ice were further south in 1912 than in any other year of the period 1901-12; icebergs, $38^{\circ} 21'$ N., in May, and field ice, $40^{\circ} 0'$ N., in April. The first berg of 1912 was passed on January 7 in 46° N., 53° W., but ice has been present since January 28, 1911; since the middle of February reports of both icebergs and field ice have been numerous. The loftiest bergs this season were sighted from the *Carmania* about $42\frac{1}{2}^{\circ}$ N., $49\frac{1}{2}^{\circ}$ W., on April 10; some were 400 ft. high and half a mile long. The chart issued by the Deutsche Seewarte also contains special notices relating to ice in the Atlantic.

A BRIEF account of the national parks created by the United States Government is given in *The Popular Science Monthly* for June by Mr. Laurence F. Schmeckebier. Probably the best known to English people are the Yellowstone, the Yosemite, and the Colorado Grand Canyon, but a large number of other reserves and national monuments are here detailed. For the administration of these a Government department exists, the officials of which have devoted much voluntary overtime labour to their efficient administration. One of their latest enterprises has been the publication of illustrative guides dealing with the natural curiosities and describing their scientific points of interest in popular language.

THE report on electrons in metals prepared by Dr. L. Amaduzzi, of Bologna, for the Italian Physical Society and the Italian Society for the Advancement of Science, has been amplified by the author, and now appears as one of the volumes of the series "Attualità Scientifiche." In this form it serves as a suitable continuation of the author's volume on the ionisation and electrical conduction in gases in the same series. It gives a clear account of the theories of Drude and of Lorentz on the thermal and electrical conductivities of metals, and shows how the electrons with adequate speeds may escape from a metal into the surrounding gas and so constitute the "thermionic current" of Richardson. Langevin's theory of magnetism and Weiss's extension of it to ferro-magnetic substances are treated at some length, and the Hall and other similar effects touched upon. The volume concludes with a short account of the part played by electrons in the modern theory of radiation. It is easy to read throughout, even with a very modest knowledge of Italian, and as the information it contains has not been collected together in any English book, Dr. Amaduzzi's pamphlet will be welcome to many physicists in this country who wish to keep abreast of modern theory.

The Builder for June 28 gives reproductions from photographs of a house constructed in one piece by pouring concrete into a single mould previously erected. This house—the first of its kind—has been cast on the Small-Harms system at Santpoort, a sea-side resort near Haarlem. The house covers an area of 39 square metres, and comprises six rooms on two floors. The cost is given at 144l. The flat roof, the floors, and the stairs are of slabs fixed in place while

the moulds were being erected. Chimney flues and other stoneware pipes were enclosed in the moulds and embedded in the concrete subsequently poured in. The mould consisted of some 2600 castings of size and weight convenient for handling, and assembled by about 10,000 bolts and nuts; the erection of the mould occupied about eight days, pouring about six hours, followed by two days' rest; removal of the mould occupied two days, making thirteen days in all for construction. Colloidal material is added to the concrete in order to avoid segregation and to facilitate its flow to all parts of the mould.

A USEFUL bibliography of the papers and records published with respect to the geology and palæontology of the north of England (Yorkshire excepted) during 1910 was contributed by Mr. Thomas Sheppard to *The Naturalist* in May and June of this year. The bibliography has now been issued in pamphlet form by Messrs. A. Brown and Sons, Ltd., of London, Hull, and York.

MR. FRANCIS EDWARDS, of High Street, Marylebone, London, W., has issued a catalogue of books relating to Australasia, which he is offering for sale. The books include some important volumes on the Antarctic.

ERRATUM.—In NATURE of June 27, p. 426, col. 2, line 41, for 89½ miles read 63½ miles.

OUR ASTRONOMICAL COLUMN.

ASTRONOMICAL OCCURRENCES FOR JULY:

- July 4. 12h. om. The Sun at greatest distance from Earth.
- 5. 14h. om. Venus in superior conjunction with the Sun.
- 10. 16h. 13m. Saturn in conjunction with the Moon (Saturn 5° 36' S.).
- 13. 8h. 31m. Venus in conjunction with Neptune (Venus 1° 27' N.).
- 14. 2h. 29m. Neptune in conjunction with the Moon (Neptune 5° 34' S.).
- „ 3h. 58m. Venus in conjunction with the Moon (Venus 4° 6' S.).
- 15. 17h. 24m. Mercury in conjunction with the Moon (Mercury 3° 57' S.).
- „ 23h. om. Neptune in conjunction with the Sun.
- 16. 12h. 9m. Mars in conjunction with the Moon (Mars 2° 46' S.).
- 22. 1h. om. Venus in perihelion.
- 23. 18h. 12m. Jupiter in conjunction with the Moon (Jupiter 4° 36' N.).
- 24. 7h. om. Uranus at opposition to the Sun.
- 25. 3h. om. Mercury at greatest elongation E. of the Sun.
- 28. 5h. 45m. Uranus in conjunction with the Moon (Uranus 4° 21' N.).
- 29. 10h. om. Mercury at greatest distance from the Sun.

THE NOVA OR VARIABLE 87, 1911, PERSEI.—On April 3 Prof. Wolf gave an hour's exposure, with the reflector, on the region of the nova, or variable star 87, 1911, Persei, discovered by Mr. C. R. D'Esterre, and the photograph is reproduced, together with Mr. D'Esterre's plate of November 13, 1911, for comparison, in No. 4585 of the *Astronomische Nachrichten*. On Prof. Wolf's plate the nova(?) is very faint,

while on the earlier plate it is comparable in brightness with two of the brightest stars seen on both photographs. Practically identical with the position of the nova(?) there is a faint pair of stars, the more northerly of which Prof. Wolf shows to be variable, so the region is evidently one of exceptional interest.

PERSEIDS IN AUGUST, 1911.—Simultaneous observations of meteors were made by Herren Büss and Djukow at Dorpat and Elwa respectively, on August 9-12, 1911; Elwa is not very far west of Dorpat. The results are tabulated in No. 4582 of the *Astronomische Nachrichten*, and embody the observed paths of 122 meteors observed at the former and 31 observed at the latter station. The maximum took place on August 12, and some of the observed paths were curved or wavy; there was a tendency also, noted on previous occasions, for the Perseids to appear in pairs travelling along parallel paths. A number of radiants were determined, the mean position being $\alpha = 44^{\circ}5'$, $\delta = +56^{\circ}5'$. Nine meteors were recognised in both records, and the heights of the appearance and disappearance were calculated; these range from 40.5 to 103.6, and from 30.5 to 101.0 kms. respectively.

OBSERVERS' HANDBOOK.—We have received the first fascicule of a work by M. G. Raymond, entitled "Les Merveilles du Monde Sidéral," in which the author gives brief descriptions and positions of the interesting celestial objects found in the first six hours of right ascension. The book reminds one of the "Celestial Objects," only that the author has arranged the double stars, nebulae, &c., under single hours of right ascension, giving the constellations in each hour in alphabetical order; thus, for example, the especially interesting objects in the constellation Andromeda are found in six different parts of the book under 0h., 1h., 2h., 21h., 22h., and 23h. The positions are given to the nearest minute for 1910, and amateur observers should find the work most useful; it is published by G. Thomas, 11 rue du Sommerard, Paris, at 4 francs for the one part.

VARIABLE STARS OF SPECIAL INTEREST.—The light-variations of twenty-five variable stars in the Small Magellanic Cloud are discussed by Miss Leavitt in Circular 173 of the Harvard College Observatory. A previous investigation indicated that there existed a relation between the brightness of these variables and the length of their periods, and this is confirmed in the present study; the logarithm of the period (in days) increases by about 0.48 for each increase of one magnitude in brightness. As the distances from the earth are presumably alike, it would appear that the period is associated with the actual emission of light determined by the physical conditions of the stars. The average range of brightness is about 1.2 magnitudes, and the periods range from 1.2 to 127 days.

Circular No. 171 contains the data for the light-curves of five variable stars having secondary minima. One of these, RT Persei, appears to be an Algol variable, and the other four, RV Ophiuchi, V Serpentis, RZ Draconis, and U Scuti, are of the β Lyrae type.

SEARCH-EPHEMERIDES FOR COMETS.—In No. 4577 of the *Astronomische Nachrichten* Dr. Hnatek publishes ten search-ephemerides for comet 1852 IV. (Westphal); the periods on which the ephemerides are respectively based range from 60.2 to 61.0 years, increasing in steps of 0.1 year. The comet is far south, and is not likely to be found during the present year.

Dr. H. J. Zwiers has calculated elements for Holmes's comet, based on the observations of 1906, and in No. 4584 of the same journal he gives an ephemeris for June and July. The comet is unfavourably placed, and is not observable in these latitudes.

THE NATIONAL MUSEUM OF WALES.

IN bright sunshine and in the midst of a brilliant assembly, his Majesty laid the foundation-stone of the National Museum of Wales on Wednesday, June 26. All sides of Welsh life and activity were represented—peers and peeresses, members of Parliament, county and municipal aldermen and councillors, magistrates, college principals and professors, Druids and bards in their distinctive robes, and representatives of Welsh music, art, and literature. Home and foreign museums were represented by Sir Cecil Harcourt Smith, of the Victoria and Albert Museum; Mr. C. E. Fagan, of the British Museum (Natural History); Dr. F. A. Lucas, of the American Museum of Natural History; Dr. C. William Beebe, of the New York Zoological Gardens; Mr. Kermode, of the Museum of Victoria, British Columbia, and many others.

The loyal address which was presented to his Majesty made grateful mention of the fact that the King had deposited in the museum the unique silver-gilt chalice and paten, of thirteenth-century workmanship, which were found at Dolgelly some twenty

may be roughly described as having the form of a rectangle 440 ft. long by 250 ft. wide, enclosing a quadrangle 307 ft. by 134 ft. in the centre. The entrance is in the middle of one of the shorter sides, and faces south and somewhat east; it leads into an octagonal court under a dome nearly 100 ft. high. From this dome galleries branch out east and west, and occupy the whole of the southern block; from the eastern gallery opens the refreshment-room, from the western the children's room. The north side on the first floor is occupied by the sculpture and picture galleries, both lighted from above. The two long sides are separated by a longitudinal partition wall into two portions corresponding to the division of the contents of the museum into two parts—the exhibition collections and the reserve or study collections. The exhibition galleries look out upon the central quadrangle, and consist of only two storeys. This arrangement enables the show galleries to be made of an adequate height, 18 ft. on the ground floor and 20 ft. on the first floor measured to the cornice of the room. The outer portion, containing the study collections, had to be kept down to a lower level to correspond with the height of the adjacent City Hall. It consists, however, of

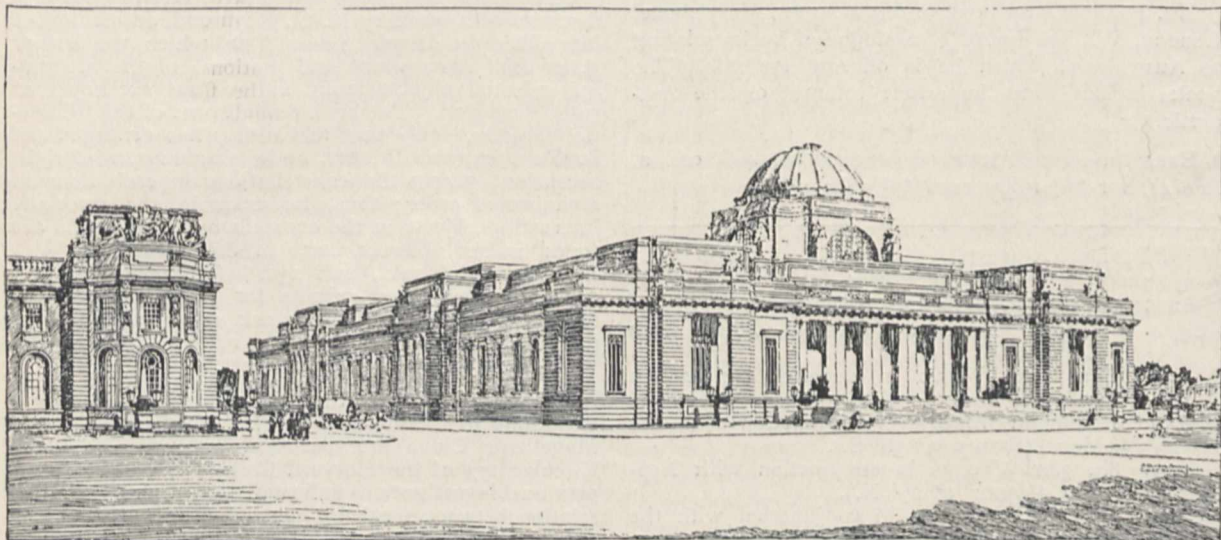


FIG. 1.—National Museum of Wales. Perspective view from the south-west.

years ago. This reference was taken up by the King in his reply in the following passage:—"The collections in the museum will serve as a record of developments in every branch of intellectual and industrial activity, and will illustrate the practical aspects of Welsh life. I am glad to have been able to commit to the charge of the museum the Dolgelly chalice and paten. I hope that the treasures which are to be stored here will be constantly enriched, and that many others will emulate the generosity and public spirit of the donor of the Caergwle cup." This last is a valuable Celtic relic of wood, oval in form, and inlaid on the exterior with thin gold in various devices; it has been handed by the owner, Sir Foster Cunliffe, Bart., of Acton Park, Wrexham, to the Ancient Monuments Commission, with a view to its transference to the National Museum of Wales.

Before leaving the museum site to visit the adjacent University College of South Wales and Monmouthshire, their Majesties inspected with great interest a model of the museum buildings on a scale of a quarter of an inch to one foot, made by Mr. J. Lambert, which had been erected in the reception pavilion.

The museum building (Fig. 1), which has been designed by Messrs. Smith and Brewer, of Gray's Inn,

three storeys, and their contents will correspond as nearly as may be with those of the show galleries adjoining them. Doors, placed at certain intervals, admit of easy passage from the show collections to the study collections and *vice versa*.

Within the quadrangle are two low buildings; the southerly one is to be devoted to an exhibition of Welsh natural history; the more northerly to Welsh history. In each will be a central space, and around it a series of alcoves, lighted from above. Each of these will have a suitable painted background, representing a scene in some part of Wales—moorland, forest, woodland, meadow, marsh, and shore—whilst in the foreground will be the plants and animals characteristic of such a locality. In the historic pavilion groups illustrating different periods of Welsh history will be installed.

The administrative rooms are placed in the south block on the second floor, and consist of a council-room, library, and the director's offices; they are approached by passenger lifts. On the east side is placed the lecture theatre, with two entrances, two extra exits, and two pass-ways from the museum galleries; it has also its own cloak-rooms, &c. A service court, for the unloading of goods, with a cart-

way leading to the road in either direction, is placed at the north end of the building, and grouped around it are unpacking rooms, workshops, service lifts, macerating, sterilising, and stone and plaster rooms. Other rooms provided include those for photography, printing, and distilling, and a large number of store-rooms, also a kitchen and bicycle rooms for men and women.

electrically-driven fans. Fireproof construction is being employed throughout, and it is intended that the cases and much of the furniture shall be of metal. There will thus be little inflammable material in the building, and any outbreak of fire could at once be isolated by iron doors placed at suitable intervals.

It is intended only to build the southern half of this extensive pile in the first instance, and to add the remainder as space is required.

The cost of this first instalment, including equipment, is estimated at 230,000*l.*, of which 60,000*l.* has been already received. Of the remainder half will be contributed by the Treasury, provided the other half is raised from other sources, so that the council is faced by the problem of raising 85,000*l.* in three or four years if the scheme is to be carried out successfully.

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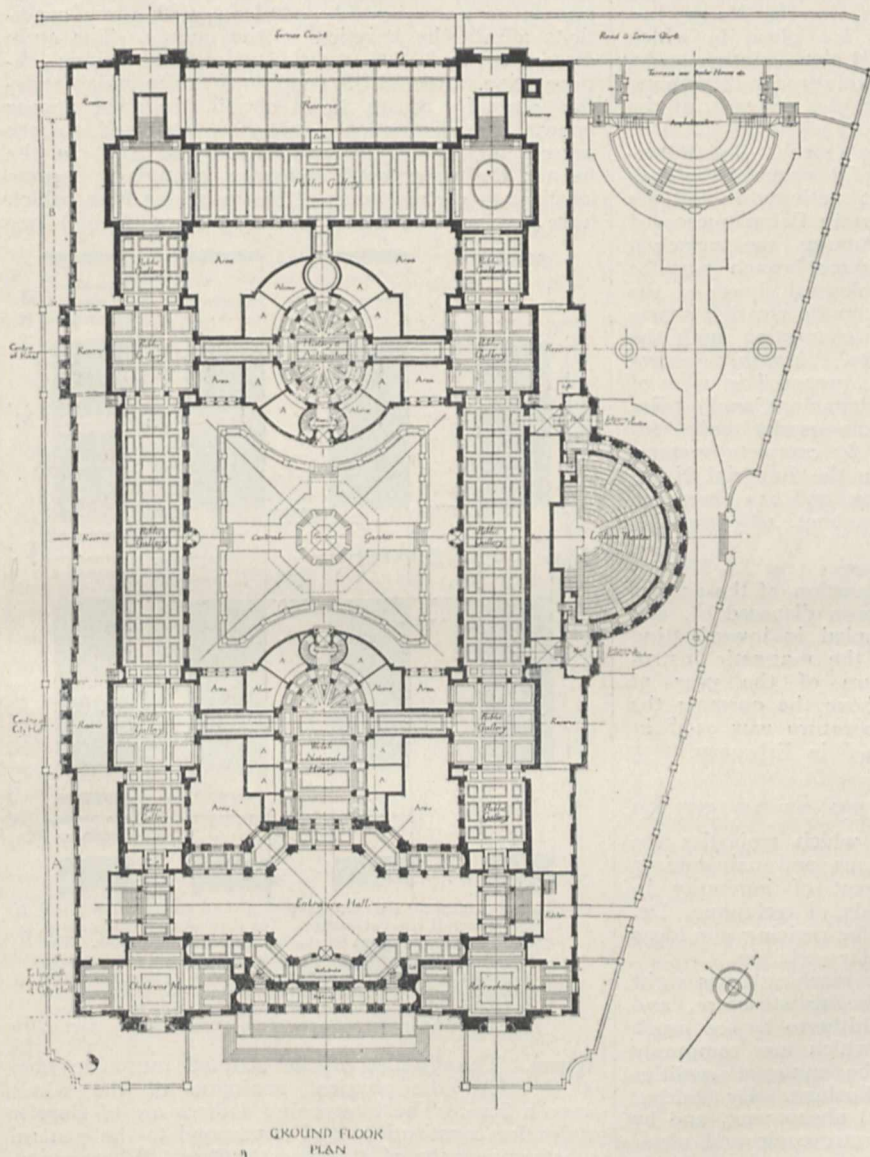


FIG. 2.—National Museum of Wales. Plan of ground floor.

Between the two pavilions for Welsh history and Welsh natural history, above described, will be a garden about 134 ft. square, in which the visitor will be able to rest and enjoy the fresh air in the intervals of inspecting the collections. Beneath the centre of this garden will be the aquarium. In the north-east angle of the site, just outside the museum quadrangle, is an open-air amphitheatre, intended primarily for the performance of Welsh national folk-songs and dances.

The heating and ventilation will be upon a combined system of inlet and extract ventilation, controlled by

num 32.4° August, giving a yearly range of 64.9°. The absolute extremes in any year were -37.0° and +35.7°.

Odessa Observatory (1910).—The meteorological observations contained in the *Annuaire* of the University Observatory include those taken three times a day at Odessa, with daily and monthly means, and the principal results (rainfall and thunderstorms) at stations in south-east Russia. The mean temperature values at Odessa are:—January 30.9° F.; July 72.1°; year 51.6°; absolute maximum, 87.8° in June; absolute minimum, -8.5° in January.

REPORTS OF METEOROLOGICAL OBSERVATIONS.

ROYAL OBSERVATORY OF CATANIA (1909 and 1910).—We have received from Prof. A. Riccò the meteorological results made at this observatory. From useful tables giving the means and extremes for nineteen years (1892-1910) we note that the mean annual temperature is 63.7°; January, 49.8°; August, 79.0°. An extreme reading of 106° was reached once, in August, 1896, and the temperature only fell below freezing point twice, in February, 1895 and 1905.

Moscow Meteorological Observatory (1910).—The observatory is attached to the Imperial University; the observations were made under the direction of Privat-Dozent Speransky, and are discussed in great detail by Prof. E. Leyst in the *Bulletin* of the Imperial Society of Naturalists, No. 4, 1910. The means of air temperature (centigrade) were:—January -7.2°, July 19.1°, year 5.5° (normal 3.9°); all months except August-October were above the normal; December was 5.6° in excess. The absolute extreme readings were: minimum -32.5° January, maximum

Deutsche Seewarte (1910).—The results of the valuable observations made at the stations under the control of the Seewarte are published in practically the same form as in previous years. Part i. contains observations made three times daily at ten stations of the second order, monthly and yearly results, and five-day means of temperature. Part ii. contains hourly readings at four normal stations; the anemometrical velocities are obtained by a revised factor, determined experimentally. Part iii. gives very useful statistics of storms experienced at fifty-seven signal stations in each month, in the North and Baltic Seas. Only those cases are given in which storms were reported by at least three stations. An appendix gives the sunshine values for Hamburg during the year: 1441 hours, or 32.3 per cent. of the possible amount.

Deutsche Seewarte, Hamburg (1911).—The thirty-fourth yearly report on the useful work of the Seewarte shows, as usual, great activity in all its branches. On November 1 Captain Behm succeeded Admiral Herz as director. Among the principal publications relating to the marine branch may be mentioned the monthly meteorological charts of the North Atlantic, and the daily synoptic weather charts of the same ocean issued in connection with the Danish Meteorological Institute. Monthly charts for the Pacific Ocean are being prepared in view of the proposed opening of the Panama Canal. For the present they will be in manuscript only, for private use. During the year 87 complete meteorological logs were received from the Imperial Navy, 1810 from the mercantile marine, and 214 shortened registers, containing altogether about 4585 months' observations.

Bombay and Alibag Observatories (1911).—The report shows that a considerable portion of the arrears of the usual publications has been disposed of, and that much time has been occupied in investigating discrepancies between some of the magnetic instruments. The mean temperature of the year at Colaba was 79.9°, being 0.5° above the normal; the greatest maximum hourly temperature was 91.4° in May, and the least minimum 59.3° in February.

THE OPTICAL PROPERTIES OF MUSCLE.¹

IN this brilliant monograph, which embodies the results of five years' laborious and painstaking investigation and is a monument of ingenuity in devising and using new methods of technique, Dr. Vlès has made out a good case for revising our ideas concerning the nature of muscular striation.

Dr. Vlès believes that modern teaching loses sight of the big, broad facts of muscular structure, and has prevented their recognition hitherto by too much insistence on minute details, which are commonly and erroneously assumed to be material realities rather than merely optical illusions. By taking cognisance of well-known optical phenomena, and by employing such methods as spectroscopic and ultra-microscopic examination and polarisation, it is possible to disprove the reality of many apparently material features and appreciably to simplify the structure of muscle fibres.

The most primitive muscular fibre is of the smooth variety, and contains a general substratum which can be recognised by its spectroscopic appearance. Superposed on this general substratum, and diffused throughout the fibre, are other molecular groupings comprising sarcoplasmic and hæmatogenous derivatives and doubly refracting substances. Smooth muscle possesses the contractile character just as does

striated muscle, but its contractility is of a nature different from that of striated muscle. Dr. Vlès has quoted evidence to show that all muscle develops primitively as "smooth" fibres, but may later take on a striated appearance, exhibiting at the same time transformations in the nature of its contraction.

He shows that the appearance of striation in muscular fibre is associated with increase in frequency or rapidity of movement, or with the occurrence of a regular rhythm in contraction.

Any cause, such as immobilisation or injury of the muscle or nerve, which interferes with these conditions affects the striation of the muscle. The striæ disappear, and the muscle undergoes hyaline degeneration. Should the conditions under which striation normally occurs again obtain, the striæ appear anew. The distinction between striated and smooth muscle appears to be due to the fact that in the former the superposed molecular groupings become localised to certain areas of the muscular fibre, which have received the name of the Q discs (Rollet) (see

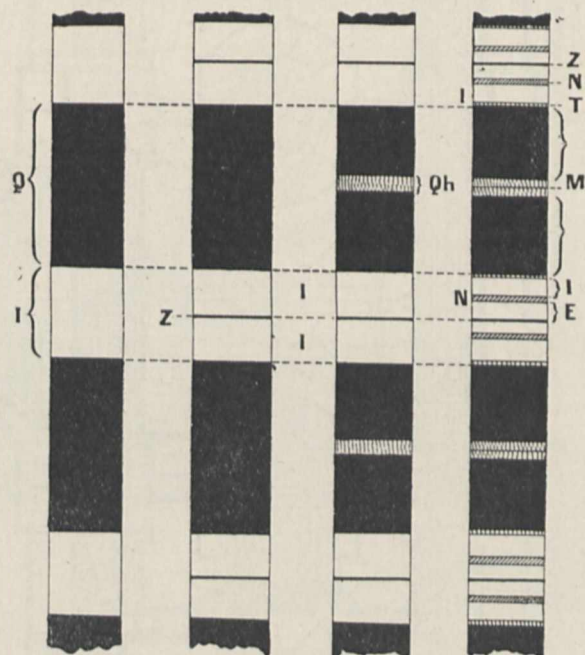


Diagram to illustrate the nomenclature of the muscular striæ in the four principal types of striation. The simplest variety of striated muscular fibre is shown on the left side of the diagram. The anisotropic disc Q differs from the isotropic band I in containing a greater number of molecular groupings. These molecular groupings are not localised in the "smooth" fibre but are diffused throughout its extent, and hence the disc Q of striated muscle is the physical analogue of the whole "smooth" fibre.

figure). The Q disc of the striated muscular fibre is therefore the physical analogue of the whole smooth fibre. The intervening I discs are of simpler molecular constitution, and correspond to the general substratum only of the smooth fibre. When movement is lost in striated muscle the superposed molecular groupings become diffused throughout the fibre exactly as in smooth muscle.

Contrary to general opinion, there is probably no membrane present between the Q and the I discs. Dr. Vlès's interpretation of the relation between a smooth and a striped fibre is that the latter corresponds to smooth fibre which has undergone localisation of its molecular groupings. Striation is probably only an expression of quite general laws of elasticity and hydrodynamics applied to the heterogeneous complex of the muscular fibre.

T. WINGATE TODD.

¹ "Propriétés Optiques des Muscles." By Dr. Fred Vlès. Pp. xviii+372. (Paris: A. Hermann & Fils, 1911.) Price 15 francs.

THE MANUFACTURE OF NITRATES FROM THE ATMOSPHERE.¹

CONSIDERING that it is only about ten years ago that the manufacture of nitrogenous products by electric power was proved to be commercially possible, the progress has been remarkable; indeed, this metallurgical development of electric power promises to be even more important than electric traction.

One source of fixed nitrogen is sulphate of ammonia from gasworks, &c., and the production in this country in 1910 was 367,587 tons, which was 26 per cent. more than in 1906. The principal increases between 1906 and 1910 were: from coke ovens, 115 per cent., and from producer-gas plants, 50 per cent. The main source of nitrogen is nitrate of soda from Chile, and in the year 1911 the total export was 2,420,400 tons.

Against these figures, the output of calcium nitrate and calcium cyanamide, which are two of the main products of the electric fixation of nitrogen processes, are still small; but the important thing to notice is that electrical processes are now on a sound commercial footing, and very large extensions of plant have been recently made in Norway.

Table I. gives particulars of the installations for the manufacture of calcium nitrate by the *direct* process of Prof. Birkeland and Mr. Sam Eyde. It will be noticed that, although the first experimental plant was started only nine years ago, already the company controlling the Birkeland-Eyde patents have installations aggregating 200,000 horse-

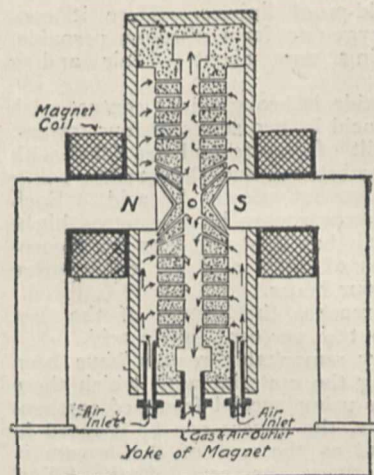


FIG. 1.—The Birkeland-Eyde furnace.

power at work, and probably by 1916 another 300,000 horse-power will be at work.

TABLE I.—Installations of the Norwegian Hydro-Electric Nitrogen Co.

Year	Horse-power	Name of Installation
1903	25	(Experiment) Frognerkilens
1903	160	(Experiment) Ankerlökken
1904	660	Arendal
1905	45,000	First Notodden (Svaelfos)
1910	15,000	Second Notodden (Lienfos)
1912	140,000	First Rjukan installation

The other electrically produced nitrogenous manure, calcium cyanamide, is made by a more *indirect* method invented by Dr. Franck and Dr. Caro, and its manufacture is not confined to Norway.

Table II. gives the principal installations, and it is of interest to note that, although the first one on a commercial scale was erected at Piano d'Orto, in Italy, only eight years ago, there are works in operation, and being built, which by the end of next year

¹ Abridged from a paper read before the Royal Society of Arts on May 15 by Ernest Kilburn Scott.

will be making calcium cyanamide at the rate of more than a quarter of a million tons per annum.

TABLE II.—Installations for Manufacture of Calcium Cyanamide by the Franck and Caro Process.

Name of Company	Place of Installation	Output per ann. in tons
Nitrogen Fertilisers Co. (North-Western Cyanamide Co.)	Odda, Norway	15,000
Società Italiana di Prodotti Azotate	Alby, Sweden	15,000
Società Italiana per il Carburio di Calcio	Piano d'Orto, Italy	4,000
Società Piemontese per il Carburio di Calcio	Terni, Italy	15,000
Société Française pour les Produits Azotes	San Marcel, Italy	3,000
" " "	Martigny, Switzerland	7,500
" " "	Notre Dame de Briançon	7,500
Bayerische Stickstoff Werke	Trostberg, Bavaria	15,000
Ost-Deutscher Stickstoffalf und Chemische Werke	Bromberg, Prussia	2,500
A. G. Stickstoffdünger	Knapsack, Germany	18,000
Società per l'Utilizzazione delle Forze Idrauliche della Dalmazia	Selenico, Dalmatia	4,000
" " "	Dugirat, near Almissa	80,000
Japanese Nitrogen Products Co.	Kinzei, near Osaka	4,000
American Cyanamide Co.	Nashville, Tennessee	4,000
" " "	Niagara	12,000

The Nitrogen Fertilisers Co., which owns the Odda and Alby Works, works under licence from the

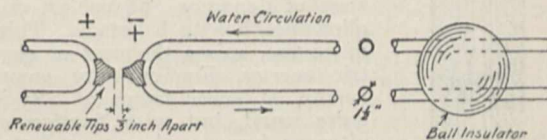


FIG. 2.

North-Western Cyanamide Co., which company controls this country, Norway and Sweden, Belgium, and all the British colonies, protectorates, and dependencies, except Egypt and Canada. The Odda factory is now being enlarged, and at the beginning of next year will be producing 73,000 tons per annum.

In the United States, the American Cyanamide Co. is about to erect a works in Alabama to manufacture 24,000 tons per annum.

Birkeland-Eyde Furnace.

This furnace, invented by Prof. Birkeland and Mr. Sam Eyde, of Norway, depends on the interaction of an alternating-current arc in a constant magnetic field. The furnace, as installed at Notodden, consists of a circular sheet-steel drum about 8 ft. in diameter and 2 ft. wide, lined with refractory firebrick, and having a disc-like space in the centre 6½ ft. diameter and 1¼ in. wide. Air is supplied at the centre of the furnace by a Root's blower, whilst a channel round the periphery of the disc space carries off the gases and unoxidised air, as shown in Fig. 1.

Two electrodes, one of which is shown in Fig. 2, project into the centre of the furnace, and are approached to within about ⅓ in. They are copper tubes 1½ in. diameter and ⅝ in. thick, and have water circulation to keep them cool.

The points of the electrodes are in a magnetic field of about 4500 lines of force per square centimetre. Alternating current at 5000 volts and fifty periods per second is supplied to the electrodes, whilst

direct current flows round the coils to produce the magnetic field.

When an arc is struck between the electrodes it is at once deflected in a direction perpendicular to the lines of force, and the necessity of having alternating current applied to the electrodes will be appreciated from the fact that with direct current the arc would be deflected to one side only. As each electrode is alternatively positive and negative, the arc is projected outwards first to one side and then to the other, thus giving a disc of flame about 6 ft. in diameter. The speed at which the arc moves outward is extremely rapid, and as the formation of a new arc is practically instantaneous, it appears to the eye as a sheet of flame.

An inductive resistance is a very necessary piece of apparatus to have in series with the arc, because its self-induction automatically effects a displacement of phase according to the currents flowing, thus enabling the arc to burn steadily. The writer assisted Mr. Howles with some experiments in fixation of nitrogen about thirteen years ago, and the necessity of having an induction coil in circuit was then noted. Without it the arc could not be maintained steady.

It should be noted that any furnace working with alternating current has necessarily a considerable phase difference. In other words, the power factor is low, and therefore, in estimating the sizes of dynamos and cables, due allowance has to be made. This, of course, raises the cost of electric energy. For ordinary power supply, a power factor of 0.85 is quite usual, but with fixation of nitrogen furnaces the power factor is only about 0.6.

Schonherr Furnace.

This furnace was invented by Dr. Schonherr, of the Badische Anilin und Soda Fabrik, of Germany. As installed at Christiansand, it consists of a long iron tube fixed vertically, through the centre of which an arc 16 ft. long is maintained. Alternating current at 4200 volts, fifty periods, is used, and each furnace takes 600 horse-power. Air blown through this tube with a whirling motion keeps the arc in the centre. The electrode at the bottom consists of an

iron rod which passes through a copper water-cooled tube. The iron rod is pushed upwards, as it burns away to ferric-oxide, and fresh rods are screwed on as required, so that the process does not stop. At the top of the tube there is the water-cooler, and it is inside here that the arc ends by striking across from the centre to the side of the tube.

As will be seen from the arrows in Fig. 3, the incoming air passes through annular tubes, on each side of which there are the hot gases from the furnace. The air is thus heated to about 500° C. before it reaches the arc. After passing through the arc, where some of it is heated to about 3000° C., it reaches the water-cooler, where its temperature is then suddenly reduced. At this point there is a rapid mixing of the highly heated nitric oxide next to the arc with the cooler air that is whirling past,

and the gas becomes permanently fixed. The nitric oxide and air leave the top of the cooler at about 1200° C.

The plant at Christiansand is entirely occupied in making sodium nitrite for the production of aniline dyes, &c. Previously, sodium nitrite had been made by the reduction of Chile nitrate with lead, but this method of production has now practically ceased.

Calcium Nitrate.

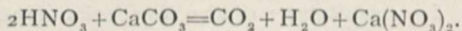
As carried out at Notodden, the method of making calcium nitrate is as follows:—The nitric oxide gas and air pass from each furnace into two fireproof-lined gas-collecting pipes, about 6 ft. in diameter, lined with fire-brick. These pipes convey the gas to four steam boilers, the heat given off by the gases being used to raise steam for concentrating the products and for driving the air compressors for pumping acids, soda, &c. The gases then go through tubes in the evaporating tanks, after which the temperature is down to about 250° C. The temperature is lowered still further, to 50° C., by passing it through a number of aluminium tubes over which cold water is flowing. The gas then enters the oxidation tanks, which are large vertical iron cylinders having acid-proof linings. Here it continues to take up oxygen to form nitrogen peroxide, the percentages being now about 98 air and 2 nitrogen peroxide.

The nitrogen peroxide is brought into contact with water to form nitric acid in two series of four towers. These towers are built of granite and are filled with broken quartz, this substance and the granite being chosen because they are not affected by acid. Each tower measures 2 metres square by 10 metres high, and it has been found that they will give an absorption of 3.3 kilograms of nitric acid per cubic metre of space per twenty-four hours.

When the liquid reaches the bottom of the first tower it contains about 40 per cent. nitric acid.

Recently some very remarkable results have been obtained by improving the material with which these towers are filled. By using special forms of earthenware instead of quartz, the towers can be reduced in size considerably, and as the cost of the towers is usually about four times the cost of the filling material, this means much cheaper towers.

The nitric acid of 40 per cent. solution is sprayed on to calcium carbonate, and the carbon dioxide gas is driven off, leaving calcium nitrate,



The solution is then pumped into solidification pans, under which cold air is circulated to accelerate cooling, and the nitrate of lime stiffens into a brittle, crystalline mass. This is broken up into pieces suited for ball crushing-mills, where they are reduced to a granular state. The coarse powder is then raised by an elevator into a hopper, from the bottom of which it falls into barrels which hold 2 cwt. These barrels are lined with paper to guard against damp.

With the Birkeland-Eyde process, one kw.-year gives 500 to 550 kilograms of nitric acid, or 853 to 938 kilograms of nitrate of lime. The latter usually contains 13 per cent. of nitrogen, which corresponds to 111 to 122 kilograms of combined nitrogen. It is guaranteed to contain 12½ per cent. of nitrogen.

The best result at Notodden has been 900 kilograms of nitric acid per kw.-year measured at the arc terminals and allowing for 100 per cent. nitric acid.

The percentages of nitrogen and approximate comparative prices of the various artificial manures are about as follows:—

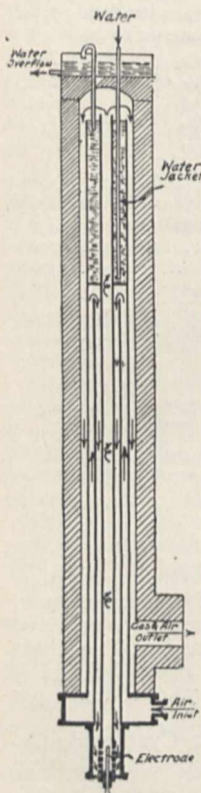


FIG. 3.—The Schonherr furnace for fixation of nitrogen.

	Content of nitrogen	Price per ton		
	Per cent.	£	s.	d.
Sulphate of ammonia from gasworks...	19.75	13	0	0
Nitrate of soda from Chile	15.50	9	15	0
Nitrate of lime made by electricity ...	12.75	8	10	0
Calcium cyanamide made by electricity	18.00	10	0	0

The Rjukanfos Installation.

The Rjukan installation is situated in Vestfjordalen. The saltpetre factories are situated at Saaheim, and the hydro-electric power-plant on the Maane River, half a kilometre away. The power installation utilises part of the well-known "Rjukanfos," and has a working head of some 274 metres and a discharge of water of 47 cubic metres per second. The total power plant in the generating station is about 140,000 horse-power, divided into ten units, each of 14,450 horse-power. Each unit is, however, capable of producing 16,500 horse-power, and they are thus the largest hydro-electric units which have yet been constructed.

In the factory most of the furnaces are of the Schonherr construction, Fig. 3 (Badische Anilin und Soda Fabrik), each of 1000 kw. They are 23 ft. long, and require 40,000 cubic feet of air per hour. The other furnaces are of Birkeland-Eyde's construction, similar to those at Notodden (Fig. 1), but of 3000 kw. each.

The annual production will amount to 70,000 tons of nitrate of lime and 8000 tons of nitrite.

Mr. Sam Eyde wrote on February 10 last:—"The results now at hand from the trial management are not sufficient to entitle us to judge which of the two systems—the Badische or the Birkeland-Eyde system—is the most profitable one. For the present it may be declared that the proceeds by both systems very likely will turn out to be approximately the same.

"A second power-plant is now under construction at Rjukan, intended for the installation of some 120,000 horse-power, which will likewise be used for the manufacture of nitrate of lime.

"Our company is further constructing a third power installation, Vamma on the Glommen River, by which will be produced 70,000 horse-power, of which 50,000 horse-power will be utilised for the manufacture of nitrate of lime. Including the factory at Notodden, we will thus in a short time utilise in all 370,000 horse-power for the manufacture of nitrate of lime."

The present plant consists of ten generator turbines of 14,450 horse-power each, five of which were constructed by J. M. Voith, of Heidenheim, five by Escher Wyss and Co., of Zurich, and one exciter turbine of 1000 horse-power by Kräerner Brug, of Christiania. The three-phase electrical generators were made by the Allmänna Svenska, of Västerås, Sweden, and by Brown, Boveri and Co., of Baden.

The turbines are fed by individual pipe-lines of 1250 mm. inside diameter at the top end and 1000 mm. inside diameter at the bottom end. The length of each pipe is 720 metres (2360 ft.); the upper 300 metres consist of riveted pipes, and the longer lower part for higher pressure consists of welded pipes.

The turbines are provided with twin Pelton wheels, each of which is driven by two nozzles. In the Escher Wyss turbine the lower jet does not strike the buckets until the latter have cleared the upper jet.

The maximum increase of speed was 15 per cent., whilst the increase of pressure above static head did not exceed 10 per cent.

The Escher Wyss turbines are each coupled to

three-phase generators made by Brown, Boveri and Co., of Baden.

At a power factor of 0.6 each machine gives 17,000 Kva. at 11,000 volts, fifty periods per second. One of the machines gives the whole of the 17,000 Kva.

Four of the units are of the double-generator type, with a shaft common to the two. The two armatures are separated by a fireproof partition, so that if a coil of one should be burnt out, the coils on the other machine are not affected.

Allowing for windage and friction, the guaranteed efficiency is 94.8 per cent. for the double generator and 95.3 per cent. for the single generator. This is at full load and with a power factor of 0.6.

The total weight of one generator is 205,000 kg. (200 tons); 92,000 kg. going to the rotating field and shaft. The armature weighs about 90,000 kg.

The outside diameter of the armature is 6 metres and the inside diameter is 4.4 metres. The radial depth of the armature lamination structure is 21.5 cm.

The magnet wheel has a cast-steel hub and arms, and the periphery of the wheel is made up of solid forged steel rings. To these rings cast-steel poles are fixed, the inner ends of the poles being dovetailed and held by cotters.

The field poles are wound with bare annealed copper on edge, and all the pole windings are in series.

The slip rings are of cast steel, and carbon brushes are used. The exciter is direct coupled, and gives 130 kw. at 220 volts.

Every rotor was tested for mechanical strength by being rotated at 1.8 times the normal speed for half an hour, that is, at 450 revolutions per minute.

The bearings are supplied with oil under pressure, and the oil is cooled by water coils.

The other five turbines supplied by J. M. Voith are very similar to the above, with double-runner wheels and two nozzles to each runner. At the official tests all the guarantees were exceeded. Coupled to each of the Voith turbines is a double 8400 Kva., 11,000 volts, 50 cycle three-phase generator made by the Allmänna Svenska Co.

(To be continued.)

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—Dr. H. K. Anderson, F.R.S., has been elected to the mastership of Gonville and Caius College, in succession to the late Rev. E. S. Roberts.

THE University of Manchester on June 29 conferred honorary degrees of Doctor of Science upon Prof. D. H. Scott, F.R.S., and Mr. Dugald Clerk, F.R.S. On the same day the University of Durham conferred honorary degrees of Doctor of Science upon Prof. P. C. Ray, of the University of Calcutta, and Prof. L. P. Anderson Stuart, of the University of Sydney, delegates attending the Congress of the Universities of the Empire, which is being held this week.

THE May issue of this year of the Johns Hopkins University Circular takes the form of the "University Register" for 1911-12. The historical statement with which the volume of 267 pages opens points out that the original endowment of the University amounted to rather more than 600,000l., which has since been supplemented by several large gifts. The income-bearing funds now have a "book value" of 916,000l. The real estate and buildings, books, scientific apparatus, and general equipment are valued at 380,000l. The assets of the University have thus a total value of something like 1,300,000l. By the act of the Legislature of Maryland, at its session of this year, the

sum of 120,000*l.* was granted for the purpose of constructing and equipping buildings for a school of technology as a department of the University, and an annual grant of 10,000*l.* was added for maintenance. It is expected that the preliminary engineering courses will be inaugurated at the beginning of next session.

THE friends of the late Miss Rosa Morison (lady superintendent of women students at University College, London, 1883-1912) desire to raise a memorial as a tribute of the affection and respect in which they held her and as a means of commemorating her work in connection with the higher education of women. To give effect to this desire, some of those associated with Miss Morison in her work at University College, Queen's College, and College Hall, Byng Place, together with some of her personal friends, have formed a committee, the president of which is Lord Reay; chairman, Dr. T. Gregory Foster; hon. treasurer, Lady Lockyer; hon. secretaries, Miss E. Chick and Miss E. Goodyear. The precise form of the memorial will be left for decision until the funds are raised. The hon. secretaries invite those who wish to take part in this memorial to communicate with them forthwith: address, Rosa Morison Memorial Committee, University College, London (Gower Street, W.C.).

SOCIETIES AND ACADEMIES.

LONDON.

Physical Society, June 14.—Prof. A. Schuster, F.R.S., president, in the chair.—T. H. Blakesley: Demonstration of the use of specific gravity balls for determining very small differences of density. Experiments were quoted which indicate a sensibility such that the error which might be expected in a properly conducted experiment would be of the order 5 in the sixth decimal place. Specific gravity balls have been employed for the purpose of discriminating between the qualities of potable waters in respect of density and of testing the efficacy of softening processes. A thermometer of open scale is employed to give the temperature at which a specific gravity ball is in equilibrium with a liquid being slowly warmed or cooled through that point of temperature. If such a determination is made in distilled water at ordinary atmospheric temperatures it fixes the specific gravity of the ball at the temperature of equilibrium within four or five units in the sixth place of decimals. If a second observation with the same ball is made in a slightly heavier liquid, the temperature of equilibrium will be considerably higher, perhaps 2° or more, than in distilled water. By applying the coefficient of cubical expansion the density of the ball at the higher temperature can be obtained, and this is the density of the second specimen of water at the second temperature. Reference to a table of densities of distilled water will furnish its density at the higher temperature, and the difference between the two numbers will give what the author calls the density excess of the second liquid over distilled water at the higher of the two temperatures. This density excess is best quoted in parts in one million.—Dr. H. F. Haworth: Maximum sensibility of a Duddell vibration galvanometer. The maximum sensibility of a moving coil vibration galvanometer as a voltage detector is obtained when the flux through it is so adjusted that the back E.M.F. of the coil is equal to its CR drop; then the back E.M.F. is equal to half the applied voltage, and the current is equal to $V/2R$, and is in phase with the applied voltage. Increases of current sensibility of about 30 per cent. at 200~ and 40 per cent. at 1000~ were obtained on running the instrument in a vacuum, thus showing that a large part

of the mechanical work produced was used in overcoming the molecular friction of the system.—F. Stroude: An accurate examination of the Steinmetz index for transformer iron, stalloy, and cast-iron. Experiments to provide an experimental basis, suitable for mathematical analysis, with the view of discovering some relation connecting hysteresis loss and flux density which will accord with results obtained practically to a greater extent than the empirical law due to Steinmetz. Experiments were made with transformer iron stalloy (3 per cent. silicon iron) and cast-iron, two rings of each material being tested. A set of comparative tests on one of the transformer iron rings was made by the ballistic method, and these tests show that, in general, for a given value of **B** the hysteresis loss and the value of **H** for the ballistic tests are higher than the corresponding values for the slow cyclic tests.

Royal Meteorological Society, June 19.—Dr. H. N. Dickson, president, in the chair.—Dr. G. C. Simpson: Coronæ and iridescent clouds. During September, 1911, the author was one of a party led by Captain Scott to survey McMurdo Sound, and on September 24, while enveloped in fog, he observed a fine fog-bow. It was opposite the sun, and a measurement of the radius with a theodolite gave 38°. The bow was practically white, but a reddish tinge could be seen on the outer side. As the fog dissipated the upper sky became clearer, and the sun shone over the top of a heavy bank of fog. For some minutes the sun had a brilliant corona with bright colours, and the diameter of this corona seemed unusually large, but there was no opportunity to make a measurement. As the fog still further cleared away glimpses of the corona appeared again, and the fog under the sun became fairly brilliantly illuminated with iridescent colours, which did not appear to be part of the corona, but in places blended into it. During the whole period the temperature was between -15° and -21° F. The fur of the sleeping bags and the wool of sweaters became covered with hoarfrost. These observations show that water can exist in the atmosphere at much lower temperatures than has generally been supposed by meteorologists. It is now generally admitted that while halos are caused by the refraction and reflection of ice crystals, coronæ are due to diffraction effects of either small drops of water or thin ice needles. From certain observations made in the Antarctic, Dr. Simpson was led to doubt the possibility of ice crystals ever forming diffraction effects. This is an important question for meteorology, for if it is true, we have a powerful instrument for determining the constitution of a cloud; if there is a corona the cloud must be composed of water, while if there is a halo it must be composed of ice.—W. W. Bryant: The adoption of a climatological day. When observations are made only once a day, viz. at 9 a.m., it is the practice to enter the reading of the maximum thermometer to the previous day, and the reading of the minimum thermometer to the current day. Mr. Bryant does not consider that these give correct results, but that they are higher than if the readings were taken at 9 p.m. or midnight and applied to the civil day.

Royal Microscopical Society, June 19.—Mr. H. G. Plimmer, F.R.S., president, in the chair.—Lord Avebury: Short account of the development of pollen and of recent researches on fertilisation. The author divided pollen into: aerial pollen carried by the wind, aerial pollen carried by insects, and subaqueous pollen. The various forms of pollen were described and their distribution in the different orders enumerated. The most common form of pollen is elliptical, with three ribs, for which Lord Avebury believes there is as yet

no explanation. Such pollen was originally spherical, and only assumed the elliptical three-ribbed form after leaving the anthers and losing a certain amount of moisture by desiccation. Compositæ for the most part have spiny pollen and are entomophilous, but the Edelweiss and some allied species are anemophilous and smooth. The Rosaceæ are almost all entomophilous, with elliptic pollen, but Poterium is anemophilous with spherical pollen. The willow is entomophilous, with elliptic three-ribbed pollen; the Poplars are anemophilous with spherical pollen. Though the size of pollen does not depend entirely on the length of the pistil, and the length therefore which the pollen tube has to traverse, still, as a general rule, the longer the pistil the larger the pollen.—E. Heron-Allen and A. Earland: Some new Astorhizidæ and their structure. Two new species of Psammosphæra and one of Marsipella were described from specimens dredged in the North Sea in connection with the work of the International North Sea Investigations (Scotland). In *P. rustica* the rhizopod constructs a polyhedral test of spicular fragments selected of suitable length and cemented side by side in a single layer, while in *P. bowmani* large flakes of mica are selected, and cemented together at the edges so as to form a polyhedral test. *M. spiralis* constructs a straight tube of minute spicular fragments of approximately equal length, which are imbedded, side by side, in a fine grey cement. The spicules are arranged in definite rows which run in a sinistral spiral round the tube.—Dr. J. F. Gaskell: A method of embedding tissues in gelatin. The tissue is fixed in a formalin mixture; previous to embedding all formalin must be removed, by washing in running water. The gelatin is soaked in cold water, then drained and melted, and the tissue is immersed in this in an incubator at 37° C. It is then cast in paper boxes in this gelatin and allowed to set at room temperature; when cool, it is put into a formalin vapour chamber to harden. Sections are cut by the freezing method, and can be obtained of any tissue 10 μ thick and of most tissues hitherto tried 5 μ sections are obtainable.

Linnean Society, June 20.—Prof. E. B. Poulton, F.R.S., president, in the chair.—C. G. Lamb: Diptera of the Seychelles: Lonchæidæ, Sapromyzidæ, Ephyridæ, Chloropidæ, and Agromyzidæ.—Dr. I. Bolivar: Saltatorial Orthoptera. The author enumerates fifty-nine species from the various islands; a number of the species and genera are new. He states that those from Aldabra consist of Asiatic and African forms, all of which are winged and easily dispersed. The fauna of the Seychelles and Amirantes is very different and much richer, containing a number of peculiar forms, eight new genera being described from the Seychelles. In the Chagos group was found a peculiar species of wingless cricket, the type of a new genus, a second species of which was found in the Seychelles.—Dr. A. Sicard: Coccinellidæ. The author enumerates thirteen species belonging to twelve genera, five of the species and two of the genera being new to science.—Hugh Scott: Coleoptera, Lamellicornia, and Adephaga. Previous to the expedition thirty-two species were known from the various islands; this number is raised to fifty-five, nine of the additional species and one genus being new to science. The faunas of the Seychelles and Amirantes on one hand, and of the Aldabra group on the other, are very distinct. The Aldabra fauna consists of Madagascar and African forms, together with a few almost cosmopolitan species; such species as are peculiar are very closely related to African species. In the case of the Lamellicornia, the Seychelles fauna contains an

endemic element confined to the forests, and a non-endemic part found in the lower cultivated lands. Carabidæ were not found in the forests, and it is doubtful whether this family has any truly endemic element in the Seychelles fauna; the species are all either Madagascar species or closely related to species found in Africa and elsewhere. Two endemic water-beetles (Dytiscidæ) were found in the Seychelles, one of these being only found in the water between the bases of the leaves of endemic Pandani in the mountain-forests.—Dr. Budde-Lund: Terrestrial Isopoda of the Percy Sladen expedition.—S. F. Dunn: Revision of the genus *Millettia*.—Carl Christensen: Ferns of the Seychelles and Aldabra.—C. Warburton: Acarina of the Percy Sladen expedition.—Capt. C. F. U. Meek: Correlation of somatic characters.

CAMBRIDGE.

Philosophical Society, May 20.—Prof. Seward in the chair.—Prof. R. C. Punnett: An experiment with rabbits. Speaking generally, black coat-colour in rodents behaves as a simple recessive to agouti, and the work of previous investigators has shown this relation to hold good for rabbits. In the present set of experiments certain blacks from Himalayan \times yellow or \times tortoise produced when mated together five types of coloured offspring, viz. tortoise, yellow, black, agouti-black, and agouti.—H. H. Brindley: The proportions of the sexes in *Forficula auricularia*. In 1892 Bateson observed that male earwigs on the Farne Islands are dimorphic as regards their callipers (Bateson and Brindley, Proc. Zool. Soc., November, 1892). Since then a statistical examination has been made of the variation of the callipers, especially of earwigs from islands. The present note is an outcome of the enumeration of the sexes in the collections made. It appears that the proportions of the sexes vary considerably with the locality and to a less degree in different years in the same locality. As a rule, females exceed the males by about 10 per cent.—H. H. Thomas: *Stachypteris Hallei*, a new Jurassic fern. The paper describes some specimens recently discovered in the lower estuarine beds of Whitby and Marske. The fertile segments were composed of imbricating scales bearing single large annulate sporangia. Spores with peculiar reticulate walls were obtained from these. Fertile specimens of this genus had only been found previously in the Corallian of Verdun, but no sporangia had been observed.—G. R. Mines: Some observations on electrocardiograms of cold-blooded animals. (Preliminary note.) Simultaneous records were taken of the movements of auricles and ventricle, of the electrical variation of the ventricle, and also, in cases where the organ was perfused, of the systolic output of the frog's heart. The main object of the inquiry, which is still in progress, is the elucidation of the point of action of electrolytes which affect the cardiac mechanism.—Dr. H. B. Fantham and Miss Annie Porter: The structure and homology of the microsporidian spore, as seen in *Nosema apis*. The paper contains (1) an account of the structure and development of the spore of *N. apis*, investigated by the authors in connection with Isle of Wight bee disease; (2) the homology of the spore structure of *N. apis* with respect to other Microsporidia, Myxosporidia, and Sarcosporidia is then discussed.—R. Hargreaves: Cyclic paths for rays reflected at an elliptical boundary.—G. Stead: Note on the spectrum of argon. In this paper a short account is given of an attempt to determine the conditions under which the red and blue spectra of argon are produced.

EDINBURGH.

Royal Society, June 3.—Sir William Turner, K.C.B., president, in the chair.—Dr. Dawson Turner: Experiments in radio-activity; the production of the thorium emanation and its use in therapeutics. After a brief account of the radio-active properties of thorium, especially in connection with applications to surgery, the author described how he had been led to try with success thorium emanation in the case of a patient suffering from an advanced excavating rodent ulcer.—Dorothy Court: The use of antiseptics in autolysis of animal and vegetable matter.—Prof. A. H. Gibson: The equilibrium of the circular-arc bow-girder.—Dr. J. Cosmo Melville and R. Standen: The marine mollusca of the Scottish National Antarctic expedition; Part II., being a supplementary catalogue. Some fifty species not enumerated in the first part were described, one of them, *Chaetopleura brucei*, being named after the leader of the expedition. More than twenty of the species were described as new.—Prof. David Hepburn: Observations on the anatomy of the Weddell seal (from the collection of the Scottish National Antarctic expedition). Part III., the respiratory system and the mechanism of respiration. The flexibility of the thoracic wall and the peculiarities of attachment of certain muscles in association with the marine habitat of the seal were contrasted with those of man. The key to the whole mechanism of inspiration was found to be in the contraction of the diaphragm. The investigation seemed to throw light on the differences of respiration in quadrupeds and man, the difference in attitude leading to a form of chest movement requiring in each case the minimum muscular effort. In the avoidance of severe muscular effort when a smaller effort will serve the purpose was found the source of the difference between the adult male and female types of breathing.

June 17.—Prof. Cossar Ewart, vice-president, in the chair.—Dr. Brownlee: Inheritance of hair and eye colour. The paper was an analysis of observations made by the late Dr. Beddoe. The Mendelian laws were obeyed in a remarkable degree. The coupling ratio between hair and eyes was probably 9 and not 7, as present theories led us to expect. As regards the use of the correlation coefficient or the contingency coefficient in estimating heredity it appeared that, at least in certain instances, it could be taken more as a test of the degree of race mixture than of actual heredity.—Dr. Robert Campbell: The Upper Cambrian Rocks at Craigeven Bay, Stonehaven; and the Downtonian and Old Red Sandstone Rocks of Kincardineshire. The fossils recently discovered in the black shales associated with typical spilitic lavas at Craigeven Bay, and forming part of the boundary fault series, clearly show that they are of Lower Palæozoic age, probably Upper Cambrian. In the second paper it was maintained that nearly 3000 ft. of strata in the neighbourhood of Stonehaven formerly regarded as Old Red Sandstone must be assigned to the Downtonian (Upper Silurian). The Downtonian rests unconformably on the Upper Cambrian, and is overlaid conformably by the Lower Old Red Sandstone.—Prof. C. Chilton: The Amphipoda of the Scottish National Antarctic expedition. The collection contained sixty-two species, of which nine were described as new. There were, however, variations, which some naturalists might be tempted to describe as new, variations which were probably climatic. The results obtained supported the view that so-called bipolar species were cosmopolitan in their distribution, being of smaller size and in much smaller numbers in the equatorial regions.—Dr. J. Rennie: The Cestoda of the Scottish National Antarctic expedition. The collection consisted of seven adult

species and three in the bladderworm stage. Of the former four were new species of *Dibothriocephalus*, viz. *D. scoticus* and *D. coati*, from *Stenorynchus leptonyx*, *D. mobilis*, from Weddell's seal, and *D. pygoscelis*, from a species of penguin. One of the bladderworms lives in the blubber of Weddell's seal. A remarkable feature of Antarctic tapeworms is the large number of minute and delicate forms.—W. J. Jackson: The Brachiopoda of the Scottish National Antarctic expedition. The collection added materially to our knowledge in regard to the geographical range of certain forms, those from the vicinity of Coat's Land being of exceptional interest.

DUBLIN.

Royal Irish Academy, June 10.—Rev. Dr. Mahaffy, president, in the chair.—T. Alexander and J. T. Jackson: New graphical construction of maximum bending moments, on short girders, due to a locomotive with a kinematical model showing instantaneous diagrams.—R. Jack: Magnetic resolution of the spectrum lines of niobium. Lines giving ten, eight, six, and fewer components were observed. The separators were found, in general, to satisfy the Runge and Ritz rules. Two short series and a number of equal differences were found connecting lines having the same Zeeman effect. A number of dissymmetrical separations were observed, and a probable explanation of the variation in dissymmetry given. It was shown that for substances with odd valencies an even number of components predominates among lines with many components, and for those with even valencies an odd number of components.—D. J. Scourfield: Fresh-water Entomostraca (Clare Island Survey). Ninety species were found, one of which is new to science and twenty new to Ireland.—Miss J. Stephens: (1) Cœlenterata; (2) Marine Sponges (Clare Island Survey). (1) The majority of the Cœlenterata collected during the survey belong to species which are fairly common all round the Irish coast. *Tubiclava cornucopiae*, *Corymorpha nutans*, and *Lovenella clausa* are among the rarer hydroids that were found. *Depastrum cyathiforme* is recorded for the second time for Ireland. The Madreporaria are represented by *Caryophyllia Smithi* and *Sphenotrochus Wrighti*. Only one fresh-water species was found, namely *Hydra vulgaris*. It occurred on Clare Island and in lakes on the adjacent mainland. (2) Sixty-four species of marine sponges were collected. Of these, twenty are recorded for the first time for the Irish coast (seven of them being new to Great Britain), and two are described as new species. The sponge-fauna of Clare Island with its exposed rocky coasts is compared with that of the sheltered bays of the adjacent mainland, and the chief differences between them are touched upon. One of the most striking differences noticed was the scarcity of the Calcarea, as regards number of species, off the limestone shores of the islands at the head of Clew Bay, as compared with the number of species found off Clare Island, where the rocks are non-calcareous.

PARIS.

Academy of Sciences, June 24.—M. Lippmann in the chair.—Armand Gautier and Paul Clausmann: Control of the new method of estimating fluorine. Detection of the smallest traces of this substance. A description of analytical results obtained by the application of methods described in two previous papers. Quantities of fluorine of the order of 1 to 5 mgr. can be determined with an error of less than 0.1 mgr.; amounts of 0.002 to 0.001 mgr. can be detected.—A. Chauveau: Stereoscopic inversions caused by the retinal images of simple points in space.—M. Gouy: Study of the D line in absolute units and application to solar

physic.—M. de **Forcrand**: Some physical constants of cyclohexanol. Determination of the cryoscopic constant, heat of solution, of fusion, and of evaporation. Pure cyclohexanol is very hygroscopic, and special precautions had to be taken to exclude moisture during the measurements.—Paul **Sabatier** and M. **Murat**: The direct addition of hydrogen to the diphenylethanes. The preparation of the dicyclohexylethanes.—R. **Lépine** and M. **Boulud**: The resorption of glycose in the tubuli of the kidney.—J. **Trousset**: The orbit of the eighth satellite of Jupiter.—Émile **Belot**: An experiment reproducing the helices of spiral nebulae.—A. **Buhl**: The partial differential equations defining surfaces susceptible of passing through a closed contour.—Maurice **Gevrey**: Certain partial differential equations of the parabolic type.—M. **Mesnager**: Thick circular plates.—Th. **De Donder**: The movement of electrons in a given magnetic field.—U. **Cisotti**: Elastic deformations without tangential stresses.—Jean **Bequerel**: The inversion of Hall's phenomenon in bismuth. The superposition of two galvanomagnetic effects of opposite sense. The experiments described show that in a sufficiently intense field Hall's phenomenon in bismuth changes its sign; these results appear to be opposed to the electronic theory of conductivity.—A. **Pérard**: The measurement of small industrial standards with plane faces by an interference method. An account of the examination of some Johansson 5 mm. and 1 mm. standards. The maximum error was 0.12 μ .—Albert **Colson**: The existence of four inactive tartaric acids and on the law of mass action. Remarks on some recent papers by MM. Darzens and Séjourné and M. Le Chatelier.—Daniel **Berthelot** and Henry **Gaudechon**: The wavelength of the active radiations in the photochemical synthesis of ternary compounds.—Paul **Lebeau**: Uranic anhydride and its hydrates.—L. **Cavel**: The gases from the mud of septic tanks. The gas obtained by dry distillation of the mud gave a gas with a calorific value of 3500 calories per cubic metre.—G. **Darzens** and H. **Leroux**: The glycidic ethers of β -naphthanone, naphthanoic aldehyde, and methyl-naphthanyllketone.—A. **Mailhe**: New azoic colouring matters from the oxide of diphenyleneamine.—G. **André**: The distribution of the mineral bases in barley in the course of the growth of this plant.—R. **Fosse**: The production of urea by the hydrolysis of albuminoids. Urea is obtained by the action of alkaline solutions upon egg albumin.—Marcel **Baudouin**: The diseases of prehistoric animals. Deformities in the cave bear (*Ursus spelœus*) due to spondylitis.—Charles **Nicolle**, A. **Conor**, and E. **Conseil**: The intravenous injection of the living cholera bacillus.—Albert **Berthelot** and D. M. **Bertrand**: Some biochemical properties of the *Bacillus aminophilus intestinalis*.—M. **Taphanel**: Disinfection of the hands by tincture of iodine and decoloration by bisulphite in surgery.—Jules **Courmont** and A. **Rochaix**: The antityphoid immunisation of man by the intestines.—H. **Carré**: An abundant source of pure agolaxic virus.—A. **Moutier**: External hypotension and internal hypertension.—J. **Chaine**: The influence of high temperatures on certain parasitic insects of the organism.—Paul de **Beauchamp**: Contribution to the experimental study of sexuality in *Dinophilus*.—Ph. **Négris**: The age of the Athens schists.—H. **Mansuy**: Recent palæontological discoveries in Indo-China.—F. **Montessus de Ballore**: The probable constancy of the world's seismic activity.

CAPE TOWN.

Royal Society of South Africa, May 15.—Mr. L. Péringuey, president, in the chair.—R. **Dümmer**: A revision of the genus *Alepidea*, Delaroché. The paper

contains full descriptions of the twenty-three known species of the African genus *Alepidea*, of which eleven are described as new.—Prof. **Jolly**: Positive electrical change in isolated nerve. The various theories which have been put forward regarding the causation of positive electrical change in isolated nerve are critically discussed, and the results obtained by different instruments and methods of investigation correlated.—J. **Walker**: A short note on the occurrence of a *Leucocytozoon* infection. Host—the ostrich. In November, 1911, when investigating the cause of the mortality amongst ostrich chicks on a farm in the Middelburg district, Cape Province, the presence of a *Leucocytozoon* infection was noted in some instances in blood smears collected from sick chicks. The *Leucocytozoon* not having been described yet, the author proposes to call it *Leucocytozoon struthionis*.—Dr. **Moir**: Valency and chemical affinity. Two and a half years ago the author showed that the atomic weights could be fairly exactly calculated by making use of a proton, μ , of atomic weight, about 0.009. The author has now discovered evidence that this proton may really be the true cause of valency and of chemical combination. This evidence consists in the fact that practically the same value of μ is given by the three most exact determinations of molecular ratios that he is acquainted with.—Prof. **Gilchrist**: Description of a new species of *Trygon* from South Africa. Three species of the Pijl-staart or Stingray (*Trygon*) have been recorded from South African waters. A description of a fourth, which seems to be a new species, is given in the paper.

MELBOURNE.

Royal Society of Victoria, March 14.—Annual meeting. Mr. J. Shephard elected president, and in the chair.—W. T. **Kendall**: Esperanto and science.—J. A. **Gilruth**: The introduction and spread of the cattle-tick (*Boophilus annulatus*, var. *microplus*), and of the associated disease, tick-fever (Babesiosis) in Australia. The introduction is not due to buffalo, but dates from importation of Batavian cattle from the Dutch Indies in 1872. These have crossed with Australian cattle, and the disease has spread over the country by the main stock routes.—J. A. **Gilruth** and Georgina **Sweet**: Further observations on *Onchocerca gibsoni*, the cause of worm nodules in cattle. Originally introduced either in Indian cattle (*circ.* 1840) or in Timor cattle (between 1824 and 1840). Previous characteristics of infection corroborated. Experiments on life-history show failure of direct infection, soil, direct contact, and three species of louse as intermediaries. Further experiments being arranged.

April 11.—Mr. J. Shephard, president, in the chair.—A. M. **Lea**: Australian and Tasmanian Coleoptera inhabiting or resorting to the nests of ants, bees, and termites; supplement.—E. C. **Joshua**: A new Holothurian of the genus *Tæniogyrus* found in Port Phillip Bay.—Walter **Stapley**: The occurrence and development of cervical ribs in man and some of the mammals that have abandoned quadrupedal progression. Cervical ribs in the mammalian neck express the breaking down of the fixed mammalian neck-type in response mainly to impulses generated by the presence of the lung in the neck due to upright position.

May 9.—Mr. J. Shephard, president, in the chair.—A. J. **Ewart**: The ascent and descent of water in trees. A poisonous and then a coloured solution were caused to be drawn up the tree. The sap in ascent avoided the poisoned parts. There was considerable loss through the roots.—A. J. **Ewart** and Bertha **Rees**: Contributions to the flora of Australia, No. 19.

BOOKS RECEIVED.

Éloges Academiques et Discours. By G. Darboux. Pp. iii+525. (Paris: A. Hermann et Fils.) 5 francs.

The Inter-relationships of the Bryophyta. By Dr. F. Cavers. ("New Phytologist" Reprint, No. 4.) Pp. viii+203. (Cambridge: Botany School.) 4s.

Pygmies and Papuans: the Stone Age To-day in Dutch New Guinea. By A. F. R. Wollaston, with Appendices by W. R. Ogilvie-Grant, A. C. Haddon, and S. H. Ray. Pp. xxiv+352+plates+maps. (London: Smith, Elder and Co.) 15s. net.

The Composition of Matter and the Evolution of Mind. By D. Taylor. Pp. 176. (London and Felling-on-Tyne: Walter Scott Publishing Co., Ltd.) 3s. 6d.

Notes sur la Physique et la Thermodynamique. By E. H. Amagat. Pp. v+146. (Paris: A. Hermann et Fils.) 6 francs.

Non-Euclidean Geometry. By Prof. R. Bonola. Translated by Prof. H. S. Carslaw. With an Introduction by Prof. E. Enriques. Pp. xii+268. (Chicago: The Open Court Publishing Co.) 2 dollars net.

The Teachers' Book of Constructive Work for Elementary Schools. By E. J. S. Lay. Pp. xii+142. (London: Macmillan and Co., Ltd.) 3s. 6d. net.

Treatise on Light. By Christiaan Huygens. Rendered into English by Silvanus P. Thompson. Pp. xii+128. (London: Macmillan and Co., Ltd.) 10s. net.

The Depths of the Ocean. By Sir John Murray and Dr. J. Hjort. With contributions from Prof. A. Appellöf, Prof. H. H. Gran, and Dr. B. Helland-Hansen. Pp. xx+821. (London: Macmillan and Co., Ltd.) 28s. net.

Sir Joseph Dalton Hooker, O.M., F.R.S., &c. An Oration by Prof. F. O. Bower. Pp. 36. (Glasgow: J. MacLehose and Sons.)

South-Eastern Agricultural College, Wye. Report on Economic Mycology for 1911. By E. S. Salmon. Pp. 55. (London and Ashford: Headley Bros.) 1s. 6d.

Lehrbuch der Zoologie. By Prof. R. Hertwig. Zehnte Auflage. Pp. xii+675. (Jena: G. Fischer.) 11.50 marks.

Elementary Quantitative Analysis. By Dr. W. Briggs. and H. W. Bausor. Pp. viii+122. (London: W. B. Clive.) 2s.

University of Pennsylvania. The Museum. Publications of the Babylonian Section. Vol. ii, No. 1: Business Documents of Murashu Sons of Nippur, dated in the Reign of Darius II. By A. T. Clay. Pp. 54+123 plates. Vol. ii, No. 2: Documents from the Temple Archives of Nippur, dated in the Reigns of Cassite Rulers. By A. T. Clay. Pp. 55-92+plates 1-72. (Philadelphia: The University Museum.)

Studies in Radio-activity. By Prof. W. H. Bragg. Pp. x+196. (London: Macmillan and Co., Ltd.) 5s. net.

The Local Incidence of Cancer. By C. E. Green. Pp. 36. (Edinburgh and London: W. Green and Sons.) 1s. net.

A Guide to the Dissection of the Dog. By Dr. O. C. Bradley. Pp. viii+241. (London: Longmans and Co.) 10s. 6d. net.

An Introduction to the Theory of Statistics. By G. U. Yule. Second edition. Pp. xv+381. (London: C. Griffin and Co., Ltd.) 10s. 6d. net.

Modern Copper Smelting. By D. M. Levy. Pp.

xi+259. (London: C. Griffin and Co., Ltd.) 10s. 6d. net.

The Main Drainage of Towns. By F. N. Taylor. Pp. ix+313. (London: C. Griffin and Co., Ltd.) 12s. 6d. net.

FORTHCOMING CONGRESSES.

JULY 8-12.—Museums Association. Dublin. President: Count G. N. Plunkett. Secretary: E. E. Lowe, The Museum, Leicester.

JULY 15-19.—Celebration of the 250th anniversary of the Royal Society. London.

JULY 24-30.—First International Eugenics Congress. London. President: Major Leonard Darwin. Secretary: Eugenics Education Society, 6 York Buildings, Adelphi.

JULY 25-28.—Congress of the Royal Institute of Public Health. Berlin. Address: Russell Square, W.C.

JULY 20-AUGUST 3.—Royal Sanitary Institute. York. Address: 90 Buckingham Palace Road, S.W.

AUGUST 5-10.—International Congress of Entomology. Oxford. President: Prof. E. B. Poulton. General Secretary: Dr. Malcolm Burr, c/o The Entomological Society of London, 11 Chandos Street, W.

AUGUST 22-28.—(i) International Congress of Mathematicians, and (ii) International Commission on Mathematical Teaching. President: Prof. Klein. Treasurer: Sir J. Larmor, F.R.S., St. John's College, Cambridge.

SEPTEMBER (first week)—International Congress of Anthropology and Prehistoric Archaeology. Geneva.

SEPTEMBER 4-11.—British Association. Dundee. President: Prof. E. A. Schäfer, F.R.S. Assistant Secretary: O. J. R. Howarth, Burlington House, London, W.

SEPTEMBER 4-13.—International Congress of Applied Chemistry. Washington, D.C. President: Dr. W. H. Nichols. Secretary: Dr. B. G. Hesse, 25 Broad Street, New York City, U.S.A.

SEPTEMBER 8-11.—Société Helvétique des Sciences Naturelles. Atdorf. President: Dr. P. B. Huber. Secretaries: Prof. J. Brülisauer (German) and M. P. Morand Meyer (French), Atdorf.

SEPTEMBER 23-28.—International Congress on Hygiene and Demography. Washington. President: Dr. H. P. Walcott. Secretary-General: Dr. J. S. Fulton, Army Medical Museum, Washington, D.C.

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