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BOTANY FOR STUDENTS.

A Text-Book of Botany. By Dr. Eduard Strasburger, Dr. Ludwig Jost, Dr. Heinrich Schenk and Dr. George Karsten. Fourth English edition, revised with the tenth German edition by Prof. W. H. Lang, F.R.S. Pp. xi+767. (London: Macmillan and Co., Ltd., 1912.) Price 18*s.* net.

FOUR years have passed since the last English edition of this comprehensive German text-book was published, and the present volume, revised by Dr. Lang, is by far the most satisfactory edition of the book which has yet appeared. The book has been very widely used by English-speaking botanists, though it is far from being an ideal work either for students or for teachers. With the rapid development of botanical research there has been a corresponding increase in the subject-matter dealt with until the volume is now uncomfortably bulky and heavy. The attempt to deal with botanical science in the most comprehensive manner, which is the aim of this text-book, has resulted in the former editions in undue condensation of the subject-matter. This defect is still very marked in the present volume and seriously impairs the value of the work.

The arrangement follows that of previous editions, namely, two parts devoted to general botany—including morphology and physiology—and special botany, comprising cryptogams and phanerogams. The first part consists of 325 pages, and in the second section, physiology, the pages for the most part are closely printed with small type.

With characteristic thoroughness the German authors appear to have included the last word in each branch of the subject, but there is also the tendency, when so many points have to be mentioned, that a large number of important subjects receive too short a notice to allow of adequate explanation. This defect has all along been particularly noticeable in the morphological section of the volume. In the present edition the structure of the sieve tube, for instance, is dismissed in about half a page of text with some indifferent figures—a treatment far too meagre to be within the unaided comprehension of the ordinary student. Germination, too, receives but the scantiest treatment.

It is true that references to all the most recent work are given, but surely it would have tended to a more liberal education in botany to deal at greater length with the fundamental facts and to put aside some of the minutiæ of detail. There is very little use in placing ornamented crockets on the pinnacles of a tower if the whole structure is likely to collapse from insecure foundations. In this, however, our plaint is not against Dr. Lang but is directed rather towards the authors of the book. The defect is probably due to the fact that they have had to compress matter sufficient for two volumes into one, and have become frightened at the size of the result. If, in the future, part i. should be separated from part ii. it may then be found possible to extend adequately and fundamentally the sections of morphology and physiology. The physiological section has now become one of the most useful in the book and is, if anything, too careful to be thoroughly abreast of modern work. Like the first section it tends to suffer from condensation and too brief treatment of the various subjects. As an instance it may be pointed out that the explanation of so important a phenomenon as plasmolysis fails to be wholly intelligible.

The second part is as comprehensive as the first. Among the fungi the recent work by Blackman and others is included with illustrations, and the utmost care has been taken to put the reader in possession of the latest results. The inclusion of fossil types where needed to explain the sequence of plant forms is a distinct addition to the book. Our chief quarrel with the phanerogamic section, and with the cryptogamic to a lesser extent, is the inclusion of the coloured illustrations, which are poor in themselves and are not likely to be of much service to British students.

The defects from which this volume suffers may perhaps be attributed to two facts, the first being that it is a compound work, and the second and more important that it has been written to meet the requirements of too many different classes of people.

The science of botany is presented as a concentrated extract of dry facts and the subject is very largely shorn of its romance and charm. There can be no doubt, however, that it ought to be possible for the intelligent examinee to obtain the maximum number of marks in his examination after a careful study of this volume.

Suitable though it may be for the various types of German students and serviceable as it undoubtedly is to English-speaking students, we cannot but feel regret, despite its many excellent qualities, that this book is coming to be recognised as the standard text-book of botany in English.

MODERN PHYSICS.

(1) *Studies in Radioactivity*. By Prof. W. H. Bragg, F.R.S. Pp. xi+196. Macmillan's Science Monographs. (London: Macmillan and Co., Ltd., 1912.) Price 5*s*. net.

(2) *The Electrical Properties of Flames and of Incandescent Solids*. By Prof. H. A. Wilson, F.R.S. Pp. vii+119 (London: University of London Press; Hodder and Stoughton, 1912.) Price 6*s*. net.

IT is seldom in the history of any science that three fundamental discoveries are included within the brief space of three years. The discovery of X-rays in 1895 marks a new epoch in the history of physical science, for it led early in 1896 to the discovery of radio-activity and was followed in 1897 by the proof of the nature of the kathode rays and the advent of the electron as a definite entity. In the following years an ever-increasing fraction of the energy of workers in physics has been devoted to a study of the numerous important problems which have arisen from these three primary discoveries.

In the early stages of the experimental inquiry a discussion of these subjects was conveniently included in single treatises on the conduction of electricity through gases and on radio-activity. With the rapid increase of our knowledge of the various subdivisions of the subject it was inevitable that special treatises would be necessary to discuss in more detail the results of recent investigations. This is illustrated by the separate publications that have appeared on the theory of electrons, ionisation by collision, and the chemistry of the radio-active bodies. This tendency towards specialisation is in many respects advantageous provided two conditions are fulfilled. In the first place, it is essential that the subject should be treated by experts who have taken an active part in the development of our knowledge of the topics under consideration; in the second place, it is of great importance that the author, in the extended treatment of the subject, should not lose sight of its connection with the main stream of advance in physics, both experimental and theoretical.

The two books under review fulfil these conditions in an ideal manner, for they are both written by men who have made notable contributions to our knowledge of the subjects under consideration, and have that requisite knowledge of modern physical views to treat the subjects in the right perspective.

(1) The work of Prof. Bragg deals mainly with the phenomena accompanying the passage of α, β and γ rays and X-rays through matter. An interesting account is given of the theoretical reasoning that led the author to predict the nature of the absorption of the α rays by matter, and of the admirable experiments made by him which led to such an important extension of our knowledge of this subject. The results of experiments on the passage of X-rays through matter are interpreted on his well-known corpuscular theory of the X-ray. The essential point of this theory is that the energy of the X-ray is corpuscular in the sense that it is concentrated and does not spread from the source like that to be expected in an ordinary pulse or wave. In addition, it is supposed that the β ray and the X-ray are mutually convertible forms of energy. When a β ray disappears as a result of a close encounter with an atom, an X-ray of equal energy takes its place and tends to be propagated in the original direction of the β ray. This theory has the advantage of giving a concrete and easily grasped idea of the processes occurring in the passage of X-rays through matter, and has served a very useful purpose in directing numerous investigations which have thrown much light on the subject.

It is remarkable that although more than seventeen years have elapsed since the discovery of X-rays, there is still a great difference of opinion as to their nature and the mechanism of their absorption by matter. The recent striking experiments of Laue and his colleagues, supplemented by the explanation of Mr. W. L. Bragg, seem to show conclusively that a fraction of the X-rays suffer regular reflection at the crystal planes of mica and of other crystals. These results seem only compatible with the view that the X-rays are some type of wave motion. On the other hand, the liberation of a high-speed electron from an atom traversed by the X-ray cannot be explained with any credibility unless it be supposed that the energy of the X-ray is concentrated over a minute volume, and can be given up in an encounter with a single atom. These apparently conflicting but fundamental properties of the X-ray must be reconciled in any satisfactory theory of the X-rays.

The book is very pleasantly and clearly written and contains a concise account of most of the important experiments on the subject under consideration. While there will, no doubt, be considerable difference of opinion as to the merits of the theories proposed by the writer, the book can be strongly recommended not only to the physicist, but to all those who are interested in the fascinating field of inquiry which has been

opened up by the discovery of new types of penetrating radiation.

(2) The work of Prof. H. A. Wilson is confined to a discussion of the electrical properties of incandescent bodies and of flames. Under the influence of the ionisation theory of gases this important field of inquiry has rapidly developed, and a large amount of experimental data has now been accumulated. An account is first given of the character and conditions of the discharge of negative and positive electricity from glowing bodies, followed by a discussion of the conductivity of flames under different conditions. It has been clearly established that the rapid discharge of electricity from hot bodies is due to the escape of free electrons, and the author discusses the result in the light of the theory developed partly by himself and partly by Prof. O. W. Richardson. This theory supposes that the free electrons in a metal acquire sufficient velocity at high temperatures to escape from the metal and to give rise to the observed discharge of negative electricity.

The earlier experiments certainly afforded strong ground for this conclusion. Since the publication of this book, however, experiments have been made by Pring and Parker and others which throw same doubt on the completeness of this explanation. It has been shown that carbon at very high temperatures and in a thoroughly exhausted space gives only a minute fraction of the current to be expected from the application of the theory to the earlier measurements at lower temperatures. There seems to be little doubt that, at any rate in the case of glowing carbon, the large electronic currents initially observed were due not to the escape of electrons in the carbon itself, but rather to some interaction between the carbon and the residual gases. The theory of the subject is at present in a somewhat unsatisfactory state, and it would appear that more complete experimental data are required before any theory can be adequately tested.

Prof. Wilson gives a brief but concise account of the important experiments on the subject, followed in every case by a discussion of the results in the light of the theories proposed. An excellent description is given of the experiments on flames with and without the additions of salt vapours, and the results are interpreted in terms of the ionisation theory. The author himself was a pioneer in this field and laid the foundation of the present theory on a firm basis of experiment.

The book is in no sense popular, but is written for the advanced student or investigator who is already familiar with the fundamental facts of the electronic theory and the ionisation theory of gases. It will be found very useful by all physicists as giving a concise and straightforward account of the present state of our knowledge of a very interesting but difficult field of investigation. E. R.

PHILOSOPHY AND PSYCHOLOGY.

(1) *The Nature of Woman.* By J. Lionel Tayler. Pp. 186. (London: A. C. Fifield, 1912.) Price 3*s.* 6*d.* net.

(2) *The Fundamentals of Psychology.* By B. Dumville. Pp. ix+382. (London: W. B. Clive, 1912.) Price 4*s.* 6*d.*

(3) *Evolution and the Need of Atonement.* By Stewart A. McDowall. Pp. xvi+155. (Cambridge: University Press, 1912.) Price 3*s.* net.

(4) *On the Consciousness of the Universal and the Individual.* By Dr. F. Aveling. Pp. x+255. (London: Macmillan and Co., Ltd., 1912.) Price 5*s.* net.

(5) *Science and the Human Mind.* By W. C. D. Whetham, F.R.S., and Catherine D. Whetham. Pp. xi+304. (London: Longmans, Green and Co., 1912.) Price 5*s.* net.

(6) *The Note-Books of Samuel Butler, Author of "Erewhon."* Selections arranged and edited by Henry F. Jones. Pp. xii+438. (London: A. C. Fifield, 1912.) Price 6*s.* net.

(7) *The Spiritual Interpretation of Nature.* By Dr. J. Y. Simpson. Pp. xv+383. (London: Hodder and Stoughton, 1912.) Price 6*s.* net.

(8) *Papers on Psycho-Analysis.* By Dr. E. Jones. Pp. xv+432. (London: Baillière, Tindall and Cox, 1913.) Price 10*s.* 6*d.* net.

(9) *Questions of the Day in Philosophy and Psychology.* By Dr. H. L. Stewart. Pp. x+284. (London: Edward Arnold, 1912.) Price 10*s.* 6*d.* net.

(1) A DESCRIPTION, historical and biological, of the feminist movement. The conclusions of the author, who is a London University Extension lecturer on biology and sociology, are: that woman, not being merely a female man, but of different aptitudes, has her own proper sphere and direction of development; that her speciality is motherhood—not merely the physical fact, but also the ennobling influences involved; that the married woman should not work in factories, &c., but should be economically dependent on the man, as he is domestically dependent on her; and that a standard marriageable wage should be secured to the male worker. The book closes with a reprint of W. C. Roscoe's article, "Woman," in *The National Review* for October, 1858. In this pioneer essay, "every

argument of real strength for and against the woman's movement, that has been used in the fifty odd years that followed its publication, will be found summarised."

(2) A good text-book, more than elementary and well adapted for its purpose as a guide to teachers. It follows James and McDougall for the most part, and is provided with suitable questions at the end of each chapter. Its scheme is the usual modern one: first, the physiology of sensation, then perception, imagination, ideation, memory, conation, feeling, instincts. Throughout, the practical application to the child-mind is kept in view, and the writing is clear and good. Mr. Dumville is master of method and lecturer on education in the L.C.C. Islington Day Training College.

(3) Mr. McDowall accepts the scientific view of biological evolution, carrying it forward to a higher plane. He suggests that the fact of spiritual development demands a determining environment to call out spiritual activities. This he conceives as a transcendent mind which comprehends, enfolds, includes the environment-sum of the whole world. Man, however, has sinned, being free; and his only way of salvation is to "accept Christ"—though if he fails to do so in this life he may have a chance in the next. Bishop Ryle supplies a eulogistic introduction to the book, which is thoughtful and earnest, and will doubtless be of use to many readers who feel the need of harmonising theology with natural science.

(4) Dr. Aveling sketches the history of the problem of universals or general terms—*i.e.* roughly speaking, what "man" means, apart from this or that man—from Plato down to the present, and then proceeds to give a detailed account of his psychological experiments. These were carried out with pictures and nonsense-words, with various observers. The results led to the conclusions—among others—that images are not necessary as contents for thought, but thinking always involves concepts as contents; and that "the 'universal' is phenomenologically present, or tends to be present, to consciousness as a concept or imageless substantive content." The research was, of course, psychological, aiming at answering the question: "What is discoverable in consciousness when we think the 'universal' or the 'individual'?" The metaphysical question ("Do universals exist in nature?") and the epistemological question ("Do our universal ideas correspond to reality?") are naturally left to their respective domains.

(5) Mr. and Mrs. Whetham have once more produced an admirably readable yet trustworthy popular-science book, and it is to be hoped that it will circulate widely. The authors trace the development of science from its dim beginnings—dim so far as history is concerned—in Chaldea and Egypt, down through Aristotle, the Arabians, Aquinas, and the Renaissance, to the Baconian period and the present day—including even such recent events as Prof. Schäfer's Dundee address. As becomes a historical survey, dogmatism and partisanship are avoided, the authors refraining from expressions of opinion on, *e.g.*, vitalism. The style is enlivened by a pleasant humour, as when the Council of Nicæa is said to have met, "with characteristic modesty, to determine the true nature of God" (p. 67), and the sequence of the book is logical and smooth. Its philosophy also is excellent, and many men of science might do worse than read the last two chapters on the scope and function of science, and its relation to religion. The "laws of nature" are the logical laws of the conceptual world formed by our own minds, and these laws are of practical use in enabling us to predict the future behaviour of our own perceptions. The business of science is to construct a consistent conceptual model, but how far that model corresponds to "reality" is not for science to say, nor can it be assumed to represent reality in any final or total way. In short, there is room for metaphysics and faith by the side of science.

(6) The whimsical genius of Samuel Butler is best known through the satirical romance "Erewhon," but his "Life and Habit" and "Unconscious Memory" show him as a serious thinker, of scientific methods, but with a spiritual and teleological view of evolution, in which he was in advance of his time. But his title to fame will probably rest on his literary style and the flashing audacity and originality of his thoughts. This is specially indicated in the volume under notice, which consists of detached and fragmentary notions, jotted down at odd times, on all subjects, from Handel to death, from mind and matter to painting. His criticisms are cruelly searching, as when he compares Pater's style to an old woman who has had her face skilfully enamelled. It is a good book to dip into when seeking smart paradoxes. We recommend it to Mr. G. K. Chesterton, of whom Butler often reminds us. Mr. Chesterton will rightly take this as a compliment when he reflects that his friend G. B. Shaw has called Butler the greatest English writer, in his own department, of the latter part of the nineteenth century.

(7) A very similar book to Mr. McDowall's

above-noticed, but on a larger scale and more detailed in its sketch of biological evolution. Dr. Simpson is orthodox in his science, but on the religious side conceives a World Principle immanent and transcendent, yet personal. "Of course, we cannot form a clear conception of such infinite, unconditioned personality. We are certain that it is something richer in content than our personality." The problem of sin is very well handled: the Genesis narrative is symbolically true, but does not teach that man fell from a state of goodness. On the contrary, he has risen from a state of *innocency*, such as the child's state before he learns to recognise good and evil. He must continue to rise, until he reaches communion with God through likeness to Him. The book contains much that is theologically and philosophically debatable, but is an excellent example of the modern literature of reconciliation, and does credit both to the learning and the piety of its author.

(8) Dr. Jones dedicates his book to Prof. Freud, among whose disciples he enrolls himself. Many interesting illustrations are given, showing the influence of subconscious desires in producing lapses of memory and the like. Other chapters deal with the relation between organic and functional diseases, simulation in hysteria, the pathology of morbid anxiety, the action of suggestion in psychotherapy, Freud's theory of dreams, and psycho-analysis and education. The writer is associate-professor of psychiatry in the University of Toronto. His book is extremely readable and good, chiefly by reason of its wealth of concrete examples. We may incline to think that the Freudian psychology is itself obsessed with sex-ideas, and is guilty of tracing everything to subconscious sexual thoughts or desires; but, after all, a theory is best tested by its thorough application to facts, and there is no doubt that Freud is a pioneer, comparable—it may be, as Dr. Jones suggests—with Darwin himself.

(9) These essays are, in the main, an expansion of a course of lectures delivered in the Queen's University of Belfast. They deal with subconsciousness, genius, pragmatism, pessimism, Nietzsche, &c. The opinions are well and temperately stated, and we only discover one dubious statement of fact—viz., that 98 per cent. of all classes of persons are hypnotisable. This percentage is much higher than the average opinion of experts would allow. The author follows Myers in his psychology, according well-merited praise to that writer and to the careful work of the Society for Psychical Research.

J. A. H.

MATHEMATICAL TEXT-BOOKS.

(1) *Exercises in Modern Arithmetic.* By H. Sydney Jones. Pp. x+336. (London: Macmillan and Co., Ltd., 1912.) Price 2*s.* 6*d.*

(2) *Notes on Algebra.* By A. F. van der Heyden. Pp. viii+133. (Middlesbrough: Wm. Appleyard and Sons, Ltd, 1912.) Price 2*s.* 6*d.*

(3) *The Teaching of Mathematics in Secondary Schools.* By Arthur Schultze. Pp. xxi+370. (New York: The Macmillan Company; London: Macmillan and Co., Ltd., 1912.) Price 5*s.* 6*d.* net.

(4) *Higher Algebra for Colleges and Secondary Schools.* By Dr. Charles Davison. Pp. viii+320. (Cambridge: University Press, 1912.) Price 6*s.*

(5) *Non-Euclidean Geometry: A Critical and Historical Study of its Development.* By Prof. Roberto Bonola. Authorised English translation with additional appendices. By Prof. H. S. Carslaw. With an Introduction by Prof. Federigo Enriques. Pp. xii+268. (Chicago: The Open Court Publishing Company, 1912.) Price 2 dollars net.

(6) *An Introduction to the Infinitesimal Calculus.* Notes for the use of Science and Engineering Students. By Prof. H. S. Carslaw. Pp. xii+137. (London: Longmans, Green and Co., 1912.) Price 5*s.* net.

(1) THIS volume consists of the examples reprinted from the author's work entitled "Modern Arithmetic with Graphic and Practical Exercises." The range covered is that required for the Oxford and Cambridge Local examinations. The quality of the examples, which are mainly of a practical character, is good. A number of typical examination papers are given at the end of the book.

(2) This note-book is intended for students who are revising the subject, not for those breaking new ground. There is much interesting historical information; but we are inclined to think that the treatment is scarcely sufficiently thorough for many purposes. For example, none but the simplest tests of convergence are given, the theory of numbers is represented by Fermat's theorem alone, and the method given for resolving partial fractions is inadequate. The geometrical representation of complex numbers, Demoivre's theorem and its applications are included.

(3) The object of the author in publishing this volume is to show that the purpose of a mathematical training is best served by making the course less informational and more disciplinary than is at present customary. He contends, and

with some truth, that the majority of teachers aim at impressing a set of facts upon their pupils rather than training them how to attack and discuss mathematical problems. Unfortunately, there are few teachers who are free agents; the requirements of the various examining boards must first be satisfied before personal individuality can be freely exercised, and much of the best work of the first-rate teacher is of a character that examinations can scarcely test. At the same time, mathematical teachers should undoubtedly know something of the science of teaching, and cannot fail to profit by a knowledge of the experience of others. In the present volume, there is much of real interest and value. After preliminary general discussions, the author examines in great detail the theory of geometrical teaching and somewhat briefly the elements of a suitable course in algebra and trigonometry. Such a work as this should find a place in the common-room libraries of our secondary schools.

(4) This is a continuation of the author's former treatise on algebra for secondary schools. It opens with the binomial theorem and includes all that usually finds a place in an advanced school course. Among the chief features of the book may be noted an excellent chapter on complex quantity; the geometry of vectors is developed, and the use of trigonometric functions renders the account reasonably complete. By introducing the notation of the calculus, the treatment of limits is simplified and the usual applications in the theory of equations become possible. The work on continued fractions is put rather more briefly than usual, but nothing of importance for any ordinary purpose has been omitted. The volume has an attractive appearance, the examples are really good, and the essay questions at the end will be of great assistance to scholarship candidates.

(5) The study of non-Euclidean geometry has, till recently, attracted the attention only of the specialist; no doubt this has been due principally to the general belief that the difficulties were so considerable, the philosophical problems so intricate, and the subject so contrary to ordinary experience that the ordinary mathematician would, without prolonged study, make little of it. Time, however, invariably lowers the levels and extends the boundaries of the territory accessible to ordinary students. There are now a number of elementary text-books which make its pursuit a comparatively easy task. There are two valuable studies by Mr. Frankland—"The Theories of Parallelism" and "Euclid I., with a Commentary"—there is a primer by Prof. Manning, a more elaborate treatise by Prof. Coolidge, and, for those who read German, the works of Killing, Liebmann, Hilbert, Vahlen, etc.

The translation of Prof. Bonola's valuable critical and historical summary will be of the greatest assistance to students. The book opens with an account of the attempts to prove Euclid's parallel postulate which were made from the time of the Greek geometers down to the seventeenth century. The next section deals with the period when men were first beginning to inquire whether a form of geometry could exist independently of this postulate. This work is associated with the names of Saccheri, Lambert, Wolfang Bolyai and others; but it was not until the time of Gauss, Taurinus, Lobatschewsky, and Johann Bolyai that the foundations of non-Euclidean geometry were securely laid. A most interesting sketch is given of the growth of thought in this period. The concluding chapter discusses the later work of Riemann, Helmholtz, Lie, Cayley, Klein, etc. There are five appendices; these deal with (*a*) the fundamental principles of statics; (*b*) Clifford's parallels; (*c*) constructions; (*d*) the independence of projective geometry; (*e*) a method of exhibiting the impossibility of proving Euclid's postulate by a consideration of the analogous geometry of a system of circles orthogonal to a fixed circle. This last appendix, which is due to Prof. Carslaw and is based on Wellstein's work, establishes, by an elementary and elegant method, a number of interesting theorems in hyperbolic geometry.

(6) These notes on the calculus, drawn up for science and engineering students, are intended to supplement the earlier parts of the ordinary text-books. The first chapter gives the analytical geometry of the straight line, the second illustrates the meaning of differentiation by examples from physics and geometry; in the next three the rules for differentiations are given; and the last two, after a few pages on the geometry of the conic, give an account of integration and its applications.

OUR BOOKSHELF.

Kausale und konditionale Weltanschauung. By Max Verworn. Pp. 46. (Jena: Gustav Fischer, 1912.) Price 1 mark.

EVEN when one profoundly disagrees, it is always a pleasure to listen to Prof. Max Verworn, for he has clear-cut convictions which he states vividly and with enthusiasm. The present essay is an exposition of "conditionism" as contrasted with "causalism," and it deals hard blows at vitalism, dualism, entelechy, free will, and other naïve and uncritical assumptions, as Verworn thinks.

It may be of interest to state the five propositions of conditionism:—(1) There are no isolated

or absolute things. All things, *i.e.* all processes and states, are conditioned by other processes or states. (2) There is no process or state which is dependent on a single factor. All processes or states are conditioned by numerous factors. (3) Every process or state is inevitably determined by the sum of its conditions. Only under similar conditions do similar processes or states occur, and, conversely, different processes and states presuppose different conditions. (4) Every process or state is identical with the sum of its conditions. The totality of the conditions is the process or state. (5) All the conditions of a process or state are of equal value for its occurrence in so far as they are necessary. But it does not seem difficult to accept all these propositions and yet remain a good vitalist.

Dizionario di Merceologia e di Chimica Applicata. By Prof. V. Villavecchia. Terza editione. Vol. ii. Lettere N–Z e Indice. Pp. 1360. (Milan: Ulrico Hoepli, 1913.) Price 15 lire.

THE scope of this work and its especial features were explained when the first volume was reviewed. The second volume embraces articles from N to Z, and occupies 1170 half pages. All the articles are written very concisely; in fact, so concisely that, *e.g.*, the author has not yielded to the temptation to do more than mention the Italian occurrences of petroleum in the article "Petrolio greggio."

The remainder of the work, covering 200 pages, forms a very complete index. It is carried through in four languages, and includes also botanical and zoological names. Thus this index very greatly assists the reader who is not sufficiently conversant with the Italian language to depend on the alphabetical arrangement of the subject-matter in the body of the two volumes.

The Vertebrate Skeleton. By Prof. Sidney H. Reynolds. Pp. xvi+535. Second edition. (Cambridge: University Press, 1913.) Price 15*s.* net.

THIS work, belonging to the Cambridge Zoological series, was reviewed at length in the issue of NATURE for July 15, 1897 (vol. lvi., p. 245), at the time of its original publication. The present edition has been revised and brought up to date. Prof. S. W. Williston has assisted Prof. Reynolds in this work, having rewritten the chapter on the Sauropsida and that on the general account of the skeleton in reptiles, as well as contributing some notes on birds and on the Stegocephalia.

Heaton's Annual: the Commercial Handbook of Canada and Boards of Trade Register, 1913. Edited by E. Heaton and J. B. Robinson. Pp. 401. (Toronto: Heaton's Agency; London: Simpkin, Marshall, Hamilton, Kent and Co., Ltd.) Price 5*s.*

THE ninth issue of this yearly handbook dealing with the resources of Canada is full of interest. It will prove directly useful to teachers of commercial geography, and much of the general information it provides will appeal to scientific readers.

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.]*

On the Appearance of Helium and Neon in Vacuum Tubes.

SINCE reading before the Chemical Society (see NATURE, February 13, p. 653) the paper on the presence of helium and neon in vacuum tubes (containing hydrogen) after the gas had been sparked, we have carefully compared the spectrum lines that are supposed to be characteristic of these gases. The result has been interesting. In the case of neon and hydrogen there appears to be a large number of lines in the secondary spectrum of hydrogen that are very close to the important lines of neon. If only those lines are taken that differ by less than a quarter of an Ångström unit (using the measurements of Watson), there are fifty-seven instances. It is not necessary to give all of them, but if the neon lines of intensity 4 and greater be taken it is found that there are twenty instances:—

Intensity	Neon	Hydrogen	Intensity	Neon	Hydrogen
9	6506·69	6506·82	4	5872·27	5872·12
10	6402·43	6402·51	10	5852·62	5852·72
9	6383·14	6383·20	4	5760·74	5760·58
5	6175·09	6175·14	7	5343·40	5343·43
7	6143·31	6143·30	4	5122·40	5122·64
6	6096·36	6096·21	6	5080·52	5080·73
6	6074·51	6074·66	4	4537·93	4537·91
5	6030·20	6030·30	4	3682·37	3682·20
5	5975·76	5975·68	9	3520·61	3520·60
5	5882·06	5882·17	6	3472·68	3472·65

Moreover, according to Watson there are only two neon lines of intensity 10, and only four of intensity 9. Of these six principal neon lines, five are paralleled in the secondary hydrogen spectrum, and the sixth line of neon (of intensity 9), 6334·65, is near to a hydrogen one, 6335·53.

There are also fifty-three neon lines that differ from those of the secondary hydrogen spectrum by less than one Angström unit and by more than a quarter. This makes 110 lines that are paralleled in the two spectra.

In the case of neon and helium there are also a series of lines that run parallel. Three of these lines were pointed out by Watson (Proc. Roy. Soc., vol. lxxxi., p. 185). He says: "The lines at 6678 and 3447, however, were very bright on the same plate, and it must be concluded that there are two neon lines almost coincident with the helium lines." "There appears to be a similar pair at 4713, though I was unable to obtain a plate on which the neon line alone was present. The wave-lengths of the lines concerned are:—

He	6678·37	...	4713·25	...	3447·73
Ne	6678·50	...	4713·51	...	3447·83

And no reason can be at present assigned to their close proximity."

In the case of neon and oxygen, one of the two bright neon lines of intensity 8 and wave-length 5330·90 is very near to a bright oxygen line wave-length 5330·84.

J. NORMAN COLLIE.
HUBERT S. PATTERSON.

February 22.

The Occurrence of the Portuguese Man-of-War (Physalia), and of a Giant Spider-Crab, "Homola (Paromola) cuvieri," in the English Channel.

THE occurrence of the Portuguese man-of-war (Physalia) on the English coast is so unusual as to be well worth recording. During March and the early part of April, 1912, numbers of the Atlantic form of Physalia were cast up on our shores at various points between Cardigan Bay and Seaford in Sussex. It was also reported by M. Caullery[1] as occurring along with Velella on the French side of the Straits of Dover in the early part of April, 1912. Specimens were also sent to this laboratory on February 10 this year from Looe, on the south coast of Cornwall. There can be little doubt that the presence of Physalia on the south coast of England in March and April, 1912, was due to the almost continuous high southerly to south-westerly winds indicated in the south-eastern part of the North Atlantic in the meteorological reports for the early part of that year.

Physalia is believed to occur normally only in the warmer currents of the Atlantic Ocean,[2] but in the early months of the year large specimens are not infrequently blown into the Mediterranean, and after storms thousands have been found about the same time of the year on the beaches of the Canary Islands. It is therefore not improbable that the Physalia stranded on the English coasts had been driven by the wind from the eastern portion of the subtropical North Atlantic.

It is interesting to note that at the end of March northerly winds set in in the eastern part of the English Channel. This circumstance probably explains why Physalia and Velella were driven on to the French side of the Straits of Dover.

It may also be of interest to mention that a specimen of the very large spider-crab *Homola* (*Paromola*) *cuvieri* has been taken for the first time on record in the English Channel. The specimen is a very fine male. When the large clawed legs are held out at right angles to the body, the span is nearly 4 ft. (117·3 cm.), while the length of the carapace is rather more than 6½ in. (16·6 cm.). We are informed by Messrs. M. Dunn and Sons, who presented the crab to the Marine Biological Laboratory at Plymouth, that it was taken by fishermen on December 16 last, in a trammel-net three-quarters of a mile E.S.E. of Pen-a-Maen Point (north-east of Dodman Point), on the Cornish coast. At this spot the depth of water is about 15 fathoms, whereas in the Mediterranean this crab is said to inhabit the deeper waters, and has been taken there in about 215 fathoms. Off the north-west coast of Africa[3] it has indeed been recorded from a depth of 350 fathoms.

There is an abundant growth of marine animals (viz. Anomia, Pomatoceros, Serpula, Sabella, Botryllus, Antennularia, Ascidiella, Plumularia) on the back and legs of the crab, a fact which seems to indicate that the animal has been living at least some months in relatively shallow water. This specimen of Homola is still living in the tanks at the Marine Biological Laboratory, and is feeding well.

The occurrence of Homola in the English Channel is one more instance of the close relationship of the fauna of this region with that of the Mediterranean and neighbouring parts of the Atlantic. Homola, however, has been recorded rarely from the west coasts of Ireland and Scotland,[4] hence there is the possibility that this northern distribution may have been effected partially by means of the current which flows from the Mediterranean, and is believed to spread along the western shores of Europe. There is, moreover, reason to believe that the more typical planktonic forms of life might be carried considerable distances in such a wind-drift as that in which Physalia must have been. It is not suggested, however, that the larvæ of Homola, for example, would be driven so far as Physalia and Velella in similar circumstances, for it is well known that these two Siphonophores, inasmuch as they are semi-aërial, comprise a separate category of plankton with regard to their adaptation for distribution.

The recent distribution of Physalia may therefore be said to offer us a picture by means of which we can more readily understand, for example, the close relationship between the fauna of the English Channel and that of the Mediterranean and neighbouring Atlantic region.

J. H. ORTON.

The Laboratory, Plymouth.

[1] M. Caullery, *Bull. de la Soc. Zool. de France*, tome xxxvii., 1912, pp. 180–2.

[2] C. Chun, "Ergeb. der Plankton-Exped." Die Siphonophoren, Bd. II., K.b, 1807, p. 89.

[3] A. Milne Edwards and E. L.-L. Bouvier, "Expéditions Scientifiques du Trav. et du Talisman." Crust. Decap., I., 1900, p. 10.

[4] "Guide to Crustacea, &c., Exhibited in the Department of Zoology, British Museum (Natural History), 1910." p. 66.

Actual Conditions affecting Icebergs.

IN the interesting discussion by Dr. Aitken on the relation between laboratory experiments and actual conditions, as affecting icebergs (NATURE, January 9), there is one element of primary importance which appears to be too much overlooked. To put it in the most general terms, icebergs are almost always moving in the drift of an ocean current; and the point to which I wish to direct attention is the relative movement of the water with respect to the iceberg.

It is the nature of constant currents to have a greater speed at the surface and to decrease in velocity with the depth. This is a usual characteristic, as found in my investigations in the Tidal and Current Survey, in several such currents. For example, when the surface speed is one knot or more the velocity may fall to about half this at 30 fathoms, and it may be only distinctly appreciable at 90 fathoms. An iceberg in such a current will, of course, move with the average velocity corresponding to its draught, and, as a consequence, the *normal* condition is that an iceberg has a superficial current running past it. It is also probable that this current will usually be much greater than such movements of the water around it as are set up by convection, from difference of temperature.

It is also to be noted that this relative movement is independent of wind disturbance and tidal effect, which often accentuate it. In the work of this Survey, I have had ample opportunity to observe these effects while at anchor in the open amongst icebergs for days at a time. In Belle Isle strait, they ground in a depth of 30 or even 50 fathoms, which shows the draught they may have; and the strong tidal streams of 2 to 2½ knots running past them create a wake behind them, like a vessel under sail. This may be considered an unusual condition, but it should not be overlooked in discussing practical safeguards, for an iceberg aground on the 30-fathom bank in the middle of Belle Isle strait is as much of a menace to navigation as any.

Although there may thus be many modifications of general conditions, it will be on the safe side to assume in this discussion that there is always a superficial current of appreciable amount flowing past an iceberg, even in the open, while it is carried along in any berg-bearing current.

W. BELL DAWSON.

(Superintendent of Tidal and Current Surveys, of Canada.)

Ottawa, Canada, January 25.

FRESH LIGHT ON THE CAUSE OF CANCER.

PROF. JOHANNES FIBIGER, of Copenhagen, describes in a long article in the *Berliner klinische Wochenschrift* for February 17 some experiments which carry our knowledge of the relation between the origin of cancer and external causes a step further. The present writer has been aware of these observations since August, 1911, but they have been in progress since 1907. They have, therefore, been pursued for some five years, which indicates alike the difficulties overcome and the praiseworthy pertinacity of the investigator.

When examining growths found in the stomachs of three wild rats, Fibiger was struck by the presence of nematodes, and he set himself to determine if they stood in causal relationship to the growths or were accidental concomitants. Cancer of the stomach in mice was described by Murray in 1908 from the laboratory of the Imperial Cancer Research Fund, but at an examination undertaken in consequence of a letter from Fibiger, neither he nor we were able to show the presence of nematodes. The growths occurred in rats obtained from some sources and not from others, and their occurrence coincided with the presence of *Periplaneta americana*. From other sources he was aware of the cockroach serving as a host for round worms. The cockroaches harboured a nematode, and he studied its life-cycle. It lives in the pavement epithelium of the upper portion of the rat's alimentary canal, where it reaches sexual maturity. The eggs containing embryos are passed with the fæces, and on being consumed by the cockroach (either *P. americana* or *P. orientalis*) the embryos are liberated, and wander into the striped muscles of the prothorax and limbs. In these situations they are found after six weeks coiled up trichina-like.

When rats eat infected cockroaches, the larvæ are freed and wander into the squamous epithelial covering of the fundus of the stomach, and occasionally also into the gullet, tongue, and mouth. They do not invade the epithelium covering the rest of the canal. Fifty-seven tame rats were fed on *P. americana* infected with the Spiroptera; in fifty-four the nematode was found in the stomach, in seven the growths which had initiated the investigation were found, and in twenty-nine others there were found the earlier stages of such growths. Feeding rats with eggs containing embryos did not convey the infection. Microscopical investigation showed in the case of seven rats growths resembling the tumour originally observed, together with the certain presence of secondary deposits in other organs in the case of two and possibly of three rats. The structure of the growths was in four out of the seven definitely that of a malignant new growth.

It would appear, therefore, that for the first time malignant new growths have been deliberately produced by experiment through the agency of a living parasite. Fibiger draws the conclusion that the disease is dependent on the presence of the Spiroptera, and, on analogy with other Helminthes, assumes they act by some poison secreted, although he is not prepared to dismiss altogether the possibility of a virus or ultramicroscopical organism being concerned. All the histological pictures found form a continuous series, but they afford no clue to the mechanism of genesis. Important is the observation that the worms were only associated with the primary growths, and were absent from the secondary deposits, showing that the cells had acquired independent powers of growth.

The association of round and other worms with cancerous growths has long been known. Borrel and Haaland described this association for mice from the Institut Pasteur in 1905 for certain growths of the lung and lymph glands. The association of a tape-worm with cancer of the small intestine in mice was described by Bashford and Murray in 1905. Haaland, when working in the laboratory of the Imperial Cancer Research Fund, published an elaborate communication on the association of a nematode with cancer of the mamma in that animal. He assumed its excretions were the cause of chronic inflammation on which nodular hypertrophy, adenoma, and carcinoma developed. Its life-history—notwithstanding continued attempts made in the hope of being able to attack the problem of causal relationship directly—has not been followed to this day, but it was shown to be different from another nematode occurring in the alimentary canal, both nematodes having been identified by Mr. Shipley and Dr. Leiper. And since then there have been many other references in the literature.

The presence of the worms must not be interpreted in the sense that they are *the* cause of cancer, as has been done in the lay Press. They probably act as chronic irritants, of which a legion is associated with the development of cancer. They may be animate or inanimate, *e.g.* mere direct *physical* injury as in fracture of bone or in the "horn core" of cattle in India, *chemical* as in paraffin, petroleum, tar, arsenic, and aniline cancer, *actinic* as in the case of the short hot clay-pipe, the Kangri, the X-ray, or brand cancers (of cattle). Squamous-celled carcinoma develops in engine-drivers over the shin where the skin has been exposed for years to the direct action of heat. They may be of an infective nature as in Bilharzia for the bladder, the tubercle bacillus where epithelioma develops in an old lupus scar, or *Treponema pallidum*, as in the association of keratosis linguæ with epithelioma of the tongue. The irritant may be a larger parasite, such as worms.

Borrel has suggested that the latter are the carriers of a specific cancer virus; on the other hand, it has been suggested that the relation for all these irritants is a mediate one in quite a different sense, and that the common factor lies in the capacity of the living cell itself to undergo variations in structure and in powers of growth such as have been demonstrated in propagated tumours when subjected to the repeated irritation produced by transplantation, as described in the reports of the Imperial Cancer Research Fund. It

is unfortunate that the growths produced experimentally by Fibiger present just as much difficulty in the elucidation of the exact process as do all other natural growths.

In the past the attempt has often been made to produce cancer by subjecting animals to the irritations associated with cancer in man, but without success except possibly in the case of X-rays. As the writer has pointed out, the irritants vary from one mammal to another, and the knowledge of the irritants to which different species and even their individual organs are liable is of very considerable importance, and will require extensive study. Prof. Fibiger is to be congratulated not only in having isolated such an apparent specific irritant, but also, by carefully imitating the natural process, on having produced cancer experimentally through the mediate intervention of a parasite for the first time. E. F. BASHFORD.

THE INTERNATIONAL AËRO EXHIBITION AT OLYMPIA.

THE development of the details of flying machines between 1908 and the present time is immediately obvious on a visit to the Aëro Exhibition; but, quite apart from the higher standard of workmanship, it is also evident that scientific principles are governing the design of aëroplanes to a greater and greater extent. Almost without exception the designs show evidence of the general desire to keep the resistance of the machines as low as possible and so get increased lifting power and speed. It is not any longer necessary to consider the bare possibility of lift, as the shape of the wings is now so good as to give about 20 lb. of lift per horse-power, and engines available for aëroplanes can be obtained of horse-powers up to 160, weighing less than 3 lb. per horse-power; such an engine can then carry, roughly, 1½ tons, a weight greater than that of any existing aëroplane.

The reduction of resistance does not then arise from necessity, but appears to be directly due to the application of scientific principles. The chief saving in resistance arises from fewer stay-wires and in the covering of the fuselage or tail girder of almost all flying machines, although there are notable exceptions, such as the Maurice Farman biplane exhibited. As compared with the first Wright machine, the stay-wiring of modern machines looks comparatively simple, and in biplanes in particular the struts have been lengthened in the direction of the wind. The strength of the struts is often obtained from a circular steel tube, the desired section for low resistance being obtained from it by the addition of wooden tails and headpieces. The difference of resistance due to shaping the tubes may, on a biplane, increase the carrying capacity of the machine to the extent of another passenger.

The covering of the fuselage to make a streamline body has, however, other effects than that of reducing the resistance. The side surface is considerable, and becomes equivalent to a vertical fin; Prof. Bryan in his book on stability has shown mathematically, what Mr. Lanchester deduced earlier from a combination of experiment and mathematical analysis, that the position of such fins is of the greatest importance when considering the lateral stability of an aëroplane, and that great care must be taken in the arrangement of such surfaces.

One then looks at the exhibits to find how far aëroplane constructors are designing according to the principles of inherent stability, and how far they leave the control to the skill of the pilot. So far as longitudinal stability is concerned, practically all the machines at the normal flying speed satisfy the mathematical requirements for the stability of small oscillations. The essential features of inherent stability are contained in a series of planes inclined fore and aft, with the angle of incidence from plane to plane decreasing progressively from front to back and in addition having the smaller or elevator planes of sufficient area. Most of the machines, such as the Blériot, BE 2, &c., have two surfaces, the main wings and a neutral or nearly neutral tail, whilst the Cody prize machine and the Maurice Farman biplane have each three planes due to the addition of a forward elevator.

Part of the tail plane, and usually the greater part, is fixed to the fuselage of the flying machine, and exercises a control which is independent of the pilot, who is left with the adjustment of the remainder for manœuvring. An exception to this subdivision of the elevator occurs in the Breguet machine, where the whole surface is under the immediate control of the pilot. This latter arrangement has the advantage of a powerful control and the corresponding possible disadvantage of depending entirely on the strength of the pilot for the maintenance of attitude. How much the advantage outweighs the disadvantage is obviously a question to be settled later by the majority of constructors, since it is not yet widely adopted.

With the possible exception of flying at low speeds, it would seem that for longitudinal stability flying machines possess a considerable amount of inherent stability, and only call for serious assistance from the pilot in special circumstances, as when the aëroplane is struck by a gust.

Lateral stability, however, receives far greater variety of treatment, and except that all machines provide large control for the pilot, there is, in the machines exhibited, little evidence of unanimity of method. Leaving out the difficult problem of the spiral dive and considering the machines for lateral stability in linear motion, the points of interest in the machines rest with the positions of the vertical fins or their equivalents.

The most usual combination of fins, which may be seen on the Blériot, Deperdussin, and Bristol machines amongst others, is a dihedral angle between the wings, constituting an equivalent fin above the centre of gravity, and the side of the covered body together with the rudder, the latter making a fin behind the centre of gravity. In a recent lecture before the Aëronautical Society, the superintendent of the Aircraft Factory pointed out that the effect of dihedral angle is dependent to a greater or less extent on the arrangement for

warping the wings, a freely connected cross-warp tending to eliminate the effect of dihedral angle. If for the time being we neglect the complication introduced by the warping mechanism, the system reduces to one of the cases considered by Messrs. Harper and Bryan, who state that, "for stability, the distance of the tail fin behind the centre of gravity must not be less than a certain inferior limit." The condition is closely connected with the covering of the tail girder, as the covering means that the equivalent fin is brought nearer to the centre of gravity of the machine.

The only representative at the exhibition of another method of obtaining lateral stability is the Handley Page monoplane. In common with other well-known machines, such as the Dunne and Etrich, the Handley Page monoplane has wings of special shape and disposition arranged so as to give righting couples to the machine when rolling or turning occurs. The experimental information available is not yet sufficiently advanced to show that this system of specially shaped wings is either better or worse than the more usual one previously referred to, which depends on wings of a simpler form.

Perhaps the best indication of the position of the subject of lateral stability is to be found in the fact that the whole of the warp and rudder is left to the personality of the pilot, and that both are powerful controls. As the periods of the oscillations are comparatively long, it is quite within the bounds of possibility that a pilot would be able to keep his balance without the aid of inherent stability devices. If, however, the treatment of longitudinal stability is any indication of the trend of construction, then in the near future we may expect considerable attention to be paid to the problems of lateral stability, and that the final solution will not be inconsistent with the principles of stability deduced from mathematical investigations of the stability of small oscillations.

THE SCIENTIFIC WORK OF THE LOCAL GOVERNMENT BOARD.[1]

IN the introduction to the report before us Dr. Newsholme surveys the public health of England and Wales during 1911, and reviews the work of the medical department of the Board for the year ending March 31, 1912. The variations in mortality from various diseases since 1901 are illustrated by charts, as in the previous report. The percentage increase of population for 1901–11 remains the same (12·4) as in the preceding decade, but this is due to a fall in the death-rate by 3·0 per cent., which just counterbalances the decline in the birth-rate. The deaths from scarlet fever continued to decline during 1911, those from diphtheria and enteric fever increased slightly, but those from diarrhœal diseases showed a considerable increase over previous years, due to the abnormally hot season; even so, however, there was less diarrhœa, still less infant mortality, in 1911 than in 1899.

The previously plague-infected district in East Anglia has been kept under observation, and during July–October, 1911, 15,332 rats were examined, and twenty-seven farms or other premises were found to harbour plague-infected rodents.

Of the auxiliary scientific investigations carried out for the board, the first is a report on arterial degeneration by Dr. Andrewes. Dr. Newsholme points out in his introductory remarks that while there has been a great reduction in the general death-rate during the past thirty or forty years, this reduction only affects ages up to forty-five years, while higher ages participate in it little or not at all. In fact, for males between fifty-five and seventy-five, the death-rate actually tends to be going up. Inasmuch as one-third of the total deaths for the age period fifty-five to sixty-five is caused by diseases of the heart and blood-vessels, a knowledge of the causation of arterial degeneration is of importance. Dr. Andrewes's report is of a preliminary nature; he considers that the use of tobacco appears at most an adjuvant cause, while the influence of alcohol cannot be satisfactorily demonstrated.

Studies on the frequency of non-lactose fermenting and non-liquefying aërobic bacilli in young children have been continued at Birmingham by Dr. Lewis, and at Liverpool by Dr. Alexander, and Dr. Graham-Smith has investigated the incidence of the same organisms in flies. Prof. Nuttall and Messrs. Strickland and Merriman record observations on the species and number of fleas on British rats.

Prof. Hewlett and Dr. Nankivell have investigated the influence of the Porter-Clark water-softening process on the bacterial content of water treated by it, and find that considerable purification is effected thereby.

Dr. Blaxall finds that 0·1 per cent. of oil of cloves is a valuable aid in the preparation of glycerinated calf lymph free from micro-organisms.

Altogether this volume contains matter of much scientific value and importance. R. T. H.

[1] Forty-first Annual Report of the Local Government Board, 1911–12. Supplement containing the Report of the Medical Officer for 1911–12.

THE MOUNTAINS AND THEIR ROOTS.[1]

(1) IT would be difficult to conceive a greater divergence in character and scope between two books, nominally dealing with cognate subjects, than between the two first-named on our list. Prof. Bonney, in his metaphorical use of the word "building," follows popular usage, for how

[1] (1) "The Building of the Alps." By Prof. T. G. Bonney, F.R.S. Pp. 384. (London: T. Fisher Unwin, 1912.) Price 12*s.* 6*d.* net.
(2) Survey of India. Professional Paper No. 12: "On the Origin of the Himalaya Mountains: a Consideration of the Geodetic Evidence." By Colonel S. G. Burrard, F.R.S. Pp. ii+26. (Calcutta, 1912.)
(3) Survey of India. Professional Paper No. 13. "Investigation of the Theory of Isostasy in India." By Major H. L. Crosthwait, R.E. Pp. iii+14. (Dehra Dun, 1912.)

many, when speaking of a building, whether it be cottage or cathedral, ever think of anything but the superstructure, the material or methods of construction, the outward form, or the internal plan? And so Prof. Bonney deals with the Alps. Commencing with the materials of which they are made, he goes on to deal with the processes by which they were raised, and the carving of their outward form by rain, rivers, and glaciers, winding up with the vegetation that clothes their surface, the animals that wander over them, and the humanity which frequents them, whether as permanent inhabitants or temporary visitors. Attractively got up and pleasantly written, it gives Prof. Bonney's views on all these subjects—views which, as he mentions in the preface, are by no means universally accepted, but which, we may add, are none the less deserving of respectful attention—and will prove of interest not merely to the geologist, but to every intelligent and observant traveller in the Alps.

(2) Col. Burrard's memoir is of an entirely different character from Prof. Bonney's book. Addressed to the adept, it makes no appeal to the tyro, and, leaving on one side all consideration of the superstructure, deals only with what may be called the foundations of the Himalayas. Geodesists have long known that the attraction exercised by mountains on the plumb-line is much less than that which should result from their visible masses, and the explanation, first suggested by the late Sir G. Airy, has of late years crystallised itself in the hypothesis of isostasy, according to which the mountains are supported by a species of flotation, the excess of material in the protuberance above sea-level being compensated by a defect of density below.

The most complete and best-known investigation of this hypothesis is that of Mr. J. F. Hayford, of the United States Coast and Geodetic Survey, who has dealt with it, in the light of American geodetic observations, in an elaborate manner. The form of the hypothesis adopted by him was that the compensation extended to a uniform depth, and was effected by variation of the density of the earth's crust, so that the total downward pressure of a column of rock under the mountains should be the same as that of the lesser thickness under the ocean depths. Assuming this as the method of compensation, he found that the residual differences between the observed and the calculated deflection became least if the depth to which the compensation extended was taken at about 113·7 kilometres, and with that assumption the residuals became so small that the hypothesis might be accepted as extremely probable. This is not, however, a necessary conclusion, for an erroneous hypothesis may be in accord with a limited number of observations, but fail when these are extended; and the result of the application of Mr. Hayford's explanation to the Indian observations shows that it is inapplicable to that country.

(3) The facts on which this conclusion is based are interesting, and are given in detail by Major Crosthwait. At stations within the Himalayas the plumb-line is deflected by about 30″ to 40″ to the north, along the foot of the hills this has sunk to some 15″ or thereabouts, and at distances of more than forty miles it disappears or is replaced by a small southerly deflection. There is, consequently, a rapid variation in the amount of the observed deflection as we cross the limits of the mountain range, and this change is about double as great as it should be on Mr. Hayford's hypothesis.

The only other explanation investigated by Col. Burrard is that of foredeep, filled with sediment, and according to his calculations this hypothesis gives results which depart even further from observation than Mr. Hayford's. Col. Burrard offers an explanation of his own—that there is a rift in the subcrust along the foot of the mountains, the gradual opening of which gave rise to the compression of the Himalayas, and which became filled with the alluvium of the Gangetic plains as it was formed. Unfortunately he confesses that he is not geologist enough to elaborate this hypothesis, and it is difficult to see how it can be brought into accord with what is known of the geology of the Himalayas and of the country to the south of them, nor how it differs from Prof. Suess's foredeep.

Moreover, Col. Burrard appears to have overlooked an important paper, published by Rev. O. Fisher in *The Philosophical Magazine* of 1904, in which he investigates the effect of the Himalayas on the plumb-line in the light of an hypothesis of isostasy radically different from Mr. Hayford's. According to this the crust is of uniform density, the isostatic compensation being obtained by a variation in thickness, and on this hypothesis he finds that the attraction of the visible range, combined with the negative attraction of the downward protuberance, should give a northerly deflection of about 24″ at the foot of the hills, of 2″ at sixty miles away, and a southerly deflection of about 2″ at the farther edge of the plains. These results appear to be in very fair accord with observations in the region of the great Gangetic plain of upper India, where the conditions resemble those postulated in the calculations; beyond this region, in the Punjab and in Bengal, the variations are greater than in the central area, but there the conditions are complicated by the fact that geology suggests, and gravitation measurements indicate, the presence of denser rock at a small depth below the alluvium.

It must be acknowledged that Mr. Fisher's investigations do not give a complete explanation of all the variations observed, but this is inevitable in the case of any hypothesis which assumes—as must be done for purposes of calculation—that the crust and the underlying material have everywhere the same density. All that can be said is that it seems to be more closely in accord with the Indian observations than Mr. Hayford's, and it is to be hoped that Col. Burrard will be able

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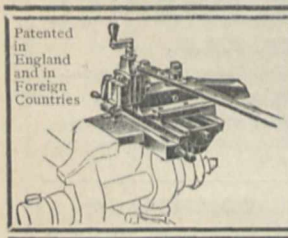

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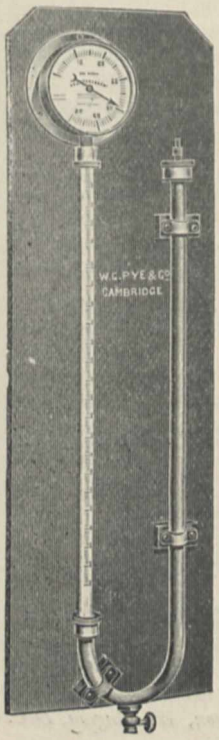

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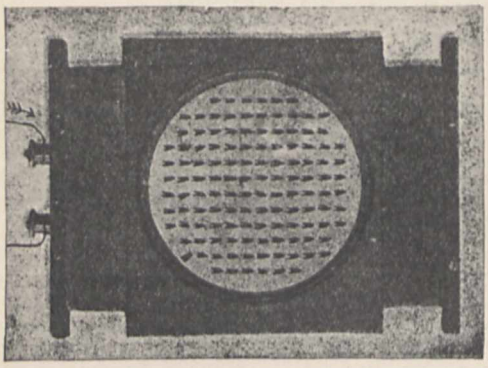

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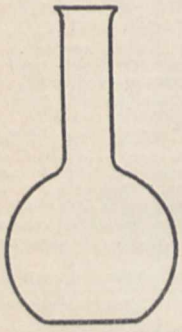

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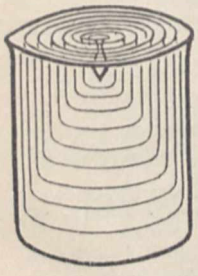

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Sir William Arrol was fortunate in finding a suitable field of work for the mental gifts with which he was so richly endowed. From the first his attention had been directed to the many novel problems, hitherto unsolved, which must be overcome if the building of long-span steel bridges was to be rendered commercially possible. It is with the great steel cantilever bridge over the Firth of Forth that his name will be for ever linked. Designed by Sir John Fowler and Sir Benjamin Baker, the hazardous and difficult task of its erection was entrusted to the firm of W. Arrol and Co. Splendid as was the design, perfect as were the working drawings down to the minutest details, when they left the hands of the two designers, it is not too much to say that it was the mechanical genius of William Arrol which made the erection of the bridge a possibility within the limits of time and cost which had been laid down by the engineers. The lengths of the spans and the height of the piers were far beyond anything previously attempted, and as a result the difficulties which had to be overcome would have daunted most men; they only served to show more clearly the extraordinary gifts he possessed. It was in this task that his mechanical genius found its best outlet. During the whole of the seven years that the work was in progress he was constantly busy, scheming new devices such as improved hydraulic riveting appliances, oil-fired rivet-heaters, complex and ingenious machines for the troublesome task of drilling the plates which went to build up the huge steel compression members, and, most important of all, no detail, however insignificant, escaped his watchful supervision and control.

He received his knighthood on the completion of the bridge in 1890, and never was this honour bestowed on one who had more worthily earned it; he had revolutionised the art of bridge-building and made it a science. The Tay Bridge, the Tower Bridge, and many other great structures will bear testimony to the fact that Sir William Arrol was, as a mechanical engineer, fully entitled to a place in that little band of men whose achievements in the field of engineering shed lustre over the last half of the nineteenth century.

NOTES.

BAD news is to hand from the Australian Antarctic expedition, under the leadership of Dr. Mawson, for two members of it have lost their lives. These are Lieut. Ninnis, an Englishman, and Dr. Mertz, a Swiss member of the scientific staff. The manner of their death is not stated, and, indeed, the whole message, which has reached Australia from the wireless telegraphic station established by the expedition at Macquarie Island, leaves us anxious for further information. It may be recalled that the expedition, reaching the Antarctic region in February of last year, was divided into two parties, under Dr. Mawson and Mr. Wild respectively, which landed about 143° E. and 95° E., in Adélie Land and Kaiser Wilhelm Land. It is known that valuable scientific work has been done, and that a considerable extent of coast-line has been charted for the first time. The vessel of the expedition, the *Aurora*, returned to Australia after landing the parties, and made a second voyage to the south to bring them off. It was thought that Dr. Mawson was aboard her, but apparently he missed her, owing to "unfortunate circumstances," which are not specified, and will have to remain in the south for another year, with six of his staff. For the rest, after mentioning the unhappy loss above referred to, he merely adds that there has been a successful sledging season, "opening up a large area of new land, both east and west of Commonwealth Bay, and obtaining important data at a number of stations in close proximity to the magnetic pole." But in view of what has befallen, anxiety must remain for many months as to the welfare of this party.

IT is officially announced that in recognition of the Antarctic work of her husband, the King has been pleased to grant to Mrs. Kathleen Scott the same rank, style, and precedence as if Capt. Scott had been nominated a Knight Commander of the Bath, as he would have been had he survived.

AN interesting exhibition of works by the late Mr. Thomas Woolner, R.A., is open at his studios, 29 Welbeck Street, W., until March 8. The exhibits include a number of objects of interest to men of science, among them being plaster busts of Charles Darwin, Huxley, and Richard Quain, bronze medallions of Darwin and Sir Joseph Hooker, a colossal head, in plaster, of Capt. Cook, and a bronze medal representing science and research. Any works not disposed of during the exhibition will be sold in the studio by auction, on a date to be announced later.

WE learn from *The Lancet* that, on the suggestion of the High Commissioner for Cyprus, the Secretary of State for the Colonies has arranged that a visit shall be paid to the island, during March, by Sir Ronald Ross, K.C.B., F.R.S.. The object of the visit is to investigate the causes of the prevalence of malarial fever in the island, and to advise in regard to the best means of combating the disease.

THE President of the Board of Agriculture and Fisheries has appointed Mr. D. H. Lane and Mr. Stephen Reynolds to be members of the Departmental

Committee which he has recently appointed to inquire into the present condition of the inshore fisheries, and to advise the Board as to the steps which could with advantage be taken for their preservation and development. The President has also appointed Dr. E. H. J. Schuster to be a member of the advisory committee recently constituted to advise the Board on questions relating to the elucidation through scientific research of problems affecting fisheries.

On Wednesday, March 12, a special meeting of the Faraday Society will be held in the rooms of the Chemical Society, Burlington House, when the programme will consist of a general discussion on the subject of "Colloids and their Viscosity." The chair will be taken by the president, Dr. R. T. Glazebrook, C.B., F.R.S., and papers will be read by Dr. Wolfgang Ostwald, Drs. H. Freundlich and N. Tshzake, Dr. W. Pauli, Dr. V. Henri, Mr. E. Hatschek, Prof. F. G. Donnan, F.R.S., Dr. S. B. Schryver, Prof. W. M. Bayliss, F.R.S., and Mr. W. B. Hardy, F.R.S.

At the annual general meeting of the Physical Society, held on February 14, the officers for the ensuing year were elected as follows:—*President:* Prof. A. Schuster, F.R.S. *Vice-Presidents:* Those who have filled the office of president, together with Mr. F. E. Smith, Prof. C. H. Lees, F.R.S., Prof. T. Mather, F.R.S., Dr. A. Russell. *Secretaries:* Mr. W. R. Cooper, Dr. S. W. J. Smith. *Foreign Secretary:* Prof. S. P. Thompson, F.R.S. *Treasurer:* Mr. W. Duddell, F.R.S. *Librarian:* Dr. S. W. J. Smith. *Other Members of Council:* Prof. C. G. Barkla, F.R.S., Prof. P. V. Bevan, Dr. W. H. Eccles, Prof. J. W. Nicholson, Major W. A. J. O'Meara, C.M.G., Prof. T. C. Porter, the Hon. R. J. Strutt, F.R.S., Dr. W. E. Sumpner, Mr. R. S. Whipple, Dr. R. S. Willows.

At the anniversary meeting of the Geological Society, held on February 21, the officers for the ensuing year were appointed as follows:—*President:* Dr. A. Strahan, F.R.S. *Vice-Presidents:* Prof. E. J. Garwood, Mr. R. D. Oldham, F.R.S., Mr. Clement Reid, F.R.S., and Prof. W. W. Watts, F.R.S. *Secretaries:* Dr. A. Smith Woodward, F.R.S., and Mr. H. H. Thomas. *Foreign Secretary:* Sir Archibald Geikie, K.C.B., President R.S. *Treasurer:* Mr. Bedford McNeill. The following awards of medals and funds were made:—Wollaston medal, Rev. Osmond Fisher; Murchison medal, Mr. George Barrow; Lyell medal, Mr. S. S. Buckman; Bigsby medal, Sir Thomas Henry Holland, K.C.I.E., F.R.S.; Wollaston fund, Mr. W. W. King; Murchison fund, Mr. R. E. L. Dixon; Lyell fund, Mr. Ll. Treacher; Barlow-Jameson fund, Mr. J. B. Scrivenor and Mr. Bernard Smith. The president delivered his anniversary address, which dealt with the form of that part of the Palæozoic platform which underlies the secondary rocks of the south-east of England.

The meetings of the Institution of Naval Architects will be held on March 12–14 inclusive, in the hall of the Royal Society of Arts. The morning meetings begin at 11.30, and the evening meetings on March 13 and 14 at 7.30. On March 12 the election of officers will take place, the president's address will be delivered, and the institution gold medal and premiums presented. Papers will be read and discussed on each of the three days of the meetings, and among the subjects to be considered the following may be mentioned:—The mechanical gearing for the propulsion of ships, by the Hon. Sir Charles A. Parsons, K.C.B.; the energy systems accompanying the motion of bodies through air and water, by Prof. J. B. Henderson; the calculation of stability in non-intact conditions, by Prof. W. S. Abell; notes on modern airship construction, by Baron A. Roenne; and the longitudinal stability of skimmers and hydro-aëroplanes, by Mr. J. E. Steele. The annual dinner will be held on March 12, at 7.30 p.m., in the Grand Hall of the Connaught Rooms.

In connection with the paragraph which recently appeared in our columns on the Pennant collection presented to the Natural History Museum by Lord and Lady Denbigh, it may be mentioned that, according to a notice in *The Times*, the birds include two very interesting specimens of the capercaillie. These, it is inferred, probably represent the old British stock, which became extinct about 1760 in Scotland, and, if so, are its only known representatives. Further examination may prove the right of the British bird to rank as a distinct race. The capercaillies now found in certain parts of Scotland are the descendants of Scandinavian birds introduced about 1837 by the then Marquis of Breadalbane, at Taymouth Castle. In a notice of the collection in *The Pall Mall Gazette* of February 19 it is stated that Mr. Edgar Smith has found that a British snail described by Pennant as *Helix rufescens* turns out to be a young specimen of *H. arbustorum*. For the British species which has hitherto been incorrectly identified with *H. rufescens* the name *H. montana* is available.

The Board of Trade announces with regard to the forthcoming expedition of the *Scotia* (see p. 680), which is being organised jointly by the Board of Trade and the North Atlantic steamship lines for the purpose of ice observation in the North Atlantic, that one member of the staff will be a trained meteorologist. Dr. Assmann, director of the Royal Prussian Aëronautical Observatory at Lindenberg, has made a valuable contribution to the scientific equipment of the *Scotia* by providing a number of kites for meteorological work, and instruments to be attached to these kites for recording air pressure, temperature, relative humidity, and wind velocity. It is hoped that if the weather conditions on the voyage are favourable a considerable addition may be made to the present very meagre knowledge as to the conditions of the currents in the upper air in the regions off the east coast of Newfoundland and Labrador. The long-range wireless apparatus in the vessel is being provided free of charge by the Marconi Company. Two wireless operators will be employed in order that a constant watch may be kept.

The keen north-easterly wind which blew with such persistence over the British Isles for the eight

days from February 15 to February 22 has checked somewhat the early and rapid development of vegetation, and in this way it will have proved beneficial. The cold over the United Kingdom was, however, by no means great, and the maximum day temperature at Greenwich was only below 40° on two days, February 18 and 20, although in the ten days from February 13 to February 22 there was only one day, February 16, with the shade temperature above 43°. The frost at night was generally slight, but on the early morning of February 23, when the north-east wind had practically ceased, the shade temperature at Greenwich fell to 24°, which is the lowest reading since February 6, 1912, and the exposed thermometer on the grass fell to 10°. The weather was generally very dry. The controlling factors were a region of high barometer, mostly to the north of Scotland, and areas of low barometer to the south of Europe. On the Continent, and especially in France and Germany, the weather for the period was much colder than in the United Kingdom. Snow fell at Nice on February 17 and 19, and on February 17 the maximum day temperature at Nice was 41°, whilst at Greenwich for the same day the maximum was 42°.

AT the annual general meeting of the Royal Astronomical Society on February 14, Dr. F. W. Dyson, the president, gave an address on the presentation of the gold medal which had been awarded to M. Henri Alexandre Deslandres, for his investigations of solar phenomena and other spectroscopic work. He pointed out that M. Deslandre's labours in solar physics have extended over more than twenty-one years. His researches on banded spectra established the laws followed by all spectra of this class; he also investigated the spectrum of the corona and of comets and their tails. But his most important work was with the spectroheliograph and a velocity recorder devised by himself, with which, perhaps, even more important results are being obtained. The chief general conclusion drawn from the velocity records is that the bright areas on the solar surface are descending and the dark filaments ascending. He has always kept in mind the ultimate object of his researches—the determination of the constitution and circulation of the solar atmosphere. The gold medal was handed to M. Roux, secretary of the French Embassy, for transmission to M. Deslandres, who was unable to be present. The president also announced that the Jackson-Gwilt bronze medal and gift had been awarded to the Rev. T. H. E. C. Espin, for his observations of the spectra of stars and his discovery of Nova Lacertæ. After a brief account of these researches, the president handed the medal and gift to Mr. Espin.

NEWS has reached us, by cablegram from Calcutta, of the death, on February 19, of Prof. W. Tate, professor of chemistry in the Civil Engineering College, Sibpur. Prof. Tate received his early scientific education at the Midland Institute, Birmingham, whence he proceeded, in 1886, to the Royal College of Science, South Kensington, as a national scholar. After a brilliant career as a student, he obtained the associateship of the college in chemistry, with honours, in 1889. He was then appointed demonstrator in one of the chemical laboratories of the college, and during that period he was engaged in some researches, and prepared a revised and enlarged edition of Sir Edward Thorpe's "Chemical Problems." About sixteen years ago Prof. Tate was appointed to the Indian Educational Service as professor of chemistry at the Civil Engineering College at Sibpur, which is situated in rather an unhealthy and somewhat malarious locality five or six miles to the south of Calcutta, on the banks of the Hooghly; and he continued in this appointment up to the time of his death. He had to reorganise, and almost to create, the chemical department of that college. Under his supervision a very successful and commodious laboratory was erected and equipped, and excellent work has been done in it by the students under his tuition. He also gave great help to committees of the Calcutta University in determining the courses in science for its degrees in civil engineering and also in other University questions. He did valuable work during the whole of his service in India, and was very popular with the members of his department, and also with his students. His death at a comparatively early age will be deeply regretted by many friends, both in India and at home.

THE exhibition of "Wonders of Science," held in the Surbiton Assembly Rooms on February 19–22, proved remarkably successful, the capacity of the hall being frequently inadequate to accommodate all seeking admission. It is estimated that more than 7000 persons attended during the hours for which the exhibition was officially open; in addition, about 1200 school children were admitted in the mornings. The official programme mentions 152 exhibits, but many of these consisted of numerous objects. They included scientific apparatus, instruments, records, and specimens, illustrating the progress of science, particularly in physics, electricity, chemistry, botany, astronomy, and medicine. In many instances instruments were shown in actual working. Demonstrations were given, from time to time, on liquid air, wireless telegraphy and telephony (including the transmission of music), the culture of bacteria, science applied to music, glass-blowing, the use of the potter's wheel, the Fleuss life-saving apparatus, &c. A party of boys who had made themselves experts in blowing soap-bubbles was always the centre of a group of interested spectators, whilst the fascination of motion drew others to the gyroscope tops, rainbow cups, mercury heart, vortex rings, and the paper circular saw which was cutting wood. Microscopic objects shown under about forty microscopes had a constant succession of interested observers. The electric light produced by induction, as shown by Mr. Sharman, attracted great attention, as did also the Röntgen rays, the radium exhibit, the Pathéscope, and the optophone, an instrument by which light rays produce audible vibrations. The great success of the exhibition may be attributed to (1) the generosity of many prominent men of science in lending exhibits and assisting in other ways; (2) the energy and zeal of a large party of local workers, aided by friends from a distance, under the leadership and direction of the

president, the Rev. J. C. Harris; (3) the satisfactory efforts of the publicity and tickets committees to advertise the exhibition beforehand in the district.

LORD CARNARVON and Mr. C. L. Woolley have recently been excavating Beacon Hill, in Hampshire, and the results are communicated by the latter to the January issue of *Man*. The fine contour-fort supplied examples of two types of construction, large circles, possibly pens surrounded by wattle enclosures, and hut dwellings sunk down to the chalk. The former contained a fragment of black pottery of the Bronze age. A mile or so from Beacon Hill is the group of tumuli known as the "Seven Barrows." In one of these, which had not previously been disturbed, were found several burnt flints, which in the absence of human bones suggest disposal of the dead by cremation, as was usual in southern England. The form of the barrow is its most interesting feature, the open stone ring recalling the external structure of the long barrows, and suggesting that this constitutes an intermediate link between the long and round types of barrow.

To the January number of the New York Zoological Society's Bulletin Prof. H. F. Osborn communicates an illustrated account of the remarkably fine series of wild horses, asses, and zebras at present living in the menagerie, where a new house has recently been built for their reception. The paper is accompanied by a couple of maps showing the distribution of the various species and races.

ACCORDING to an article by Mr. E. R. Waite in the fourth number of Records of the Canterbury (N.Z.) Museum, that institution has acquired, at a cost of 400*l*., the skeleton of a Sibbald's rorqual, prepared from an individual stranded near Okarito, on the west coast of the south island. In the flesh this monster measured 87 ft. in length. The museum has also added to its collection a cast and the skeleton of a stranded specimen of Layard's beaked whale.

WE have received from Mr. J. A. Hutton, of Woodlands, Alderley Edge, a table showing the annual number of salmon taken in the Wye from 1905 to 1912, with nets and with rods, and also the number of tons of "fish" taken, year by year, from 1890 to 1912. In the first table the "record" occurred in 1912, when the total number of salmon was 6205, with a collective weight of 91,068½ lb., while in the second the maximum catch, by Miller's netting, was 60¼ tons.

IN the February issue of *British Birds*, the editor records that a swallow ringed in Staffordshire in May, 1911, was taken near Utrecht, Natal, on December 23, 1912. After commenting on the length of the journey made by this bird, Mr. Witherby expresses the opinion that the evidence at present available does not support the view that British swallows normally travel southwards by the East African route, as might be inferred to be the case from the new record.

SOME months ago we recorded the arrival at Mr. Carl Hagenbeck's establishment of five specimens of the pigmy West African hippopotamus, these, which were sold to Berlin and New York, being the first living examples of their kind to reach Europe. As announced in *The Times* of February 7, an immature living specimen has been received at the Zoological Gardens in Regent's Park. A descriptive illustrated account of the animal, which has been conditionally purchased by the society, is given by Mr. Pocock in *The Field* of February 15.

THAT the mysterious humming in the air heard at times in fine summer weather in this country is due (as recorded in NATURE in November last) to chironomid flies, is fully endorsed in a note communicated to the February number of *The Entomologist's Monthly Magazine* by Dr. E. E. Green. Writing from Ceylon, Dr. Green states that when bicycling by the border of a lake he heard a loud noise, which he had first attributed to machinery in motion, but that soon after he ran into a dense fog of minute flies, from which the sound proceeds. These flies, which sometimes swarm into the houses of the residents in such numbers that they may be swept up in the morning by the bushel, are, it seems, a species of Chironomus. Dr. Green also endorses the opinion that the sound is produced by a true stridulating action.

PROF. A. H. TROW has during the last six years made a study of the inheritance of certain characters in the common groundsel (*Senecio vulgaris*), and has published some of his results in *The Journal of Genetics*, vol. ii., No. 3. He finds that this is an aggregate species which includes many segregate or elementary species, of which he has cultivated twelve; these were maintained pure and true to type for at least several generations. Six of them have been studied in detail, and are distinguished by more or less descriptive names; the others are for the present simply designated with their place of origin, all except one being British. The investigation has included the critical examination of about 10,000 groundsel plants; the most exacting work, consisting of long and tedious series of measurements of the vegetative organs, will form the basis of a further paper by the author.

UNDER the title, "World Weather Bureau Favoured," *The Pittsburg Post* (Pa.) of January 27 contains the report of a statement by Mr. H. H. Clayton, for many years meteorologist at the late Prof. Rotch's observatory at Blue Hill (Mass.), with reference to the importance of the establishment of a central international weather bureau, where the accumulating observations from all parts of the world could be discussed. The idea of such an institution was mooted many years ago, and Mr. Clayton thinks its want is growing greater; he remarks: "It is ever becoming more apparent that if we are to leap the bounds of day-to-day forecasts for the seasons we must collect observations and study the meteorology of the world as a whole." And with reference to crops and their connection with droughts and rainfall he points out that fabulous sums are at stake. Bearing upon the latter subject we may also refer to an interesting lecture, "Meteorology and Agricul-

ture," especially the section on the possibilities of the use of statistics, delivered by Dr. W. N. Shaw at Cambridge, and printed in the Journal of the Scottish Meteorological Society (vol. xvi., No. xxix.) Mr. Clayton pays a well-merited tribute to the "splendid pioneer work" of Rotch, Teisserenc de Bort, Hildebrandsson, and of Sir Norman and Dr. Lockyer, but he points out that an organisation on a very large scale is required, employing meteorologists from all over the world, cooperating with all Government institutions, yet having an individual existence and a permanent endowment.

IN his second Cantor lecture before the Royal Society of Arts, on the methods of economising heat, Mr. C. R. Darling referred to the great saving which might be effected if engineers would devote more attention to the physical laws and methods of heat insulation. Data are now available which enable the heat losses in the case of furnaces, and the heat gains in the case of refrigerating plant, to be reduced materially. The two problems must be kept distinct, as the materials which may be best at one temperature are seldom the best at another temperature, owing to the great change of heat-insulating properties of substances with temperature.

THE National Electric Lamp Association of Cleveland, Ohio, has just published No. 1 of an Abstract Bulletin which contains abstracts of all the scientific papers issued from the physical laboratory of the association from its inception in 1908 to the present time. The full papers are already available in the proceedings of scientific societies or in the technical Press, but the abstracts of twenty-eight papers which the present number of the bulletin contains will be of great use to those who require the results of the investigations without the experimental details. We have had occasion to refer to some of these results, and we only propose here to direct attention to the wide ground covered by the abstracts, which are all prepared by the authors themselves. Several of them deal with the selective radiation from incandescent metals, many with photometry of lights of the same or different colours, a number with the efficiencies of lamps, and several with visual acuity. The association is to be congratulated on the scientific value of the work which is turned out from its physical laboratory.

NOTICES have recently appeared in the daily Press and *The Scientific American* regarding an invention by M. Moreau, of Paris, which, according to the accounts, is claimed to be a solution of the problem of automatic stability for aëroplanes. The main feature would appear to be that the aviator sits in a kind of swing, described as a pendulum seat, operating on the rudder for vertical steering, although it is stated that the seat can also be fixed by means of a brake. This arrangement may facilitate personal control, and in this respect, experience may prove it to be successful, but it can scarcely be likely to secure "stability." Suspension of the aviator's seat is statically equivalent to raising the centre of gravity of the system, while, on the other hand, any pendulum arrangement increases the number of possible oscillations and adds to the difficulty of satisfying the conditions of stability. So little has been done in applying the principles of rigid dyanmics to aëroplanes that any attempt of this kind must be regarded as highly doubtful from a theoretical point of view. At the present time even Newton's laws of motion are quite disregarded in many writings and experiments on aviation. The "ideal pendulum," which is supposed to maintain a fixed direction without oscillating, has no more existence than the perfectly smooth body of our text-books. Failing an efficient study of the dynamics of the problem, the safest course in experimenting with pendulums is to damp their oscillations as much as possible. Perhaps the aviator himself damps the oscillations, in which case this may be a practical and successful way out of the difficulties.

NO. 1 of vol. v. of the Journal of the College of Agriculture, Tokyo, contains a number of exceptionally interesting papers. Prof. U. Suzuki and S. Matsunaga show that nicotinic acid occurs together with oryzenin in rice bran; this observation is of special interest, as, apparently, it is the first time that nicotinic acid has been observed in plant material, although a homologue, picolinecarboxylic acid was isolated by Schreiner and Shorey some years back from soils rich in humus. Mr. T. Yabuta has studied a new organic acid which is formed by the action of *Aspergillus oryzae* on steamed rice in the manufacture of "koji," and to which the name "koji-acid" is given; it is not identical with any acid yet obtained from the lower fungi, and is apparently also formed by some other Aspergillus species, but not by Penicillium or Mucor. There is an interesting paper by Mr. S. Muramatsu on the preparation of "natto," a vegetable cheese obtained by fermenting boiled soya beans, and the nature of the micro-organisms involved in the change, whilst Mr. R. Inouye contributes an important study of the chemical composition of the silkworm at different stages of its metamorphosis.

The Builder for February 21 refers to the announcement that Prof. Boni has found that three large lifts were in operation at the Imperial Palace on the Palatine Hill in ancient Rome. Modern refinements of mechanism and finish were lacking, but the fact that machinery of this kind was employed affords additional evidence of the engineering genius of the Romans. Roman houses were heated in the first century by means of hot air proceeding from furnace-rooms and circulating under floors and inside the walls. Excavations in Pompeii have brought to light a house with well-designed hot and cold water service on a plan closely resembling modern installations. Instances such as these emphasise the point that modern achievements depend upon improved appliances and increased scientific knowledge rather than upon superior intellectual capacity.

MR. J. D. POTTER has published separately, at the price of 2*s*. 6*d*. net, the "New Log and Versine Altitude Tables," from "The 'Newest' Navigation Altitude and Azimuth Tables for Facilitating the Deter-

mination of Lines of Position and Geographical Position at Sea," by Lieut. R. de Aquino, the second edition of which was reviewed in NATURE for February 6 last (vol. xc., p. 617).

THE proceedings at the conference on the theory of radiation, held in Brussels in 1911, have been referred to in two articles in NATURE. The first appeared on November 16, 1911 (vol. lxxxviii., p. 82), and the second on January 16, 1913 (vol. xc., p. 545). We have now received a copy of a volume containing the papers read at the conference and reports of the discussions upon them; it is printed in French, edited by MM. P. Langevin and M. de Broglie, and published by M. Gauthier-Villars, of Paris, at the price of 15 francs.

OUR ASTRONOMICAL COLUMN.

ASTRONOMICAL OCCURRENCES FOR MARCH:—

March 2. 0h. 24m. Jupiter in conjunction with the Moon (Jupiter 5° 22′ N.).
3. 22h. 50m. Uranus in conjunction with the Moon (Uranus 4° 2′ N.).
4. 8h. 30m. Mars in conjunction with the Moon (Mars 3° 19′ N.).
9. 2h. 53m. Mercury in conjunction with the Moon (Mercury 1° 29′ N.).
11. 8h. 30m. Venus in conjunction with the Moon (Venus 2° 1′ N.).
13. 12h. 36m. Saturn in conjunction with the Moon (Saturn 6° 23′ S.).
17. 8h. 43m. Neptune in conjunction with the Moon (Neptune 5° 34′ S.).
19. 3h. 0m. Venus at greatest brilliancy.
20. 17h. 18m. Sun enters Sign of Aries, Spring commences.
21. 23h. 58m. Moon eclipsed, invisible at Greenwich.
29. 14h. 29m. Jupiter in conjunction with the Moon (Jupiter 5° 19′ N.).

THE SOLAR ACTIVITY.—A sun-spot of unusually high latitude is at present visible on the solar disc. First seen on February 19, when it had just come over the eastern limb in heliographic latitude about 35° N., the spot has since developed somewhat, and on Monday last the leading nucleus was fairly large and dense. An outbreak in such a high latitude possibly marks the beginning of a new sun-spot cycle, for the new cycles generally commence at a great distance from the equator, while the old cycle is dying away near the equator.

As pointed out in Monday's *Times*, the epoch of the next maximum of spot activity is somewhat uncertain because the previous maximum, 1906, was late, and presented a double peak.

PHOTOGRAPHIC MAGNITUDES OF STARS IN COMA BERENICES.—On five plates taken with a 4-in. anastigmat portrait lens, Herr Hnatek has measured the extra-focal images of 104 stars in the asterism Coma Berenices, and publishes the results in No. 4629 of the *Astronomische Nachrichten*. In addition to the definitive mean magnitudes, ranging from 5·2 to 10·3, Herr Hnatek gives the magnitudes as determined from each of his five plates, the B.D. number, the spectral type (Harvard), and the differences between his own and five other measures by various observers; these comparisons show differences varying with magnitude and spectral type. For example, it is seen that the difference of magnitude Hnatek-Pickering increases as the temperatures decrease, and amounts to 0·43 mag. for class K stars.

THE DISTRIBUTION OF SPECTROSCOPIC BINARY STARS.—From Prof. Stroobant we have received an abstract from the *Comptes rendus* (vol. clvi., p. 37), in which he has discussed the distribution of spectroscopic binaries, as compared with other stars, in the celestial sphere. Dividing the sphere into 20° zones of galactic latitude, he finds that of the 306 stars given in Campbell's second catalogue of spectroscopic binaries, 217 lie within the zone +30° to −30° galactic latitude, and only eighty-nine without it. For naked-eye stars generally, the proportion is 3154 to 2565, according to Houzeau.

This preponderance near the Milky Way is found to be due to the relatively large number of helium stars among the binaries, about 35 per cent. of the total, for, according to Pickering, 93 per cent. of 686 helium stars are to be found in the galactic zone.

HIGH-LEVEL MEASUREMENT OF SOLAR RADIATION.—In No. 1, vol. xxxvii., of *The Astrophysical Journal* Prof. Very discusses the conditions affecting the measures of solar radiation at high levels. Taking measures made up to nearly 30 km., he shows that aqueous vapour, the chief atmospheric absorbent of solar radiations, is still present, in appreciable quantities, at these great altitudes; thus the limits of the aqueous atmosphere are extended much further than some meteorologists have thought to be possible. Having reduced observations made at sea-level, 4420 and 13,700 metres, he finds thermal equivalents, at these heights, of 1·5, 2·00, and 2·86 cal./sq. cm. min. respectively, and by plotting these results gets a value for the solar constant of radiation of 3·5 cal./sq. cm. min.

THE BLEACHING OF FLOUR.[1]

EARLIER reports to the Local Government Board on the chemical changes produced in flour by bleaching, which have been summarised already in these columns, have been written with the object of producing chemical evidence of the supposed injurious effect of bleaching. A recent legal decision of considerable moment has stated that the presence of 3·43 parts of nitrites per million does not alter the genuineness of flour, and that it is admitted that no injurious effects from such a quantity of nitrites can be proved. The result of commercial bleaching is merely to alter the colour of flour to suit the taste of the consumer without altering the nature, substance, and quality of the flour so as to render it a different article.

In the present report, Dr. Monier-Williams admits evidence which brings his views more into line with those prevailing elsewhere.

Following the suggestion of Wesener and Teller, the colouring matter of flour has been compared by him with carrotene, the yellow plastid colouring matter of plants which is so obvious in the carrot. The method of comparison adopted is a physical one, namely the examination of the absorption spectra of the two pigments, which are shown to be identical. The colouring matter of flour is thus established as carrotene.

Pure carrotene crystallises in small leaflets of an intense red colour, which, on exposure to the air, gradually absorb oxygen and form a colourless compound. Carrotene also absorbs practically its own weight of nitrogen peroxide, forming colourless compounds of unknown nature, which, however, all give

[1] Report to the Local Government Board by Dr. G. W. Monier-Williams. Food Reports, No. 19. October, 1912. Price 3*d*.

the colour test for nitrites. It is thus clear that the two processes of bleaching carrotene, namely either by oxygen or by nitrogen peroxide, are quite distinct. It is assumed that the same holds good in flour and that artificially bleached flour, in which normally about one-third of the colouring matter has been destroyed by bleaching, and naturally aged flour are not quite the same thing.

It is shown by Dr. Monier-Williams that unbleached flour, stored in small bags, as is customary in the retail trade, gradually loses its colouring matter, and at the same time picks up nitrites, which in time may amount to 1·4 parts of $NaNO_2$ per million. This is much the same quantity as is present in the freshly milled bleached flour typical of the London mills,[2] which, although it loses further colouring matter on storage, does not absorb any more nitrite. Actually after two months' storage bleached and unbleached flours are practically identical. Samples of very heavily bleached flours had altered after two years' keeping, so that they then only contained about as much nitrite as ordinary unbleached flours kept for a few months.

The interesting conclusion is drawn that under ordinary conditions of storage there is an approximate figure towards which the nitrite content of all samples, whether highly bleached or unbleached, will eventually converge.

With the cooperation of Mr. Kirkland, Dr. Monier-Williams has tested the baking qualities of some heavily bleached flours. Mr. Kirkland reports that all the loaves were of excellent quality, and had no remarkable taste or smell. The one exception—flour containing 100 times the usual quantity of nitrite—gave a loaf which did not rise so well and possessed a somewhat rancid, oily taste.

Leaving any ethical considerations as to the propriety of bleaching flour entirely out of account, this report serves to establish conclusively that there is no scientific evidence that bleaching by means of traces of nitrites is injurious, and it is now proved that the presence of traces of nitrites in stored flour is a natural course of events.

REEVES'S NIGHT MARCHING WATCH.

MESSRS. C. F. CASELLA AND CO., LTD., have submitted a "night marching watch," designed by Mr. E. A. Reeves, and costing 2*l.* 15*s.* This is an ingenious device intended to help travellers to know their bearings when moving at night, provided that they are able to recognise the brighter stars. The stars made use of are Aldebaran, Rigel, Sirius, Procyon, Regulus, Denebola, Spica, Arcturus, Antares, Altair, Fomalhaut, Capella, and, of course, by day the sun. The positions of these, together with the days of the months, are printed on a ring outside the watch face, but under the watch glass, and capable of being turned by the bezel (which unfortunately is smooth instead of being milled) so as to bring the date against the hour XII. Then the hour on the watch face under any star's position when multiplied by two is the time measured from noon to this star's meridian passage. A rectangular mark of luminous radium paint carried on the star rim is then set to this doubled time, and the watch is ready for use with that star.

The hour hand carries a luminous projection which rides over the edge of the star rim, and as this hand rotates in the watch twice as fast as the earth rotates or the star appears to go round, the angle between the two luminous marks already described as subtended at the centre of the watch, is double the hour angle of the star. But the angle at the centre is double the angle subtended by the same arc at a point on the circumference, and therefore these two marks will subtend the star's hour angle at any point on the circumference on the other side of the watch. A luminous arrow-head is therefore placed upon the edge of the glass, which is capable of being turned round without turning the bezel. When the arrow mark is removed from the other two, and the watch face is inclined roughly to the colatitude with the first-named luminous mark at the upper side, and then turned in azimuth until a line passing through the arrow and the other mark is directed towards the star, then the first luminous mark as seen from the arrow will be in a southerly direction.

As is usual with astronomical things, there are certain cases where the rules have to be turned inside out (as, for instance, when a star crosses the meridian to the north), and these are explained in the pamphlet. Unfortunately this pamphlet is ambiguously worded, and anyone not understanding the principle would have great difficulty in finding out what to do. The question which must occur to anyone at all familiar with the night sky is this: Has not ingenuity been misplaced? Even if the pole star be not visible, there is very little doubt, at least in the northern hemisphere, where it is. In the southern hemisphere, it is true, there is a great blank in the polar region, but it does not take long to learn the relations of the conspicuous southern stars to the pole. While therefore some people might like to use the watch and enjoy the use of it on account of its ingenuity, others might prefer in practice to do without.

THE VEGETATION OF THE TRANSCASPIAN LOWLANDS.

DR. O. PAULSEN has published an English edition, revised and corrected by Dr. W. G. Smith, of Edinburgh, of his important memoir on "The Vegetation of the Transcaspian Lowlands." This memoir forms the first part of the biological section of the botanical results of the second Danish Pamir expedition—the systematic part of the botanical results having been already published as the examination of the various natural orders was completed—and contains 279 pages, with 79 illustrations, and a map of the area studied. After describing the situation and boundary of the region examined, together with the general geological and climatic characters of Transcaspia, the author deals in considerable detail with the vegetation, which he classifies under the headings of five distinct plant-formations. These formations are the riverside thickets (bushland) and four types of desert formation (salt, clay, sand, and stone deserts).

The second half of the memoir is devoted to an extremely interesting account of the various biological types of growth forms. The author follows Raunkiaer's system according to which the plants are arranged in classes depending upon the way in which they live through unfavourable seasons, special emphasis being laid on the degree and kind of protection afforded to the dormant shoot-tips. Of the 768 species listed, nearly half are annuals which live through the hot, dry summer as seeds, having flowered during the rainy period; trees and shrubs are few and small, chiefly tamarisks, Calligonum (Polygonaceæ), and shrubby Papilionaceæ (especially Astragalus); the Compositæ of the Transcaspian flora include 103

[2] In other districts where a very white flour is required a stronger bleach is often adopted.

species: Chenopodiaceæ 94, Papilionaceæ 85, Cruciferæ 51, Gramineæ 44, Boraginaceæ 42. Interesting comparisons are drawn between the Transcaspian flora and the floras of various other regions, desert and otherwise, with reference to the proportional representation of the families and also of the biological types. The memoir concludes with detailed notes on the structure and biological adaptations of various Transcaspian species investigated by the author.

F. C.

THE "AËROSCOPE" KINEMATOGRAPH HAND CAMERA.

AN interesting demonstration of the greatly extended adaptability of kinematographic apparatus was given by Mr. Kasimir Proszynski at a meeting of the Royal Photographic Society on Tuesday, February 18. In introducing the "Aëroscope" hand camera, the lecturer made some general remarks dealing with the problem of flicker, the presence of which, more or less pronounced, has been of considerable trouble to producers of moving pictures. He stated that up to the present time it had been generally understood that the suppression of flicker was in some manner due to the phenomenon of persistence of vision, which, according to the experiments of Helmholtz and other investigators, continues about one-seventh of a second after the light impression has ceased.

Mr. Proszynski considers this idea a mistaken one, and by means of a series of diagrams and demonstrations with the lantern he made out a strong case for his view that flicker is due to the slightly varying lengths of time during which the light from each picture is transmitted to the screen through the openings in the sector shutter. If the opaque portions of the shutter are not all exactly equal, the eye, being extremely sensitive to slight *variations* of illumination, receives the impression of alternating light and darkness corresponding to the difference between the angular size of the blades of the shutter sectors. From this point of view the flicker should be completely eliminated by using any simple shutter with four, three, or even two wings, the essential feature being that the wings must all be very accurately made of the same size. Various forms were shown in the lantern projector; in practice the three-bladed sector shutter is found most suitable.

Another feature embodied in the "Aëroscope" camera is its adaptability for use without a tripod stand, thereby greatly extending the scope of its usefulness to the portraying of scenes quite inaccessible to the ordinary camera requiring a steady support. The camera is fitted with self-contained mechanism for driving the film, consisting of a small air motor, driven by compressed air stored in four steel reservoirs held in the camera body. These cylinders can be recharged by means of a cycle pump to a pressure of 400 lb. per sq. in. The motor is fitted with a governor for keeping the motion of the mechanism uniform, and a lever control on the exhaust for securing different values of this motion to suit different subjects.

The chances of injurious vibration during the exposure of the film are very neatly minimised by the introduction of a heavy gyrostat wheel in the end of the camera box; this is also driven from the air motor.

A series of beautiful pictures of scenery, including animals and moving water, taken by Mr. Cherry Kearton in North America, was sufficiently convincing as to the efficiency of this novel method of animated picture photography.

C. P. B.

THE NATIONAL PHYSICAL LABORATORY.

WITH the view of raising funds to complete the additions now in progress at the laboratory, the executive committee of the laboratory last autumn appointed a funds committee, with Sir W. H. White as chairman, and entrusted it with the task of appealing for support to persons interested in their national work.

This work was commenced at Teddington in the year 1901; the great need of an institution such as the laboratory and the importance of its work have been amply demonstrated by its rapid growth. The original buildings comprised Bushy House, granted by the Crown, and an additional building for the engineering department. The wide scope of the work at the present time will be sufficiently indicated by an enumeration of the various buildings, and a brief indication of the purposes for which they are intended.

(1) Bushy House, providing accommodation for administration offices and for divisions dealing with electrical units and standards, general electrical measurements, thermometry, optics, and tide-prediction.

(2) Engineering building, for general engineering research and tests, with additional accommodation for aëronautical investigation, and for the examination of road materials (Road Board Laboratory).

(3) Metallurgy building, for investigations into the properties of metals and alloys.

(4) Electrotechnics building, equipped for researches connected with electricity, and for the testing of alternating- and direct-current instruments of all kinds, as well as of material for electrical purposes; also for photometric work, especially the standardisation of sources of light.

(5) Metrology building, for measurements of length, end gauges, cylindrical gauges, screw gauges, tapes and wires for survey work, &c., the standardisation of weights, and the testing of measures of area and volume, glass vessels, &c.

(6) William Froude National Tank, for experiments on models of ships.

(7) Observatory Department. This section of the work has been housed at Kew Observatory, and includes the testing of thermometers, optical instruments such as telescopes, binoculars, sextants, theodolites, &c., watches, chronometers, and many other types of instruments.

To provide for the research work which is continuously in progress, and occupies perhaps two-thirds of the time of the scientific staff, generous assistance has been afforded by many private individuals, by the City companies, and by all the great technical institutions, some of which have made annual grants for this purpose for many years past.

Some three years ago it was evident that further buildings were needed at Teddington. The accommodation for the metallurgical work was then quite inadequate, while the office and administration rooms were entirely unsuited to their purposes. The library had long overflowed the small room allotted for its use ten years ago. The arrangements for the receipt and dispatch of goods remained much as at the beginning, and it had become increasingly difficult to deal with the apparatus and material sent for test.

Moreover, the optical and thermometric test work at Kew has quite outgrown the opportunities for test at the old observatory, and modern demands require a revision of the methods and appliances available for the work. In addition, a scheme has been approved by the Royal Society and the Government for setting free the observatory for meteorological observations

and research by the removal of the test work to Teddington. The Office of Works has arranged to make certain alterations at Kew for this purpose, while the laboratory committee provides the necessary accommodation for tests.

Accordingly a scheme of new buildings at Teddington was prepared at an estimated cost of about 30,000*l.*, or, if scientific equipment is included, 35,000*l.* Towards this the Lords Commissioners of H.M. Treasury agreed to contribute 15,000*l.* in three instalments if the scheme could be completed without further application to the Government. Thus, it was left to the committee to raise, for the buildings alone, about 15,000*l.*

This sum has now been obtained; the metallurgy building, erected through the generosity of the late Sir Julius Wernher, is complete and occupied, but much additional equipment is required. The other buildings are in course of erection, and funds are urgently needed towards their equipment. The minimum estimate for this is 5000*l.*, of which about 3000*l.* has been contributed. Thus, apart from the special equipment for metallurgy, at least 2000*l.* more is needed to complete the scheme, and it is for this that support is being asked.

The following are the present members of the committee:—Sir William H. White, K.C.B., F.R.S. (chairman), Lord Rayleigh, O.M., F.R.S., Sir A. B. Kempe (treasurer R.S.), Prof. A. Schuster (secretary R.S.), Mr. J. A. F. Aspinall, Sir J. Wolfe Barry, K.C.B., F.R.S., Dr. G. T. Beilby, F.R.S., Sir Hugh Bell, Bart., Dr. Horace T. Brown, F.R.S., Colonel Crompton, R.E., C.B., Mr. J. M. Gledhill, Mr. R. Kaye Gray, Sir R. A. Hadfield, F.R.S., Mr. D. Howard, Sir J. Larmor, M.P., F.R.S., Dr. W. H. Maw, Mr. R. L. Mond, Sir A. Noble, Bart., K.C.B., F.R.S., Hon. Sir C. A. Parsons, K.C.B., F.R.S., Sir Boverton Redwood, Bart., Mr. Alex. Siemens, Mr. T. Tyrer, and Prof. W. C. Unwin, F.R.S.

PROGRESS IN AGRICULTURAL EDUCATION.

THE Board of Agriculture and Fisheries has issued its annual report on the distribution of grants for agricultural education and research in the year 1911–12 (Cd. 6601). Bound up with the report are statements respecting the several colleges aided, and a summary of the agricultural instruction provided by county councils in 1910–11.

The classes and courses of instruction which the Board of Agriculture and Fisheries aids are those intended for persons of sixteen years of age or more, who have finished their school education, and are either pursuing technical studies with the view of becoming agriculturists, or are already engaged in agriculture and desire to improve their knowledge of the subject. The list of grants awarded in aid of educational institutions in the year 1911–12 shows that the total amount of the grant was 18,840*l.*, the same as in 1910–11. The interim grants in aid of agricultural research paid by the Board from the Development Fund during 1911–12 amounted to 9263*l.*, and the special grants for experiments and research to 250*l.*

The accounts sent to the Board by local education authorities show that they are spending in round figures 80,000*l.* per annum on agricultural education. The Board's grants for work in universities and colleges, not included in this sum, would bring the total public expenditure on agricultural education, apart from the Development Fund, to about 90,000*l.* per annum.

We reprint below a part of Prof. T. H. Middleton's introduction to the report, referring to research institutes for agriculture:—

The State has now placed, for the first time, a large sum for research at the disposal of British agriculture, and it is clearly the duty both of the central and local authorities to devise means for applying to practical farming the knowledge provided by workers in research institutes. The purpose of the grants made for research is not in this instance to subsidise scientific workers, but to develop agriculture by scientific means, and until the knowledge of the laboratory has been translated into practice in the field the work is incomplete. When reconsidering their educational methods, local education authorities should understand that their aid is expected in securing from the expenditure and labour incurred in agricultural research results of real value. The research institutes endowed by the Development Fund are national, not local institutions. The primary duty of the persons engaged in these institutes is to advance knowledge, and the needs of local agriculture, if they are considered at all, can only be considered incidentally. The result is that if any locality wishes to make use of the research institutes it must take steps to adapt scientific discoveries to its own conditions.

It should further be remembered by those responsible for the education of agriculturists that not only are the results of the work of all the new research institutes to be available for agriculturists in any county, but as a consequence of the establishment of research institutes in England this country may now draw upon the results obtained by the investigators of all other countries in a way that was formerly impossible. There has thus been created a system for bringing within reach of English agriculture the knowledge resulting from the vast amount of work now undertaken in the research laboratories of all civilised countries. But all this knowledge will be valueless to any particular locality until it has been applied by farmers to the cultivation of their land. How is this application of scientific discoveries to the commercial questions of the ordinary farm to be accomplished? Can farmers be expected to study scientific treatises? If farmers did study and understand the publications of research stations, could they afford the time and the cost involved by the adaptation of the applications of new principles to the particular circumstances of their own farms?

If answers to such questions as the foregoing are attempted it will be agreed that the Development and Road Improvement Funds Acts have added new responsibility to the work of local education authorities, or at least that a duty which was formerly inconsiderable has now become important. The only important task of a local committee charged with agricultural education has hitherto been to provide for the instruction of young persons up to the time when they leave school or college, or to supply itinerant teachers capable, as a rule, of instructing novices only; they are now expected to make the provision required for advising experienced farmers on the means to be adopted in applying scientific discoveries to practice—a difficult and responsible task.

It is sometimes contended that the only satisfactory way of applying science to agriculture is to give the young farmer a sound scientific training, and leave him to apply the discoveries of scientific men which come before him in his later years. This, it is assumed, he can do for himself after he has gained experience. The usefulness of a proper early training cannot be questioned, and the work of the research institutes will make its usefulness even greater in

future, but however good the early training of the farmer may be, it will not enable him to make full use of the work of research institutes unless he has scientific advisers to guide him. Agricultural science has made such progress in recent years and its departments have become so specialised that the acquaintance which a lad may make with it at school or college would no more enable him to dispense with scientific guidance in after-life than a course in veterinary hygiene would enable him to dispense with the veterinary surgeon, or a course in agricultural law would enable him to conduct his own law business. The indifferent success which experimenting agriculturists meet with has been a subject of remark for two centuries at least by farmers who must pay rents; but the reason for the ill-success has not been so clearly recognised as in the corresponding case of the man who is his own lawyer.

It is further a mistake to suppose that the proper way to introduce the results of scientific research to farmers is to spread information by means of lectures or leaflets. Information can be spread by these means, but not, as a rule, the results of research as first published by the research institute. Few of the discoveries made by research workers are likely to be immediately applicable to the farm practice of a particular district. Modifications in a well-established art clearly require skilful handling, and when it is desired to utilise the results of research, cooperation between skilful farmers and trained scientific men should therefore be aimed at. When on a particular farm the success of the new method has been established as a result of this cooperation, neighbours will learn by imitation, and the improvement may with advantage be brought to the notice of others by lectures and leaflets.

In view, then, of the provision now made by the State for research, of the importance of securing for each county the fullest benefit from results available for all, and of the need for caution in introducing new methods, local education authorities should consider the nature and qualifications of the local staff required. For spreading a knowledge of practices which have been shown to be improved practices, instructors with a good practical knowledge of some branch of agriculture are wanted. The number at present available is small, but the requirements are already known and well defined. Local education authorities need experience no great difficulty in securing suitable men for this particular type of work after the supply has had time to adjust itself to the demand. The position as regards the farmer's scientific advisers is, however, different, and for the most part the types have still to be evolved. For the purpose of translating the results of research into successful practice a highly trained scientific man is required having a special knowledge of some particular branch of science and a sufficient acquaintance with agriculture to command the respect of skilful and enlightened practical farmers. Many branches of science bear on agriculture, the research scheme contemplates institutes in eleven subjects, and most of these subjects would provide a field of work for several specialists. It is clear, therefore, that no county could afford to maintain all the specialists who might usefully be engaged in assisting farmers to apply research. For the present all that is practicable is to lay the foundations of a system having as its object the bringing into existence of a class of well-qualified specialists who shall devote themselves to the service of agriculture. The first essential is that the specialists to be employed should really be specialists; "all-round" men would be of no use for the particular purpose in view. The second essential is that the persons who are to be engaged in the work of promoting agriculture should be of the same calibre as those who have advanced arts like medicine and engineering.

It is obvious from the qualifications required in the men to be employed, that the only practicable way of securing their services will be for groups of counties to associate themselves with collegiate institutions providing laboratories and other facilities for scientific workers, and it is with the object of facilitating combination and of initiating the system of employing specialists recommended above that the Board's advisory scheme was drafted.

Having regard to the institutions available as centres, the Board arranged the counties of England and Wales in twelve groups or "provinces," and it has obtained a grant of 12,000*l.* per annum from the Development Fund, which will be employed in providing certain trained specialists in each area. The grants are made to the governors of the collegiate centres, who, subject to the approval of the Board, select the officers and are responsible for their work. The teaching staffs of most of the institutions selected are already doing some advisory work, and the officers first selected under the new scheme will be chosen with the view of supplementing the work of the staff already in existence. As the work expands, it is expected that additional advisers will be added to the staff.

While these grants are made to the governors of central institutions it should be clearly understood that their object is to place skilled scientific advice at the disposal of farmers resident in the different groups of counties, and in framing their schemes of work local education authorities will be expected to make provision for securing to residents in their administrative areas the benefits of the provision made by the colleges. In particular, local instructors should be directed to apply to the college in all cases in which the assistance of an expert is desirable.

It will be apparent that while the new system is in its early stages many of the questions submitted to institutions may be on subjects other than those on which the advisers have expert knowlege; in such case the advisers would in the first place consult their colleagues on the college staff, and if the necessary advice is not obtainable they would then consult advisers at other institutions. By linking the collegiate centres together in this way it is intended that a farmer in any particular county should be able, through the centre with which his county is associated, to get the best expert advice on any agricultural question.

A further shortcoming inevitable in the working of a new scheme may be noticed. Since no class of agricultural specialist, corresponding to the medical specialist, exists, it will be necessary to train up men for the work, and therefore to employ at the outset young and inexperienced persons. For the first few years the work must suffer from this lack of experience, but just as well-trained young medical men quickly acquire experience, so will these specialists who are being trained to help agriculturists.

It may be convenient in conclusion to give a list of the groups of workers who will in future be provided for the purpose of aiding the farmer to increase the productiveness of land.

Group I.—Scientific workers engaged in research—the extension of knowledge—in national research institutes devoted to the study of different sections of agricultural science without reference to the needs of particular localities.

Group II.—Scientific workers engaged in consultative work with a view to the application of the results of research to practice. These workers will be stationed at collegiate centres serving groups of counties; as distinguished from workers in Group I. they

will make a special study of the needs of particular localities.

Group III.—Teachers engaged in the diffusion of knowledge; of these the following subgroups may be distinguished:—

(*a*) Lecturers in universities and colleges instructing pupils whose age, previous education, and circumstances enable them to attend college courses.

(*b*) Teachers employed at farm schools in instructing pupils who for various reasons would not benefit from, or could not attend, college courses.

(*c*) Instructors employed in peripatetic work teaching those who, because of their age and circumstances, cannot study in schools or colleges.

The work of persons employed in the different groups may overlap. The worker in a research institute may often be asked for advice, a college teacher may frequently be called upon to give extension lectures, and at certain seasons of the year the peripatetic instructor may be required to teach in a farm school; but in the main the work of the different groups is distinct, and now that increased funds are available it is to be hoped that the authorities responsible for selecting those employed under agricultural education schemes will recognise more fully than heretofore the need for a division of labour. The "all-round" agricultural expert is no longer much required, except for the general supervision of local work; to be really useful either to the large farmer or the small-holder the teacher must be a specialist; if he is a scientific man his attainments in some branch of science should be high; if a practical man he must be a more skilful practitioner than the majority of those whom he instructs.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

LONDON.—Mr. T. Ll. Humberstone has been appointed to the Mitchell studentship. The studentship, which is of the value of 100*l.*, is awarded to the selected candidate to enable him to study and investigate some definite feature of business or industrial organisation at home or abroad. Mr. Humberstone proposes to investigate a scheme of industrial fellowships in the Universities of Pittsburg and Kansas, under which research work in applied science is promoted with funds provided by, and to some extent under the supervision of, great industrial and commercial organisations.

Applications are invited for the newly established Franks studentship in archæology, founded by the Society of Antiquaries in London, in memory of Sir A. Wollaston Franks, K.C.B., sometime president of the society. The object of the studentship is to enable the student to carry on some research or preparation for research (as distinct from professional training) in the archæology of the British Isles in its comparative aspects. The studentship is of the value of 50*l.*, and is tenable for one year. Applications should reach the academic registrar not later than March 5.

OXFORD.—Prof. Lloyd Morgan, F.R.S., has been appointed Herbert Spencer lecturer for 1913.

BY the will of the late Lord Ilkeston, the sum of 800*l.* is bequeathed to the warden, bursar, or other proper officer of the University of Durham upon trust to apply the income for a "Winifred Foster Scholarship" for a woman student who requires help to maintain herself at the University.

A VERY well illustrated prospectus of Bingley Training College has been received. The college owes its existence to the public spirit of the County Council of the West Riding of Yorkshire, and was opened for the reception of students in October, 1911. It provides accommodation for 200 resident women students, and includes a central educational block, five halls of residence, gymnasium, kitchen, bakery, and laundry. The purpose of the college is to train teachers for public elementary schools, and the training provided is such as to fit the students for their work as teachers. No provision is made for students wishing to take a course leading to a university degree.

THE Berlin correspondent of *The Morning Post* states, in the issue for February 24, that plans for transforming the scientific institutes at Frankfort-on-Main into a university have now been sanctioned by the Prussian Ministry of Public Instruction. In May, 1912, the Emperor commissioned the Ministry to submit to him the draft of the statutes as soon as it was satisfied that the necessary funds for the establishment and endowment of a university were in hand. Ample funds are at the disposal of the city of Frankfort for the purpose, and the drawing up of the statutes is now merely a matter of form. The capital required and subscribed for the scheme is nearly 400,000*l.* The existing institutes will be enlarged and a medical institute created. It is doubtful whether the university can be opened, as anticipated, in October, 1914. The new university will devote special attention to social science.

IT is announced in *Science* that Ohio-Miami Medical College of the University of Cincinnati has received 25,000*l.* from a donor whose name is being withheld. An effort is being made to raise an endowment fund of 200,000*l.* From the same source we learn that during the past year three wills, involving property valued at 25,000*l.*, have been proved in favour of Knox College. About half of this amount becomes available immediately for the endowment of a professorship in one of the departments of science, while the remainder is held in trust during the lifetime of the widow of one of the testators. Mr. Eugene Meyer and his wife, of New York, have given Cornell University 2000*l.* to endow a fellowship in memory of their son, Edgar J. Meyer, who graduated from Sibley College, and whose life was lost by the sinking of the *Titanic*. The purpose of the fellowship is to encourage research in mechanical and electrical engineering.

A REUTER message from Delhi announces that an important State paper on the educational policy of India was issued officially there on February 21. It begins by quoting the King's speech at Calcutta University and the promises of Imperial grants for education. The needs of every grade and department of educational work are reviewed, and the paper goes on to state that India urgently needs to be equipped with an ethnographic museum. It lays special stress on the formation of character through direct instruction, and indirect agencies such as the betterment of environment, hygiene, physical culture, and organised recreation. It invites local governments to appoint expert committees to ensure satisfactory school and college hygiene. In reviewing university education, the paper contemplates facilitating grants in aid, and frames rules distinguishing the Federal and the affiliating university. The policy is to multiply universities, having one affiliating university for each leading province and developing teaching faculties and research at a university centre, while establishing teaching and residential universities at Dacca, Benares, Aligarh, and elsewhere as the need arises. Special attention is given to the education of the domiciled community and Mahomedans, the training of teachers, and the establishment of an Oriental Research Institute on Western lines. It foreshadows a large increase of the inspectorate and teaching staff,

and indicates the need of better prospects for the educational services and of having expert guidance at every turn. The paper recommends also that primary and secondary education should be more practical, and that provision should be made in India for higher education and research.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, February 20.—Sir Archibald Geikie, K.C.B., president, in the chair.—Prof. H. E. **Armstrong**, M. S. **Benjamin**, and E. **Horton**: Studies on enzyme action. XIX., Urease: a selective enzyme. II., Observations on accelerative and inhibitive agents. —Prof. C. S. **Sherrington**: Nervous rhythm arising from rivalry between antagonistic reflexes; reflex stepping as outcome of double reciprocal innervation. The paper is in continuation of work on the reciprocal innervation of symmetrical muscles—work recently communicated to the society. The observations have been almost wholly upon the decerebrate preparation. The symmetrical muscles used in the present experiments have been the extensors of the right and left knee. It is shown that taking an afferent nerve which produces steady reflex excitation of the muscle, and another which produces steady reflex inhibition of the muscle, it is possible by stimulating both nerves concurrently to obtain regularly rhythmic contractions and relaxations of the two muscles, the rhythm being about 2 per second.—Dr. H. E. **Roaf**: The liberation of ions and the oxygen tension of tissues during activity (preliminary communication). The combination Ag | AgCl | Muscle | Ringer-Solution | HgCl | Hg shows an increased negative charge on the silver when the muscle contracts. The combination Pt | MnO_2 | Muscle | Ringer Solution | HgCl | Hg shows an increased positive charge on the platinum when the muscle contracts. This result must be due to an increase in hydrogen ions. The combination Pt | Muscle | Ringer Solution | HgCl | Hg can be used as an indicator of the oxygen tension in contracting muscle.—W. **Cramer** and J. **Lochhead**: Contributions to the biochemistry of growth. The glycogen content of the liver of rats bearing malignant new growths. Glycogen disappears more rapidly from the liver of tumour-bearing rats than from the liver of a normal rat.—Prof. T. G. **Brodie** and J. J. **Mackenzie**: Changes in the glomeruli and tubules of the kidney accompanying activity.

Geological Society, February 5.—Dr. Aubrey Strahan, F.R.S., president, in the chair.—Dr. A. M. **Davies** and J. **Pringle**: Two deep borings at Calvert Station (North Buckinghamshire), and the Palæozoic floor north of the Thames. The two borings are about 370 yards apart in a due east-and-west direction. The eastern boring gives the following section:—

Altitude of Surface = about 290 *O.D.*

	Thickness ft.	in.
Soil	4	0
Oxford Clay—Ornatum Zone ... Non-sequence.	93	3
Forest Marble ... ... Non-sequence.	38	9
Great Oolite ... ... Non-sequence.	59	6
Chipping Norton Limestones ... Non-sequence.	7	6
Lias—Domerian, Algovianum Zone to Charmouthian, Jamesoni Zone Unconformity.	240	6
Lower Tremadoc—Shineton Shales	954	6
	1398	0

—R. W. **Hooley**: The skeleton of *Ornithodesmus latidens*, an Ornithosaur from the Wealden Shales of Atherfield (Isle of Wight). The bones were obtained from blocks recovered from the sea after being washed from a huge fall of the Wealden Shales. Portions of the skeleton missing in the Atherfield specimens are supplemented by bones in the British Museum (Natural History), No. R/176, upon which the late Prof. H. G. Seeley founded the genus. There are remarkable peculiarities in the skull which isolate it from all known families. The wonderful preservation of the bones enables the mechanism of the skull, joints, and movements of the limbs to be described. The paper deals with the morphology, and institutes comparisons with other types. The evidence proves that it is necessary to form a new family, and that Ornithodesmus has descended from a suborder which should include Scaphognathus and Dimorphodon.

Physical Society, February 14.—Prof. A. Schuster, F.R.S., president, in the chair.—Prof. G. H. **Bryan**: The dynamics of pianoforte touch. The author discussed Helmholtz's and Kaufmann's theories of the vibrations of a pianoforte wire excited by impact, with special reference to the effects obtainable with the modern pneumatical piano-players and player-pianos, and the common widespread belief that these can never reproduce the touch of the human fingers.

Royal Meteorological Society, February 19.—Mr. C. J. P. Cave, president, in the chair.—W. H. **Robinson**: Periodical variations of the velocity of the wind at Oxford. The author dealt with the annual and diurnal changes in the velocity of the wind as recorded at the Radcliffe Observatory during the last fifty years. The average monthly values show that there is a rapid fall in the velocity of the wind between March and June, and an equally rapid rise between September and December. The minimum is in September. There is a range in the annual variation of three or four miles per hour. On comparing the wind velocity with the mean monthly temperatures of the air the author finds that an increase (or decrease) of one mile per hour in the velocity of the wind corresponds to a fall (or rise) in the temperature of about 8° F. As regards the diurnal oscillations, the wind increases its velocity with an accession of warmth, and decreases with a lowering temperature, this being the inverse of that found in the discussion of the annual variation.—J. S. **Dines**: Rate of ascent of pilot balloons. The author described some experiments which he had made in the large airship shed at the Royal Aircraft Factory, Farnborough, with the view of determining the rate of ascent of small pilot balloons of the type which he has used for the past two years in his work for the Advisory Committee for Aëronautics.—W. L. **Balls**: Meteorological conditions in a field crop. The author described the methods which he had adopted for ascertaining the temperature, the humidity, and the force of the wind on the surface of the soil in a field of cotton at Giza. The growth of the cotton plant in Egypt is usually completely arrested by sunshine during the greater part of the day, through the severe water loss necessitated by thermo-regulation of the internal temperature, and growth, during most of the season, is thus confined to the hours of darkness. The usual limiting factor of this growth during the night is the temperature of the tissues—roughly, the air temperature, with slight modification by clouds; thus any cause making for a rise in temperature at night involves a higher growth-rate in consequence; this in its turn, in the early part of the season at least, implies more rapid development of the flowering branches, bringing about earlier appearance and more rapid accumulation of the flowers, and hence of the crop.

EDINBURGH.

Royal Society, February 3.—Prof. Hudson Beare, vice-president, in the chair.—J. S. **Anderson** and G. B. **Burnside**: A new method of starting mercury-vapour apparatus. The vacuum tube was so arranged that liquid mercury filled the region which was subsequently to be filled with the incandescent vapour. By an ingenious device the current as it passed by the platinum into the interior of the tube heated the lower end, expanding the mercury upwards past a narrow constriction in the tube. The mercury column became broken at this constriction, and at once a small arc light through the mercury vapour was formed. This rapidly grew, pushing the liquid mercury to the other end of the tube. The resistance of the circuit being thereby greatly increased, the heating effect in the small outside coil was correspondingly diminished, and thus automatically the lamp was its own temperature regulator. Important details were given as to the method of making the apparatus.—J. **McWhan**: The electron theory of thermoelectricity. This was an application of thermodynamic principles to the electron theory of thermoelectricity, the assumption being that from each metal at all temperatures electrons evaporate producing a definite electron pressure in the neighbourhood. Expressions for the Thomson effect and for the thermoelectric power were obtained.—N. P. **Campbell**: The application of Manley's differential densimeter to the study of sea waters on board ship. The differential densimeter was described in 1907 (see NATURE, vol. lxxvi., p 311), and its use explained. Briefly described, it is a modification of Hare's method for comparing densities of liquids. As originally constructed it was not found very convenient for use on board ship. In the present paper certain modifications are described, and results are given showing that it can be used effectively at sea. The density of each sample of sea water may be determined with ease and accuracy at the time it is collected. One great merit is that since the sample being studied is balanced against a standard solution of known density at the same temperature, and since the temperature correction is the same for both solutions, there is no necessity for applying this temperature correction.

PARIS.

Academy of Sciences, February 17.—M. F. Guyon in the chair.—G. **Bigourdan**: Observations of nebulæ made at the Paris Observatory.—Paul **Appell**: The equilibrium of wires the elements of which attract or repel each other as a function of the distance.—L. **Lecornu**: The cause of a boiler explosion. A discussion of the causes of the explosion of a boiler forming part of a hot-water system in a private house.—L. **Maquenne** and E. **Demoussy**: The value of the chlorophyll coefficients and their relations with true respiratory coefficients. The results of a long series of experiments are summarised in eleven conclusions, stress being laid on the variation in the respiratory coefficient of leaves with the stage of growth.—M. **Gouy**: The production of intense magnetic fields at the surface of the sun. A discussion of the possibility of the views currently held regarding the production of intense magnetic fields in sun-spots.—W. **Kilian** and Ch. **Pussenot**: New data relating to the tectonic in the neighbourhood of Briançon.—J. **Violle**: The inconvenience which might be caused to telegraphs and telephones in the neighbourhood of certain special lightning conductors called *niagaras*. Report of a committee on lightning conductors. It is recommended that no receiving station or telegraph line should be nearer than 20 metres to this special form of lightning conductor.—M. **Vuillemin** was elected a correspondant for the section of botany in the place of the late M. Strasburger.—Maurice **Gevrey**: The nature of the solutions of certain partial differential equations.—A. **Pchéborski**: Some polynomials with minimum deviations from zero within a given interval.—M. **Valiron**: Integral functions of order zero.—Carl **Störmer**: A mechanical problem and its applications to cosmic physics. The results of a theorem on the trajectories of electrified corpuscles in the field of an elementary magnet. Amongst the applications mentioned as possible are the theory of the aurora borealis of Arrhenius, and the experiments of Birkeland bearing on the zodiacal light, comets, and Saturn's rings.—U. **Cisotti**: The rigid movements of the surface of a vortex.—A. **Grumbach**: The retardation of electrolysis with a polarising electromotive force.—Georges **Meslin**: The reciprocal influence of parallel antennæ on the conditions of reception of Hertzian waves.—André **Blondel**: The bipolar diagram of synchronised alternators working as generators or receivers on a network a constant potential.—G. **Reboul**: The influence of the geometric form of solids on the chemical actions which they undergo. When a solid is acted on by a gas the attack is most active at the points where the curvature is greatest.—Jean **Bielecki** and Victor **Henri**: A quantitative study of the absorption of the ultra-violet rays by fatty acids and their esters in aqueous and alcoholic solutions. In a body of the formula $C_nH_{2n+1}.CO_2R$ the absorption is determined by the acid group, the alkyl group having slight influence.—A. **Sénéchal**: The violet chromium sulphates. A study of the water contents of the crystallised salt in various degrees of hydration.—J. **Bougault**: Phenyl-α-oxycrotonic acid.—P. **Lebeau** and A. **Damiens**: The estimation of acetylene and ethylene hydrocarbons in mixtures of gaseous hydrocarbons. An alkaline solution of the double iodide of mercury and potassium is suggested as absorbent for gases of the acetylene type; for ethylene, concentrated sulphuric acid containing 1 per cent. of vanadic acid is shown to be a satisfactory reagent.—Pierre **Lesage**: The curve of the limits of germination of seeds after remaining in saline solutions.—R. de **Litardière**: The variations of volume of the nucleus and the cell in some ferns during the heterotypical prophase.—G. **André**: The migration of the mineral elements and the displacement of these elements in leaves immersed in water.—R. **Fosse**: The formation of urea by the higher plants.—M. **Tcherning**: A theory of vision.—Jacques **Mawas**: The asymmetry of the ciliary body and its importance in astigmatic accommodation and movements of the crystalline lens.—Jules **Courmont** and A. **Rochaix**: Immunisation against *Staphylococcus pyogenes aureus* by way of the intestine. The introduction of the dead organisms into the intestine confers a certain degree of immunity, and the infection is profoundly modified in its characters.—Casimir **Cépède**: The Cytopleurosporea.—Venceslas **Moycho**: Study of the action of the ultra-violet rays on the ear of the rabbit.—M. **Deprat**: The Palæozoic strata of the Black River (Tonkin).—Maurice **Lugeon**: A new mode of fluvial erosion.

BOOKS RECEIVED.

Anatomical Model of the Mare. (London: Vinton and Co., Ltd.) 2*s*. 6*d*. net.

Streifzüge an der Riviera. By Prof. E. Strasburger. Dritte Auflage. Pp. xxvi+582. (Jena: G. Fischer.) 10 marks.

New Log and Versine Altitude Tables. By Lieut. R. de Aquino. Pp. v*+36*. (London: J. D. Potter.) 2*s*. 6*d*. net.

Siebente Versammlung der internationalen Kommission für wissenschaftliche Luftschiffahrt in Wien

28 Mai bis 1 Juni, 1912. Sitzungsberichte und Vorträge. Pp. v+172. (Vienna: K. K. Hof und Staatsdruckerie.)

Transport de Force: Calculs Techniques et Économiques des Lignes de Transport et de Distribution d'Énergie Électrique. By C. Le Roy. Deux. Partie. Pp. 143. (Paris: A. Hermann et Fils.) 6 francs.

Aborigines of South America. By the late Col. G. E. Church. Edited by Sir C. R. Markham. Pp. xxiv+314. (London: Chapman and Hall, Ltd.) 10s. 6d. net.

Calendario della Basilica Pontificia del Santissimo Rosario in Valle di Pompei per l'Anno 1913. (Valle di Pompei: Scuola Tipografica Pontificia.)

Canada. Department of Mines. Mines Branch. Report of the Building and Ornamental Stones of Canada. Vol. i. By W. A. Parks. Pp. xiii+376+vi+lxxvii plates. (Ottawa: Government Printing Bureau.)

Transactions of the Institution of Engineers and Shipbuilders in Scotland. Fifty-sixth Session, 1912–13. Part iv. Pp. 109+diagrams. (Glasgow.)

A Treatise on Hydromechanics. By A. S. Ramsay. Part ii., Hydrodynamics. Pp. xiii+360. (London: G. Bell and Sons, Ltd.)

DIARY OF SOCIETIES.

THURSDAY, FEBRUARY 27.

ROYAL SOCIETY, at 4.30.—The Thermal Properties of Carbonic Acid at Low Temperatures: C. F. Jenkin and D. R. Pye.—Re-reductions of Dover Tidal Observations, 1883–1884, etc.: E. Roberts.—The Formation of the Anthocyan Pigments of Plants. Part IV. The Chromogens: Prof. F. Keeble, E. F. Armstrong, and W. N. Jones.—The Formation of the Anthocyan Pigments of Plants. Part V. The Chromogens of White Flowers: W. N. Jones.—The Changes in the Breathing and the Blood at Various High Altitudes: Mabel P. Fitzgerald.

CONCRETE INSTITUTE, at 7.30.—Economy in Reinforced Concrete Design: J. A. Davenport.

SOCIETY OF DYERS AND COLOURISTS, at 8.—Starch and Decomposition Products: Dr. M. Hamburg.—A Method for the Testing of Malt Extracts: R. J. May.—The Valuation of Malt Products: W. P. Dreaper.—A Contribution to the Methods of Testing Malt Extracts: Dr. A. Herz.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—Fourth Kelvin Lecture—The Ohm, the Ampere, the Volt, A Memory of Fifty Years (1862–1912): Dr. R. T. Glazebrook.

FRIDAY, FEBRUARY 28.

ROYAL INSTITUTION, at 9.—Active Nitrogen: Hon. R. J. Strutt.

PHYSICAL SOCIETY, at 5.—Interference by Röntgen Radiation: Prof. C. G. Barkla and G. H. Martyn.—Alternating-current Magnets: Prof. E. Wilson.—A Graphical Method of Optical Imagery: W. R. Bower.

SATURDAY, MARCH 1.

ROYAL INSTITUTION, at 3.—The Properties and Constitution of the Atom: Sir J. J. Thomson, O.M.

MONDAY, MARCH 3.

SOCIETY OF ENGINEERS, at 7.30.—Presidential Address: A. Valon.

ARISTOTELIAN SOCIETY, at 8.—Does Consciousness "Evolve"?: Prof. L. P. Jacks.

SOCIETY OF CHEMICAL INDUSTRY, at 8.—Notes on Chinese Antimony Ores, Crude and Regulus: W. R. Schoeller.—Notes on Thermometry: J. H. Coste.

VICTORIA INSTITUTE, at 4.30.—Pompei: E. J. Sewell.

ROYAL SOCIETY OF ARTS, at 8.—Cantor Lecture—Coal Gas as a Fuel for Domestic Purposes: F. W. Goodenough.

TUESDAY, MARCH 4.

ROYAL INSTITUTION, at 3.—The Stars and their Movements: Prof. H. H. Turner.

RÖNTGEN SOCIETY, at 8.15.—The Physiological Effects of the Magnetic Field: Dr. H. Lewis Jones.—The Rationale of the Static Current: Dr. H. Humphris.

ROYAL ANTHROPOLOGICAL INSTITUTE, at 8.15.—A Saxon Graveyard at East Shefford, Berks: H. Peake and Dr. E. A. Hooton.

ZOOLOGICAL SOCIETY, at 8.30.—Contributions to the Anatomy and Systematic Arrangement of the Cestoidea.—IX. A New Genus of Ichthyotæniids: Dr. F. E. Beddard.—Zoological Results of the Third Tanganyika Expedition conducted by Dr. W. A. Cunnington, 1904–1905. Report on the Branchiura: Dr. W. A. Cunnington.—New Species of Rhopalocera from Costa Rica: W. Schaus.—Notes on Plankton collected across the Mouth of the St. Croix River opposite to the Biological Station at St. Andrews, New Brunswick, in July and August, 1912: Dr. A. Willey.

INSTITUTION OF CIVIL ENGINEERS, at 8.—Notes on City Passenger-Transportation in the United States: G. D. Snyder.

WEDNESDAY, MARCH 5.

GEOLOGICAL SOCIETY, at 8.—The "Kelloway Rock" of Scarborough: S. S. Buckman.—Jurassic Ammonites from Jebel Zorghuan (Tunis): L. F. Spath.

ENTOMOLOGICAL SOCIETY, at 8.

SOCIETY OF PUBLIC ANALYSTS, at 8.—The Accurate Determination of Carbon Dioxide in Carbonates: F. S. Sinnatt.—Egyptian Butter and Semna: S. H. Trimen.—The Bacterial Testing of Disinfectants: A Practical Criticism: C. T. Kingzett and R. C. Woodcock.—A Quick and Improved Method for the Estimation of Boric Acid in Milk and Cream: F. W. Richardson and W. K. Walton.—The Moisture in some English, Colonial, and Foreign Butters during 1910–1912, with a Note on the Mitchell-Walker Moisture Test: L. Gowing-Scopes.

ROYAL SOCIETY OF ARTS, at 8.—Ordinary Meeting—The Development of Research Work in Forest Products: E. R. Burdon.

THURSDAY, MARCH 6.

ROYAL SOCIETY, at 4.30.—*Probable Papers:* An Automatic Method for the Investigation of the Velocity of Transmission of Excitation in Mimosa: Prof. J. C. Bose.—The Evolution of the Cretaceous Asteroidea: W. K. Spencer.—A Preliminary Note on the Fossil Plants of the Mount Potts Beds, New Zealand, collected by Mr. D. G. Lillie, Biologist to Capt. Scott's Antarctic Expedition in the *Terra Nova* in 1911: Dr. E. A. Newell Arber.—(1) Trypanosomes found in the Blood of Wild Animals Living in the Sleeping Sickness Area, Nyasaland; (2) Trypanosome Diseases of Domestic Animals in Nyasaland. II. Trypanosoma Capræ (Kleine); (3) Morphology of Various Strains of the Trypanosome causing Diseases in Man in Nyasaland. I. The Human Strain: Surg.-Gen. Sir D. Bruce, F.R.S., Majors D. Harvey, A. E. Hamerton, and Lady Bruce.

ROYAL INSTITUTION, at 3.—Surface Energy: W. B. Hardy.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—Recent Developments in the Street Lighting of Manchester: S. L. Pearce and H. A. Ratcliff.

ROYAL SOCIETY OF ARTS, at 4.30.—Indian Section—The City of Karachi: J. F. Brunton.

FRIDAY, MARCH 7.

ROYAL INSTITUTION, at 9.—Photography of the Paths of Particles Ejected from Atoms: C. T. R. Wilson.

SATURDAY, MARCH 8.

ROYAL INSTITUTION, at 3.—The Properties and Constitution of the Atom: Sir J. J. Thomson, O.M.

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