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Research Professorships.

THIS year's anniversary meeting of the Royal Society, an account of which is given elsewhere in the present issue of NATURE, was the first since Sir Alfred Yarrow made his munificent gift of 100,000*l.* to the Society in February last, "to mark my sense of the value of research to the community." The meeting was, therefore, appropriately devoted in the main to an account by the president, Sir Charles Sherrington, of the purposes to which this and other large benefactions are to be used. The essential aim of the Society is the creation of new knowledge by scientific inquiry, and the new professorships which have been founded through recent gifts will promote and facilitate this intention.

Lord Justice Warrington, in proposing the toast of the Royal Society at the anniversary dinner at the Hotel Victoria, drew a parallel between the proceedings in a court of law and those in a laboratory of science. In both cases evidence is elicited with the object of arriving at a correct judgment upon it, and endeavours are made by cross-examination to test the truth of the testimony given. The suggestion that it is much easier to get truthful response by appropriate stimulus in Nature than it is from human witnesses is, however, one to which scientific investigators may hesitate to subscribe. Nature can never be trusted to give a direct answer to a question if she can avoid it, and will deceive the inquirer if she can. Also, while the laws of civil life can be broken, there must be no exception to a law of Nature, which is simply a description of certain relationships expressed in words or in mathematical terms. When observations prove such a relationship to be incorrect, then the law has to be modified or abandoned to take the new facts into consideration. Moreover, while in civil law precedent is all-powerful, in science it counts, or should count, for nothing.

The motto of the Royal Society, *Nullius in verba*, adapted from Horace's *Nullius addictus iurare in verba magistra*—not bound to swear to the words of any master—is an expression of the revolt against authority which was in the ascendant when the Society was founded. Long before the reaction against the Aristotelian method and doctrine which Francis Bacon represented with such virulence and bitterness, Roger Bacon had claimed for himself and his contemporaries the liberty of independent inquiry. At the Renaissance, impatience with the constant appeal to the authority of Aristotle was widespread among all who were foremost in the revival either of science or of letters, and what Francis Bacon did in his "Novum Organum"

was to embody prevailing views and propound a new philosophy.

In his "New Atlantis," Bacon planned a palace of invention, a great temple of science, where the pursuit of natural knowledge in all its branches was to be organised on principles of the highest efficiency. His Solomon's House was regarded as a prophetic scheme of the Royal Society, and the story of it as a vision of the practical results to be anticipated from diligent and systematic study of Nature. By the establishment of research professorships the Society is directly creating a body of experimenters on this design, which was that originally conceived for it, in addition to being "the Store-House of Natural Philosophy."

When a research professor is already associated with a university or other teaching institution, the appointment will mean that the professor will be relieved of his lectures and other duties of instruction of students. The amount of time which this work and participation in administrative affairs demand differs in different centres, but in most cases it leaves little opportunity for sustained attention to research problems. Prof. Alfred Fowler, who has been appointed to one of the Yarrow research fellowships, is professor of astrophysics at the Imperial College of Science and Technology, London; and though he has not perhaps been so overwhelmed with instructional responsibilities as are many professors in provincial universities, yet much of his time has had to be given to them, and the time left for his experimental investigations has been correspondingly limited.

Prof. Fowler's main contributions to astronomical physics are described in Sir Charles Sherrington's presidential address. The modern phase of his work may be said to have begun in the year 1912, when he succeeded in obtaining, from a tube containing helium and hydrogen, certain series of lines, some of which had previously been observed only in the spectra of a few stars or had been predicted on theoretical grounds as forming part of the spectrum of hydrogen. Shortly afterwards, Bohr published his now famous theory of the origin of spectra, in the light of which the series detected by Fowler were seen to be due to helium, and with this discovery began the close association between the experimental work of Fowler and the theoretical work of Bohr which has led to such remarkable advances in recent years.

In the Bakerian Lecture of 1914, Fowler showed that the enhanced lines of the alkaline earth metals formed series precisely similar to those of the "arc" lines, except that the series constant had four times its normal value. According to Bohr's theory, this meant that the enhanced lines were produced by atoms which had lost one electron, and the generalisation at once followed that the atoms of any element which had lost one electron would yield series having 4N in place of the Rydberg constant, N. Carrying the process still further, Fowler has recently shown that the spectrum of silicon contains series characterised by a constant 16N, indicating the existence of radiating atoms which have lost three electrons.

A great deal of Prof. Fowler's time has been devoted to the training of research students, whose work testifies to the encouragement and help they have received from him. Curtis's determination of the Rydberg constant for hydrogen, and Catalan's remarkable paper on the spectrum of manganese, may be mentioned as two of many examples of work of this kind. It is a matter for regret that his new appointment entails the cessation of the very clear and interesting courses of lectures from which students of the Royal College of Science have benefited for more than twenty years, but there is no doubt that the gain to science resulting from his larger opportunities for research work will be immense.

Major Taylor has not occupied a professorial chair, but he is lecturer in mathematics at Trinity College, Cambridge, and will continue his work there as Prof. Fowler will at the Royal College of Science. The new professors may take part in instruction, or not, but no work of this kind is to be undertaken if it should prevent them from giving the best of their energies to research. The holders of the Yarrow research professorships are to devote their whole time to research in mathematical, physical, chemical, or engineering science. The professorships are similar to the Foulerton medical research professorship of 1400*l.* or more per annum, and may be compared with the Foulerton medical research studentship of 700*l.* per annum, the Sorby research fellowship of 600*l.* per annum, and the Beit memorial senior medical research fellowships of 600*l.* per annum. Particulars of these are given in the Yearbook of the Universities of the Empire (Appendix XXIV.). It may be of interest in connexion with these endowments to mention that there are a few similar foundations in the United States, notably the Heckscher Research Foundation, established in 1920 in Cornell University. "As research in America," said the founder, "suffers from the exhaustion of professors by teaching and other duties, it is my desire that professors and instructors . . . shall . . . for such periods of time as the university authorities may prescribe, be liberated partially or wholly from those duties," etc.; for the present the income is not to be used for permanent research professorships. Senator Vilas likewise bequeathed to the University of Wisconsin money for creating ten chairs of pure research without routine work, in which the salaries (10,000 dollars) would attract

men of worth. The experiences of Johns Hopkins and Clark Universities, both of which were intended to be institutions for original scientific research, have shown the great difficulties that stand in the way of establishing independently of the state a university which shall be exclusively a school of advanced studies.

In Canada, Queen's University of Kingston, Ontario, has a Chown science research chair (in physics or chemistry), which was recently vacated by Dr. A. L. Hughes on his acceptance of a chair of physics in the University of Washington, St. Louis; and in connexion with the University of Alberta two "research professors" have been employed under the direction of an Industrial Research Council, of which the Premier of the Province was chairman, their fields of investigation being fuels and road materials. In Australia, the University of Queensland has lately established a research professorship of medical psychology.

In deciding that for the present the income is not to be used for *permanent* research professorships, the Heckscher trustees may have been influenced by criticisms which have been directed against the Carnegie Institution of Washington on account of their heavy budget for permanent establishments, which seems not altogether consistent with the original idea of the founder—to discover exceptionally endowed men in various specialities and give them for the time being the broadest facilities for accomplishing more or less definite pieces of work. It is their immunity from the risk of becoming overweighted with fixed establishment charges that contributes so largely to the success of foundations like the Mellon Institute, where research is organised on a "job" or contract system, the problem being set by a person or firm interested in its solution, the scientific worker being found and engaged, *ad hoc*, by the Institute, and a "fellowship" being assigned for a definite period fixed with reference to the probable duration of the research; in many cases the fellow is promised a "bonus" (which has in some cases reached 10,000 dollars) or a percentage on the industrial exploitation of the process studied.

All these research foundations differ, however, from those now established by the Royal Society inasmuch as they are associated with particular institutions. In the Society's scheme, there is perfect freedom as to the place of research, and the main intention is to give an investigator of proved worth the means to continue his explorations of the field of Nature undisturbed by other duties, and with his eye always towards the light. We welcome the generous recognition thus given to research as a profession, and believe that the action described by Sir Charles Sherrington marks the beginning of an important epoch in the history of the Royal Society.

Electronic Theories for Chemists.

(1) *The Electron in Chemistry: being Five Lectures delivered at the Franklin Institute, Philadelphia.* By Sir J. J. Thomson. Pp. v+144. (Philadelphia: The Franklin Institute, 1923.) 1.75 dollars.

(2) *Valence, and the Structure of Atoms and Molecules.* By Prof. G. N. Lewis. (American Chemical Society Monograph Series.) Pp. 172. (New York: The Chemical Catalog Co., Inc., 1923.) 3 dollars.

(1) SIR JOSEPH THOMSON'S book contains the substance of five lectures which were delivered so recently as April of the present year. The reviewer believes that it was dedicated to chemists and has read it in that light, for in no other can he pretend to see.

As is well known, the author does not subscribe to all the newer physical doctrines and is hopeful of founding a theory of the atom with the aid of less revolutionary postulates. Starting from the conception of the atom as a massive, positively electrified centre surrounded by electrons, Sir Joseph Thomson begins by admitting that the properties of the atom require the introduction of some principle not recognised in the older physics. This principle he supposes to affect the law of force between the nucleus of the atom and the electrons in such a way that at a certain distance the force changes from attraction to repulsion. The introduction of a new term into the expression of the usual inverse square law gives the required result, albeit somewhat indifferently well, and the corresponding stability of various electrically neutral systems composed of electrons, apparently stationary, can be worked out. The now familiar octet emerges naturally enough from such considerations, but the origin of the pair of electrons which form the "shell" of the helium atom and the K layer of heavier elements is left obscure, nor is it at once evident why the octets of the inert gases are relatively so extremely stable.

If no more than an adumbration of the periodic system is to be seen in the somewhat tentative theory which the author here proposes, this fact should not be allowed to weigh too heavily against it, lest hereafter it may prove that other theories have sacrificed too much in order to retain a predetermined outward form.

In chapter ii. the combination of atoms by means of one, two, or more electrons is considered, and it is explained why lithium, beryllium, boron, and carbon are solids whilst oxygen, fluorine, and neon are gases, and why, for example, the study of the mode of scattering of polarised light by gases furnishes evidence that the molecule of oxygen is more elongated than that of, say, hydrogen. Careful readers, however, will note that nitrogen does not fit into the picture, and will

suspect that Sir Joseph Thomson has abandoned an earlier intention of assigning to the molecule of this element a configuration not unlike that of the atom of an inert gas.

The method of positive ray analysis, which originally we owe to the author's genius, has given many results which scarcely admit of misinterpretation, a virtue not always conspicuous in the conclusions derived from other methods of investigation of atoms and molecules. Chemists will therefore turn eagerly to those pages in which Sir Joseph Thomson explains how positive rays throw light upon the chemical properties of the elements.

Highly interesting and suggestive, too, are those sections of the work which treat of polar molecules and their importance in connexion with chemical reactivity, as, for example, the explosiveness of certain gas mixtures and the inertness of certain carefully dried systems such as those included in the classical experiments of H. B. Dixon and of H. B. Baker. These ideas on polarity are extended to explain electrolytic dissociation in solutions, the formation of the double layer, and the principle of the Armstrong hydroelectric machine, to mention only a few applications.

The conditions which give rise to the development of electrical polarity in a molecule are treated from an elementary point of view, and the principles are used to explain the varying acidness of hydroxylic compounds and substitution in hydrocarbons and their halogen derivatives.

Residual affinity, active molecules, Werner's co-ordination numbers, production of light during chemical change, magnetic characters of elements and compounds, and of oxygen in particular, are also considered. Nor does Sir Joseph Thomson omit discussion of Thiele's theory of conjugation and related questions; but the applications of his views to organic chemistry have undergone some modification since the book was written, as comparison with his recent contribution to the *Philosophical Magazine* will show.

The electronic theory of solids occupies the last chapter of the work, and as this involves the treatment of crystal structure, compressibilities of metals and other elements, surface tension, intermetallic compounds and mixed crystals, it will make a special appeal to chemists and metallurgists who can think in three dimensions, and there is much of interest for others.

The text is freely interspersed with mathematical symbols, but there is little that cannot be comprehended by those who have a knowledge of algebra and elementary physics. Chemists owe to Sir Joseph Thomson grateful thanks for a work which illuminates many of the dark corners of their science with the glow of his rich knowledge and experience.

(2) The current of orthodox opinion on electronic theories of valency has changed its course so often that the permanence of any one aspect of the subject cannot be assumed. Nevertheless, the adjective "ephemeral," which Prof. Lewis suggests in reference to his monograph as a whole, should properly be applied only to the latter half of the work. The earlier chapters, which deal with the pageant of discoveries and ideas which led up to the present position of our knowledge of the atom, could scarcely be bettered as an initiation to the subject, and are distinguished by an ingenious arrangement of the material and by the graphic way in which it is described.

Beginning with Dalton's conceptions of the discontinuity of matter, the author leads, by several converging paths in turn, to the ionic dissociation theory, to the discovery by J. J. Thomson of the electron, and to the electronic conception of the atom. The ideas of Abegg, Thomson, Kossel, and others in relation to the octet theory are explained, while an interesting reproduction of some of his own lecture notes of 1902 throws light on the embryology of the cubic atom.

Later in the book, Ramsay is credited with the first idea of electrons shared by two atoms (1908). Stark's conception of valency electrons attracting simultaneously the positive parts of two different atoms is given great prominence and illustrated with four diagrams. Parson and Kossel are not forgotten in this connexion, and the author generously makes out the best case for every possible claimant to a share in the development of the notion of co-valency.

The history of the Bohr atom is also expounded in the introductory chapters, and thus spectral series, radiant heat, specific heats at low temperatures, Planck's oscillators, the quantum theory, and Einstein's photoelectric equation come forward in turn for exposition, the significance of each being made clear. Bohr's theory of the hydrogen atom and some of its more striking applications to the theory of emission and X-ray spectra, ionisation and resonance potentials, are explained in a simple way.

Werner's theory of co-ordinated compounds, or at least that part of it now accepted as a permanently useful generalisation, might with advantage have been included in these earlier chapters, leaving its interpretation in terms of the electronic theories to be dealt with in the later and highly controversial sections of the work, where Prof. Lewis develops his own views with the aid of numerous applications both in organic and inorganic chemistry. Some of the electronic formulæ suggested are already well-known and provisionally accepted; others, including many which are novel, will be received with varying grades of satisfaction.

As was to be expected, the electron duplet is in this

book vested with an importance which eclipses that of the octet itself. The author dislikes odd numbers of electrons, and regards molecules such as that of the highly stable and colourless nitric oxide, with fifteen electrons, as obstructionists, like the single player and the three-ball match on the golf links. In this attitude he represents at present a considerable majority of physical chemists; but although this helps to keep speculation within bounds, there are nevertheless some who still feel that they derive advantage from practising in fields where these recalcitrant molecules appear as examples of reactive combinations and not as exceptions to any rule.

The author reconciles Bohr's theory with his own by assuming that the fixed position assigned by him to each electron in the atom represents the average position of the electron in its orbit. This interpretation, however, appears to the reviewer to be an arbitrary one which later on may prove untenable, and which necessarily brings into prominence the magnetic phenomena associated with the movement of the electron. However that may be, the device obviously clears the way for a classification of the elements based on Bohr's system, but always, in the hands of Prof. Lewis, with full acknowledgment to the sources of inspiration.

Where Sir Joseph Thomson relies mainly on forces of the electrostatic type, Prof. Lewis holds that "such forces are responsible neither for the fundamental arrangement of the electrons within the molecules nor for the bonds which hold the atoms together." In the present work, consequently, magnetic moments assume directive or causative functions corresponding with those attributed to electrical moments in the preceding work; it naturally follows that ionisation and numerous reactions which "verge on the ionic type" become not merely limiting cases, but, like molecules containing an odd number of electrons, definite exceptions to the system.

Considerable space is devoted to co-ordination, bivalent hydrogen, ionisation, and strengths of acids and bases. There is much here which is suggestive; but when, for example, Prof. Lewis (p. 107) quotes an opinion that "an aqueous solution of hydrochloric acid would have the properties of a weak acid if it were not for the formation of this hydronium chloride," he is not helpful, for this applies only to the conductivity of the solution and not to its "acidness."

A number of problems of special interest to the organic chemist are touched on, including conjugation, partial valencies, and tautomerism. Huggins's theory (1922) of the electronic structure of benzene, which closely resembles that suggested independently by R. Robinson, in a discussion at the Chemical Society early in the same year, is cautiously commended.

The last chapter, which deals very broadly with the discontinuity of physico-chemical processes, photochemical reactions, colour, and with the future of the quantum theory, displays the prepossessing features of the early sections of the work, which is eminently readable throughout.

The printers and publishers have ably supported the authors of these two works in producing attractive monographs. There appear to be very few errors or omissions. In Sir Joseph Thomson's book, on p. 41, line 26, for "electrons" read "atoms," and on p. 135, line 14 from the bottom, for "proposition" read "proportion"; in Prof. Lewis's book, two dots have inadvertently been omitted from the formula for butadiene on p. 91. A. L.

Bruce of the *Scotia*.

A Naturalist at the Poles: the Life, Work, and Voyages of Dr. W. S. Bruce, the Polar Explorer. By Dr. R. N. Rudmose Brown. With Five Chapters by W. G. Burn Murdoch. Pp. 316 + 25 plates + 3 maps. (London: Seeley, Service and Co., Ltd., 1923.) 25*s*. net.

MR. RUDYARD KIPLING'S recent rectorial address on "Independence" gave general expression to the problem of those who in thought or action set themselves against the domination of "the Tribe," and here in the Life of Dr. W. S. Bruce we have an example of the career of one who did so. From this point of view, it might be wished that Dr. Rudmose Brown had been led to estimate in how far the "iron ration" on which Bruce relied was fitted to sustain him in his efforts to attain his ideals by his own exertions. Such a life, analysed with full knowledge of temperament, equipment, ambitions, and achievements, might bring enlightenment, help, and warning to others who are setting out on a scientific career. Yet the author was perhaps wiser not to make his biography a critical estimate of character. He has given an honest account of the work of a strenuous life in that spirit of sympathetic friendliness which Bruce inspired in all who knew him. From the facts set out in the narrative portion, read in the light of the two fine concluding chapters, "Ambitions and Dreams" and "The Man and his Work," the reader will not find it difficult to build up for himself an appreciation of the naturalist-explorer who differed in so many ways from the popular conception of a polar leader.

Bruce, when he first came to Edinburgh as a youth of seventeen, was a gentle, pathetic, lovable fellow full of vague visions and fine ideals, and no one suspected

that his shy, compliant nature was capable of holding on with the soft and flexible tenacity of a Chiton to any scheme on which his heart was set. Love of natural history was his dominant characteristic, and it drew him to the field and seashore rather than to the class-room. He completed no course of formal study and took no degree, remaining to the end an observer, collector, and organiser rather than a systematic or specialised man of science.

In a fascinating group of four introductory chapters and one of "Further Recollections," his old friend and companion, Mr. W. G. Burn Murdoch, reveals Bruce's early environment in Edinburgh, where he responded both to the magical stimulus of Prof. Patrick Geddes in science and to the emotional Celtic patriotism then pervading the University Hall where he lived. These chapters also describe the voyage on the *Balaena* to the Weddell Sea in 1892–3, when the spell of the polar regions fell on a mind which never after escaped its influence. After an account of the part Bruce played in the Jackson-Harmsworth Expedition to Franz Josef Land and in other private Arctic voyages, Dr. Rudmose Brown deals, with fuller knowledge than any one else possesses, with the origin, progress, and results of the Scottish National Antarctic Expedition to the Weddell Sea in 1902–4.

The solid results of the voyage of the *Scotia* entitle Bruce to a high place as an Antarctic explorer, though at the time he was rather overshadowed by the fame of the *Discovery*. The inception of the *Scotia* Expedition was his own, the funds for it were contributed by friends in response to his personal appeal; the plan of the cruise and the work done were original, dictated not by any external authority but by his own foresight and the chances which presented themselves in that region of unexpected obstacles and opportunities. How he looked on his assistants is shown by one of the too rare extracts from Bruce's diary on the *Scotia* (p. 148):

"I would like them to regard the ship as their university, as their *alma mater* in the highest possible sense, where they will be able to study the phenomena of Nature, without bias, from Nature itself; and learn that they, as well as their fellows, have many shortcomings. I am here as leader rather than commander, in order to guide the work of others, so that the aggregate may be of the greatest possible value to science and the world."

Bruce's pertinacity secured the finest series of deep-sea soundings ever made in the far south, and numerous hauls of the dredge, trawl, and fish-traps in deeper Antarctic waters than any other expedition has investigated. The discovery of Coats Land was scarcely noticed by the public, for though it was a geographical result of the first order, Bruce's indifference to non-scientific opinion led him to make little of it in comparison with his oceanographical work, which interested the newspaper reader very little. The most permanent outcome of the *Scotia* Expedition is the meteorological station established on Laurie Island (61° S.), which, after being organised and kept up for a year by Mr. R. C. Mossman, was taken over and maintained by the Argentine Government.

Though his later years were to some extent clouded by a sense of grievance with the tardy and inadequate assistance rendered by his own Government, Bruce continued to carry on by himself work which would have taxed the resources of a well-endowed scientific institution, but he escaped at frequent intervals to solace himself in Spitsbergen solitudes. He created the Scottish Oceanographical Laboratory, he classified and distributed the abundant collections of the *Scotia*, and made considerable way with the publication of the scientific results of the expedition. Of his struggles in this effort Dr. Rudmose Brown says (p. 252):

"Bruce strained his own scanty means to breaking-point to keep the publications going. The proceeds of lectures, articles and sale of bird skins and eggs were all devoted to the same cause. He had a hard struggle to keep his laboratory open and meet the printing accounts, yet he insisted that all the results should be adequately dealt with and fully illustrated. The one contingency he resisted was the abandonment of his laboratory and his publications. Poverty he was ready to face and did face: only his most intimate friends at the time knew of his struggles. Through all those days he never lost hope. . . . But all his schemes were for the advancement of science; his own interests counted not at all."

Bruce had no expensive tastes or impulses, and only cared for money to enable him to carry on his work; to this his personal life was entirely subordinated. In the end he attained to recognition as the best authority in Great Britain on practical oceanography and polar natural history; all the more is it deplorable that his oceanographical laboratory was broken up in his lifetime, and the collections, in gathering which he had spent his life, dispersed, albeit within the bounds of his beloved Scotland.

HUGH ROBERT MILL.

Mendelian Inheritance and Eugenics.

Heredity and Eugenics. By Prof. R. Ruggles Gates. Pp. xiii + 288. (London: Constable and Co., Ltd., 1923.) 21*s.* net.

IN the space of some 250 pages of well-produced matter, Prof. Gates has devoted himself to an examination of the known facts of human inheritance, with special reference to Mendelian inheritance. According to the preface, a compelling interest in

eugenics and a conviction that statesmen and law-makers alike have failed to realise how fully any intelligent attempt to improve the conditions and qualities of the human race must be founded on a knowledge of the manner in which qualities arise, are inherited, maintained or lost, have driven the author to glean from many sources. Thus he has been able to assemble in the present volume a crowded record of observations on the physical and mental characters of man, the results of the blending of races, the problems of population, and other aspects of eugenics, the main practice of which appears to be the production in the human frame of ready remedies for the evils of our social systems.

A general list of works bearing more or less directly on the infant subject of eugenics, and a bibliography of papers which have largely contributed to the matter of the text, complete the volume, and provide both ample reference for the general reader who would probe more deeply into recorded facts and opinions, and proof of the lively interest which has grown within the last two decades in Nature's laws which make or mar man's prospects from birth.

To maintain a well-born race is a natural aspiration involving no necessarily clear conception of the acme of human development of qualities either physical or mental; for although we cling to a vague ideal of a healthy mind in a healthy body and define more or less clearly the standards whereby we judge our fellow-creatures, there is no guarantee from the long pages of descent that the standards of human well-being for which we strive have kept in motion and in strength the main stream of human life.

It is well to realise how temporary are our aims, and that, in the practice of eugenics, our purposes are moulded more by our social systems than by a wide knowledge of whence man came and how, and of whither he is going and why, in the inexorable drifts of countless generations. To render better the span of life for our descendants is indeed a noble aim, the realisation of which must be based on a study of great tribal trends rather than on the application by one social cast to another of a knowledge of chromosomes, sex-linked inheritance, or the incidence of feeble-mindedness and colour-blindness. For man has come down the ages for good or ill by paths which neither a knowledge of inheritance nor a man-formed scheme of eugenics could have controlled effectively, and so he will go, despite our best endeavours, by the ceaseless drive of world-forces which eugenic practice can never mould to our will.

Much space is devoted in the text of the present volume to such topics as stature, eye-colour, hair-distribution, brachydactyly, and cataract, and to the occurrence of feeble-mindedness among the destitute, musical aptitude, and the limits within which characters of a parent persist in the offspring. But on the vital questions which are ever before us of the origin and meaning of any single character which declares itself in a life-span with a fate to be sealed in descent, there is silence. It is well that this should be fully realised, for it marks much of the current literature on eugenics, and stamps it as a speculation in futures of which we know nothing for lack of knowledge of the past. For Mendelian inheritance, on which eugenic practice so fully rests in its quest for the betterment of the human race, is little more than an elaborate distributing agency which deals in complex characters of unknown origin for which the future is obscure.

The book is well written and adequately illustrated: it will serve admirably as a guide to those who seek an honest statement of the present position of the principles on which the practice of eugenics is being built to-day. J. McL. T.

Our Bookshelf.

Ultraviolet Radiation: its Properties, Production, Measurement, and Applications. By M. Luckiesh. Pp. xi+258+12 plates. (London: Crosby Lockwood and Son, 1923.) 21*s.* net.

WHEN Scheele in 1777 projected the visible spectrum upon silver chloride, he was on the verge of discovering ultraviolet radiation, but it escaped his attention. Ritter in 1801 noted the effect on silver chloride of what proved to be this new type of radiation. This was the starting-point of a series of discoveries of photochemical effects made in the early part of the nineteenth century. The limit of transparency of ordinary glass is in general at about 340 millimicrons. Quartz crystals were found to be transparent as far as 185 millimicrons. Instruments employing quartz made it possible to extend the ultraviolet spectrum greatly, and by using fluorite Schumann extended the explored region from 200 to 120 millimicrons. Lyman placed the light source in an exhausted spectrograph chamber, and by employing a reflection grating was able to extend the known spectrum to about 50 millimicrons. Recently, Millikan has spanned the gap between these short ultraviolet rays and X-rays.

A detailed account of the experimental work that has been done on the subject of ultraviolet radiation is provided in a recent work by Mr. M. Luckiesh of the Nela research laboratories. The author states that his aim is to present authentic data of such scope as to be useful to those who are interested in the subject. Theory has purposely been subordinated to experimental facts because the latter are not affected by the inevitable changes in theory. The result of his labours is to furnish a storehouse of information which will be of service to the chemist, the physicist, the engineer, the biologist, the ophthalmologist, and the physician, for to each this form of energy is of practical value.

After a short introduction and an account of the

ultraviolet light in solar radiation, the subject of transparency of gases, liquids, solids and, in particular, glasses, is discussed in detail. Then follow important chapters on the reflection and production of ultraviolet radiation, in which the many sources now available are described and compared. After describing the detection and measurement of the rays, the author discusses their effect upon living matter and various photochemical actions. Although the reader would have been grateful in some places for a more critical discussion, he must feel that he is indebted to the writer for the large number of investigations described and for the many references.

The Savile Club, 1868–1923. Pp. vii + 206. (Privately printed for the Committee of the Club, 1923.)

THIS book will not only be welcomed by members of the Savile Club generally, but will also be a source of interest and pleasure to all such "strangers" as may come to read the anonymous author's "round unvarnished tale" of the birth and growth of the club, which has well striven to retain the original characters impressed upon it by the principles laid down by its founders. The founders' desire was, in brief, to establish a club consisting of a "mixture of men of different professions and opinions" by "a careful process of election." The eminently readable and racy story of the Savile's progress that occupies seventy pages of this history, in conjunction with the interesting chronological list of members and committees given in the rest of the work, supplies good evidence that these principles have not been forgotten.

A careful study of the whole of this work, as regards both matter and manner, and especially the apt quotation in the preface from the *Spectator* (No. 34, April 9, 1711), suggest to the present writer a probable clue to its author's identity. Such an author must necessarily be a Savilian of very long standing, and intimately acquainted with many fellow-members. He must, further, have had the habit of going to the club very frequently, and be endowed with mighty memory for details. Added to all this, he must be a genuine devotee to the club's principles and traditions. It is not possible to find in the whole list of members any one but Sir Herbert Stephen who possesses this infinite variety of qualifications. This hypothesis concerning the authorship withstands the application of a crucial test—the spirit and style of this admirably composed record.

Readers of NATURE may well take special interest in this book, which shows that the Savile Club has numbered among its younger members a large proportion of those who have become the most distinguished men of science in Great Britain and the world at large.

Electro-Chemistry related to Engineering. By W. R. Cooper. ("A Treatise of Electro-Chemistry," edited by Bertram Blount.) Pp. xiv + 136. (London, Bombay and Sydney: Constable and Co., Ltd., 1923.) 12*s.* 6*d.* net.

EVERY electrical engineer will admit that the science of electro-chemistry is of vital importance to his industry. All the copper he uses is refined exclusively by electro-deposition, and all the aluminium is produced electro-chemically. The electric refining of steel is now widely used, and so also is the electric production of ferro-alloys. These alloys have enabled wonderful results to be obtained in the construction of aircraft. Supply engineers have to be very careful not to let electricity leak from their mains, as the resulting "vagabond" currents corrode water- and gas-pipes. It is therefore advisable that they should know to what extent their stray currents produce this corrosion, and whether they will corrode reinforced concrete or not. We were particularly interested in the chapter on electrical precipitation of dust, smoke, and fume, and its commercial applications. Unfortunately the costs vary greatly with circumstances, so no general figures can be given; but we think that if the laws regulating the emission of smoke into the atmosphere were made a little more stringent, manufacturers would soon find it more economical to prevent it electrically. The chapter on electro-culture gives excellently and very briefly the present state of the art. Mr. Cooper's knowledge is acquired at first hand. In the final chapter he discusses the relative importance of cheap power and cheap freights. In some countries the cheap power available is more than counterbalanced by the high cost of transport. To scientific workers, and more especially to electricians, this book will prove useful.

In Witch-Bound Africa: an Account of the Primitive Kaonde Tribe and their Beliefs. By F. H. Melland. Pp. 316 + 24 plates. (London: Seeley, Service and Co., Ltd., 1923.) 21*s.* net.

WHILE anthropologists frequently maintain the necessity for insight and sympathy in the administration of the affairs of backward races, it is not often that concrete examples of the peculiar psychology of primitive man are put to the layman so convincingly as some of the instances which Mr. Melland has singled out in this book. As an official of some twenty-two years' standing, he is in a position to speak with authority. From this point of view his book can be recommended heartily to every one interested in the government of our backward races.

On the scientific side, Mr. Melland's account of the Ba-Kaonde of Northern Rhodesia is equally important. The Ba-Kaonde consist of three elements, to which, however, the author gives a common name as a matter of convenience. He is of the opinion that they are offshoots of the Batuba. Some of their customs suggest an affinity with Central rather than South Africa. There is, for example, practically no "bride-price," but the husband stays with the bride's people for a period of from three to ten years, and his children belong to them. As the title of this book suggests, Mr. Melland is much impressed by the importance of witchcraft in the life of the people.

The Cultivation of Sugar Cane in Java: an Elementary Treatise on the Agriculture of the Sugar Cane in Java, and more especially on its Cultivation on the Krian Sugar Estate. By R. A. Quintus. Pp. xii + 164 + 38 plates. (London: Norman Rodger, 1923.) 12*s.* net.

THE position occupied by Java as a cane-sugar producing country, and the care bestowed on the cultivation of the crop, ensures a welcome to a book in English dealing with the agricultural methods employed on an important estate in eastern Java. This volume,

written by the manager of the Krian estate, is virtually a text-book of sugar-planting under the conditions obtaining in Java. In addition to its utility as a practical guide, it should prove of interest from the point of view of comparative agriculture, since, in Java, local circumstances call for an intensive form of cultivation which does not obtain in all sugar-growing countries. The fundamental principles of sugar cultivation, however, are the same in all producing regions, and they are clearly set out by the author. There are two sections of the book. The first part, which is introductory, deals with cultural conditions in Java, and affords a discussion on soils, manuring, and the botany of the sugar-cane; while part two furnishes a practical account of the cultural methods adopted on the Krian estate, including operations down to the harvesting and transport of the cane, and deals also with certain aspects of estate administration. The book is excellently illustrated with photographs and coloured plates.

The Theory of Experimental Electricity. By W. C. Dampier Whetham. (Cambridge Physical Series.) Third edition. Pp. xi+349. (Cambridge: At the University Press, 1923.) 12*s.* 6*d.* net.

To students with a limited knowledge of mathematics who desire a sound theoretical basis on which to build we can heartily recommend this book. The author writes in a most interesting and convincing way, and gives an excellent preliminary introduction to the latest electrical theories, as well as a clear account of the apparatus and methods used in an electrical laboratory. He points out that according to the electron theory, matter is an electric manifestation, and so the mass of a body must be explicable as electric inertia. The electric inertia of a magnetic field can be represented as due to the motion of electric tubes of force in the luminiferous ether. In this way electric inertia is in its turn "explained" as "mechanical inertia" of the hypothetical substance invented to enable our minds to form a rational picture of other physical phenomena. The author points out that, in a certain sense, simplification is thus attained. All natural phenomena are referred to the properties of the ether. Nevertheless, the mystery is but changed. We may have explained matter in terms of ether, but how are we to explain ether? The book closes with this question unanswered.

Statistical Method. By Prof. Truman L. Kelley. (Text-book Series.) Pp. xi+390. (New York: The Macmillan Co.; London: Macmillan and Co., Ltd., 1923.) 18*s.* net.

THIS volume by an educationist should be of great service to those who use statistical methods in any field, since it provides a summary of nearly all, if not all, the methods which have been proposed for measuring relationship. This seems likely to be its chief use, but it includes also a discussion of frequency distributions and of Pearson's set of curves, with chapters on index-numbers and other special applications. The study begins with data already collected, but the introductory chapters outline the principles of tabulation and graphical representation. Although problems are suggested in several chapters, the book can scarcely be regarded as a text-book for beginners, being very condensed in many parts, with few worked examples, but rather is a critical survey. In the treatment of correlation much use is made of a symbol for $\sqrt{1-r^2}$ as "coefficient of alienation." Appendices supply a list of symbols used, a bibliography—which is not up-to-date as regards editions of books—and an extended table of deviates of the normal curve. The index is small but useful.

Eastern England: some Aspects of its Geography, with Special Reference to Economic Significance. By John Bygott. Pp. xv+358. (London: G. Routledge and Sons, Ltd., 1923.) 6*s.* net.

IN this book the author has attempted with a large measure of success to make a geographical study of agricultural England, devoting his attention to East Anglia and Lincolnshire. The study is comprehensive and thoroughly geographical. In no aspect of the subject does Mr. Bygott lose touch with the effects of location, relief, soil, and climate, and he considers the region in the past as well as the present. The volume rises far above the rank of the ordinary text-book as a serious contribution to the regional geography of the British Isles. There is a little overlapping in places; occasionally condensation would not be amiss; and it might facilitate the use of the book if some of the statistical matter was arranged in tabular form; but these are all minor points, and do not materially detract from a useful volume. The numerous sketch-maps are not the strongest part of the book.

R. N. R. B.

The First Days of Man: as Narrated quite simply for Young Readers. By F. A. Kummer. (The Earth's Story, 1.) Pp. 293. (London: Hodder and Stoughton, Ltd., 1923.) 7*s.* 6*d.* net.

ALTHOUGH this little book does not call for extended notice, it is worth mention as a type of educational work which is more common in the United States than in Great Britain. After a preliminary chapter dealing with cosmic evolution, it gives the main outline of the development of civilisation up to the end of the Stone Age in a logical order and an attractive form suitable for quite young children. In the whole it keeps fairly closely to accepted fact and theory, while avoiding the more formal methods usually adopted in the elementary introductions to the results of archæological study which have hitherto been offered to the British public.

An Introduction to Mining Science: a Theoretical and Practical Textbook for Mining Students. By J. B. Coppock and G. A. Lodge. (Longmans' Technical Handicraft Series.) Second edition. Pp. xi+252. (London: Longmans, Green and Co., 1923.) 4*s.*

THIS book provides a sound and interesting course in elementary science, from the point of view of the needs of miners. It is clearly written, and is well printed and illustrated. The experiments are carefully described, although it is questionable whether a large class should prepare small specimens of nitroglycerine, and then pour them down the sinks, as directed (p. 186). In the experiment on p. 120, a bit of "compo" tubing is less likely to do damage than glass. The technical matters are well explained, and the book will be useful.

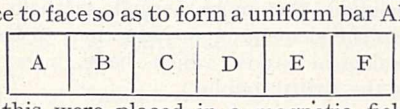
Letters to the Editor.

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, nor to correspond with the writers of, rejected manuscripts intended for this or any other part of* NATURE. *No notice is taken of anonymous communications.*]

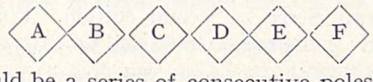
The Polarisation of Double Bonds.

PROFS. LAPWORTH AND ROBINSON in a letter under the above title in NATURE of November 17, p. 722, raise some objections to a theory which I published in the *Philosophical Magazine* in September. The first of these objections is to the difference which I make between the action of an external electric field on singly- and doubly-bonded atoms. It seems to me that such a difference must exist. For, suppose that there is a double bond between two carbon atoms $C_2 = C_1$, the octets of electrons round C_1 and C_2 have four electrons in common situated between C_1 and C_2. If an external electric field acts on the molecule, tending to make electrons move from left to right, some of the electrons held in common may be so far displaced from C_2 and towards C_1 that they can no longer be regarded as shared with C_2. If two of these are displaced far enough for this to happen, the octet round C_1 will be intact and C_1 will be saturated, while the octet round C_2 will be reduced to a sextet, so that C_2 will be unsaturated and chemically active; there are still two electrons left between C_1 and C_2 to form a single bond binding C_1 and C_2 together. If there were originally only a single bond between $C_2 - C_1$, the octets round C_1 and C_2 have only two electrons in common; if one of these moves so far towards C_1 that it can no longer be regarded as completing the octet round C_2, so as to make this atom unsaturated and active, there will only be one electron left between C_1 and C_2 to bind them together. We should expect that they would easily come apart and form oppositely charged ions. Thus in this case neither of the carbon atoms would become active chemically while in combination.

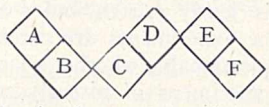
Profs. Lapworth and Robinson object also that the effect of electrostatic induction would only be manifest at the beginning and end of a chain, that there would be no poles in intermediate positions. It is, however, only when the chain is entirely uniform that the evidences of polarity would be restricted to its ends. To take a very crude illustration: if we have a number of cubes of soft iron and place them face to face so as to form a uniform bar ABCDEF,



then if this were placed in a magnetic field where the force is parallel to the bar, the poles would be at or near the ends. If, however, they were arranged in diamond fashion,



there would be a series of consecutive poles at equal intervals along the chain. If they were arranged like



there would again be consecutive poles, but the intervals would be different. With regard to the objection that my theory involves Kekulé's structure for the benzene ring, I used this structure in my paper because it was the simplest and most definite. But unless all the carbon atoms in the ring are supposed to be the same in all respects, almost any theory would, I think, lead to analogous results.

Again, Profs. Lapworth and Robinson say that, according to the theory given in my paper, when vinyl chloride is acted upon by hydrochloric acid the result should be $ClH_2C - CH_2Cl$ and not, as I say, $H_3C - CHCl_2$. I cannot agree with this at all. The effect of substituting Cl for H is on the theory to produce an electric field which attracts negative ions. This, it is true, will extend to the carbon atom in vinyl chloride which is not chlorinated, and make it more likely to attract a chlorine atom than it was before the chlorine was introduced. But when another Cl atom is introduced into the molecule the carbon atom to which it goes is determined not by the absolute value of the attraction in one part of the field but by the difference in the attraction. The Cl atom will go to the part of the field where the attraction is greatest, and this will be the part of the field nearest to the chlorine atom which is the origin of the attraction, so that the new chlorine atom will go to the carbon atom which is in this part of the field; that is, it will go to the carbon atom already chlorinated.

J. J. THOMSON.

Trinity Lodge, Cambridge,
November 19.

Experiments on Ciona and Alytes.

IN NATURE of November 3, page 653, Mr. H. Munro Fox announces that he did not succeed in repeating my results in his Ciona experiments in Roscoff: amputated siphons regained only their normal length. Mr. Fox supposes that the extra growth in length of the siphons in my experiments was produced by extravagant feeding, and not by the regenerative activities of the animals.

Before Mr. Fox publishes the full account of his work, which he promises, I beg him to note the following facts, namely:

(1) The two principal cultures (operated and control) of my Ciona were placed at the same time and at the same stage of development, with the same provision of food, in two precisely similar aquaria, which stood beside each other. The dimensions of these aquaria were 300 × 170 × 100 centimetres. I did not undertake a quantitative estimation of the number of micro-organisms present; but the food available was, so far as I could see, rather on the scanty than on the abundant side.

All the specimens in the control culture possessed short siphons, and therefore the influence of food on the length of siphon is excluded.

(2) I am not the first and only observer who has noted the "super-regeneration" of the siphons after they have been cut off several times. Mingazzini[1] asserts that siphons amputated three or four times at intervals of a month became longer after each regeneration. Mingazzini was able in this way to produce artificially the local variety, "macrosiphonica," found in the Gulf of Naples. I fully anticipated that the decisive experiment on regeneration and inheritance in Ciona would encounter violent contradiction. On that account I took care to construct this critical experiment out of experiments which had already been made by other investigators. That this was possible in the case of Ciona was one of the reasons which led me to choose this species. Indeed, I have had a predecessor (E. Schulz) also on the question of the regeneration of the "Keimplasma" out of somatic material, though his experiments were made not on Ciona but on another

[1] "Sulla regenerazione nei Tunicata," Bolletino Soc. Nat. Napoli, Series I., year 5, 1891. (An abstract of this paper appeared in the Naples *Zoologischer Jahresbericht* for 1891 under the head "Tunicata."

Ascidian (Clavellina). The only originality which I claim is the combination of *well-known* experiments and their application to the solution of a problem of inheritance.

Barfurth,[2] after he had discovered (at that time in his laboratory at Dorpat) that the limbs of frog-larvæ had the power of regeneration, laid stress on the superiority of one positive result as against any number of negative results. "Even if only Dorpat tadpoles regenerated their limbs, nevertheless his result would be established." I make the same claim for Ciona, "even if only Ciona from Naples and Trieste grow long siphons." Finally, have perhaps only southern populations this power?

I make use of this opportunity to refer also to NATURE of September 14, in which Dr. W. Bateson writes again on the subject of Alytes. The type specimens of my experiments are in the Museum of Experimental Development attached to the Biological Institute of Vienna, and are the property of the Museum. I communicated Dr. Bateson's proposal to the directorate, and added, as my own opinion, that I was not in favour of exposing the critical specimen of Alytes with nuptial pads to the dangers of a second journey, only because Dr. Bateson had neglected the opportunity of examining it when he was able to do so. Nevertheless, I did not oppose a veto to the directorate sending the specimen if they wished to do so.

I was formerly very generous in lending type-specimens, but I have unfortunately had very unfavourable experiences in so doing. PAUL KAMMERER.

Vienna, November 10.

Problems of Hydrone and Water: the Origin of Electricity in Thunderstorms.

As one of my younger sons remarked to me some time ago—it is impossible, in these days, to get up a scrap! I challenge the current explanation—we cannot yet call it a *theory*, but, again, in these days, no one has care of words, every one calls his pet notion a theory—of the origin of the electricity let loose in thunderstorms, raising thereby an entirely fundamental issue. Yet no one dare face the problem. In these days, we have no regard for fundaments; our care is only for the chimney-pots; we devote ourselves to polishing these, forgetting that often the foundation of the house is yet to be built. I privately challenge the Sage of Salisbury, who formerly took some interest in electrical phenomena and lightning conductors and deigned to consort with us weak chemical vessels; his reply is proof that he has not seized my point and is "up above the world so high" that he cares only to contemplate electrons in transcendental garb, not in that of the vulgar raindrop. Big as he is, he has wrapped himself up snugly within the atom and won't consider what happens between at'ems—when they are molecules and interact.

I am sorry if I have depressed Dr. Simpson (NATURE, Oct. 27, p. 620). I well know that he bases his conclusions upon the experiments he has made. Unfortunately, from the sad experience of fifty years, I know that the results of experiments are often to be interpreted in opposite and equally plausible ways. Lenard and Dr. Simpson, so far as I am able to judge, have made experiments on very similar lines; the conclusions at which they arrive are different, however; rain, too, is sometimes negative, sometimes positive. I ask that exact stock may be taken of the work, and that we may know precisely what it is that has been measured. The feeling is upon me that the circuits dealt with were not so simple as is supposed.

We chemists are in grave difficulty. Physicists seem not only unwilling but also unable to grasp the spirit of our work; we are, therefore, forced to dabble in their field and naturally feel far from safe in dealing with electrical problems—though some of us have no hesitation in pronouncing on the electrical in'ards of the atom. If the physicists had sympathy with us, they would long since have tutored us and not allowed us to talk the nonsense we have indulged in, all these years, on the subject of ionic suicide in solution.

I am really posing a problem far deeper than that considered by Dr. Simpson. Whether energy be let loose in the division of big raindrops or when small ones unite matters relatively little to me—what I first want to know is whether, in such a liquid circuit, the energy would appear otherwise than as heat; whether, in fact, electrical energy can get loose from an electrodeless liquid circuit. This seems to me to be one of the fundamental problems to be solved in connexion with chemical change in solutions. The fire is a far more potent display of energy than a rain shower, yet we have no evidence of electricity being stormily loosed from it, however strong the draught up the chimney. I would beg for a Roland from Sir Oliver in this connexion: if he cannot meet me, I would ask some other Knight Physical to make his proclamation on the issue I have stated or, in some way, confound my inconvenient, if not improper, curiosity concerning an ordinary but always entrancing phenomenon. As to an external source, ultra-violet radiation must be doing something in the upper atmosphere. HENRY E. ARMSTRONG.

The Gorilla's Foot.

SINCE I have examined and sketched the feet of one or two dead gorillas in the Zoological Society's Gardens, may I be permitted to say that no one acquainted with the foot of this ape can dissent from Sir Ray Lankester's condemnation (NATURE, November 24, p. 758) of the photograph of the cast of the foot of the Kivu specimen published by Mr. Akeley? The photograph successfully conceals the fundamental resemblance, so far as mobility is concerned, between the hallux of the gorilla and that of monkeys, and suggests a resemblance, which does not exist, between the hallux of this ape and of man. It is, therefore, entirely misleading; but it is quite in keeping with Mr. Akeley's statement that the big toe in the gorilla "has grown away from the thumb, which is useful in climbing, towards the big toe, useful for walking" (*World's Work*, October 1922, p. 377).

Without any reflection being cast on Mr. Akeley's *bona fides*, that statement may be dismissed as incorrect, and as attesting the author's unfamiliarity with the structure of the gorilla's foot. Admittedly the hallux of the gorilla, like that of any monkey, can be stretched forwards so as to lie in contact with the adjoining edge of the next toe; but it cannot take up that position without forming a long and deep integumental crease on the sole of the foot. To the failure of Mr. Akeley's cast to reproduce this crease, showing the mobility of the hallux, must be mainly assigned the fictitiously human appearance of his photograph of the gorilla's foot. It is to be hoped that the duplicate cast will not be exhibited in the Natural History Museum without a label clearly explaining this misleading defect. R. I. POCOCK.

November 26.

NOTE.—While this letter was in the press, I saw at the Natural History Museum the duplicate cast above referred to. It shows quite clearly the deep crease mentioned; and the deceptive photograph would have revealed it, if proper attention had been paid to the direction of the light.

November 29.

[2] "Sind die Extremitäten der Frösche regenerationsfähig?" *Arch. Entw. Mech.*, vol. 1, 1894.

Colour Vision and Colour Vision Theory.

IN his letter on this subject which appeared in NATURE of September 29, p. 473, Dr. Edridge-Green apparently promised to deal with my explanations when these were given. In reply I selected two in which the full reasoning had been given, and I invited him to implement his undertaking. In his letter in NATURE of November 10, p. 687, he apparently declines to do so, and passes his burden on to the reader.

In none of his letters has Dr. Edridge-Green attempted to discuss my proofs, or indications of the proofs; but on the contrary he has in each letter merely made fresh assertions of other cases in which he presumes similarly that the trichromatic theory is incompetent. Nevertheless, ignoring the absence of discussion on his part, I took up each fresh assertion as it came, and dealt with it as with those which preceded. In his present letter he repeats the process, bringing forward three new cases. Since, in one of these, he deals with a statement of mine ("Colour Vision," p. 151), I shall, as before, discuss these new examples also, though that procedure cannot be continued indefinitely.

He seems to agree that my explanation of the absence of shortening of the spectrum at the red end after fatigue by yellow light is sound if the presumption made be true. But he asserts that the presumption is inconsistent with the work of König, Abney, and others. The presumption is that all three sensations are stimulated by visible light of any wave-length. Now Dr. Edridge-Green is wrong in asserting that this presumption is inconsistent with the *work* of König, Abney, and the others. It is certainly inconsistent with the *presumption* made alternatively by these investigators, which implied that the red sensation alone was stimulated by light near the red end of the spectrum. But the *work* never proved the correctness of that presumption, which, like the other, was quite a legitimate one nevertheless. For all conclusions regarding colour mixture, obtainable by one set of fundamentals, are necessarily obtainable by any other set linearly related thereto. The only type of work, by which discrimination between two otherwise suitable sets of fundamentals is possible, is work which deals with phenomena related to the sensations by a non-linear law. That condition was apparently unknown to Abney, and so he adopted the not necessarily true view that his selected fundamentals were absolute. They are certainly very convenient for observational work.

Dr. Edridge-Green then says that my explanation does not explain why there *is* shortening of the red end of the spectrum after fatigue by *red* light. Now that is an entirely separate point to which my explanation was not directed. But the trichromatic explanation thereof is quite simple and straightforward. The theory never asserts that lights of two different wave-lengths (yellow and red lights in the present case) will necessarily produce the same fatigue effects in any given region of the spectrum. The law of fatigue is not yet known, but the fatigue parameters used in the trichromatic theory are adequate fully to express it whenever they are formulated as functions of the various conditions which can affect fatigue. It is the absence of recognition of these and similar features of the moulding of the trichromatic theory which has led Dr. Edridge-Green into the erroneous statements unfortunately made by him so frequently regarding the powers of the theory.

Dr. Edridge-Green next raises another new point in saying that I do not "explain Shelford Bidwell's crucial experiment, namely, that his red borders are not seen with spectral yellow light but are seen with a mixed yellow made up of red and green matching it." Now Bidwell's experiment is in no sense crucial. The trichromatic theory has no *a priori* expectation that a pure yellow light and a mixed yellow light shall have the same effect with regard to border colours any more than it has with regard to fatigue. That is entirely dependent on the *nature* of the actions and interactions which are involved, a question on which the theory makes no fixed foregoing pronouncement. It is a matter for physical and physiological investigation. When that inquiry is settled, the theory will incorporate the result as an aid to the formulation of the parameters in terms of known quantities, just as in the case of fatigue discussed above. The theorist welcomes Bidwell's observations, and he is willing to give a similar welcome to those made by Dr. Edridge-Green.

The third and last new case is in the same position. Dr. Edridge-Green cites the gradual disappearance of the positive after-image of a spectrum, which proceeds successively from the red to the violet end. He says that the trichromatic theory states that the positive effect of the red sensation disappears before that of the green. The statement applies if we adopt (say) Abney's fundamentals, but might require modification otherwise. Yet that is not of any essential importance. But he proceeds to say that, "in an absolutely dark room, if pure spectral yellow light be thrown on a white screen and a flicker apparatus rotated slowly in front of it, the yellow will not change its hue; on the trichromatic theory it should become green. The results are quite different when stray light is allowed to fall on the screen as well." Now, while the trichromatic theorist will welcome any such verified data, he cannot admit any compulsion towards the expectation that the colour should become green. The conditions of the retinal illumination are entirely different in the two cases. So the results of the observations can only furnish information regarding the manner of variation of the decay parameters and of the threshold values as functions of the illumination and its duration and its quality, of the length of the rest interval, and also of the areal distribution of the illumination.

I am glad that Dr. Edridge-Green has brought forward these three examples, for they are typical of many cases in which the views of writers on the subject have been adversely affected by the stereotyping of ideas which, while being appropriate enough to the strong restrictions properly imposed in the earlier stages of the theoretical development, have long since been removed. W. PEDDIE.

University of St. Andrews,
November 10.

Late Fertilisation and Sex-Ratio in Trout.

MRSIC [1] has shown that in rainbow trout late fertilisation—*i.e.* the retention of ova within the body of the female after they are fully ripe—results, as it does in frogs (Hertwig,[2] Kuschakewitsch [3]) in an increased percentage of males in the offspring. This is due (as also in frogs—Hertwig [4]) to the transformation into males of some of the young animals which had started to develop as females. The only difference between the frog and the trout is that, whereas in the former case the short period of 4 days' delay will cause *all* females to become transformed

[1] Mrsic, 1923, *Arch. Entw. Mech.*, 98. 129.
[2] Hertwig, R., 1912, *Biol. Centralbl.* 32.
[3] Kuschakewitsch, 1910, "Festschr. f. R. Hertwig," 1910.
[4] Hertwig, R., Sitz. Bayr. Ak. Wiss., 1921.

into males, in the trout a much longer period, in fact the utmost which the female parent will stand —21 days' delay—will only raise the proportion of males to about 67 per cent.

Working with the brown trout with shorter (4-14 days') periods of delay, I have obtained results of the same kind but not so marked.[5]

It was thought that it would be interesting to try the effects of delay outside the body. Accordingly, on December 13, 1922, all the ova of a large female brown trout were stripped into a basin. One portion (lot A) were fertilised immediately. The rest of the eggs were left in the basin, in the small amount of fluid which comes away with them, but without the addition of any water, although in a moist atmosphere. A second lot (B) was fertilised 2 days later, and a third and final lot (C) after a total delay of 4 days. The sperm of the same male was used for all three fertilisations.

The surviving young trout were preserved in October 1923. All which had died after hatching were also preserved, and all but 4 of these could be sexed.

The results may be tabulated as follows :

Lot.	Total ova fertilised.	Died before hatching.		Died after hatching.			Killed Oct. 1923.		Total sexed.		
		% of ova.	No.	% of hatched.	No.	% ♂.	No.	% ♂.	No.	% ♂.	P.E.
A	351	10·3	36	26·7	84	48·7	231	51·1	315	50·5±1·90	
B	286	55·2	158	64·1	82 (78 sexed)	48·7	46	47·8	124	48·4±3·03	
C	208	65·4	136	56·9	41	36·6	31	58·1	72	45·8±3·52	
Total	845	39·1	330	40·2	207 (203 sexed)	46·3	308	51·3	511	49·3±1·49	

None of the variation shown by these male percentages is statistically significant. For example, the difference between the ♂ percentages of A and B (totals sexed) is 2·1, with a P.E. of ±3·39; and that between those of A and C is 4·7±4·06. Even that between those for "C, died after hatching" and "C, killed Oct. 1923" is only 21·5±7·84, and must therefore be treated as an error of random sampling. Thus the treatment has *no effect* upon the sex-ratio.

The mortality rate, on the other hand, is markedly affected by the treatment. This is especially notable in the death-rate before hatching; but even after hatching, although the controls show the abnormally large death-rate for the first ten months of 26·7 per cent. (due to an exceptionally bad attack of fungus-disease), that for the treated ova is more than twice as great. Mrsic (*loc. cit.*) found that over-ripeness within the body of the female exerted a deleterious effect upon the young fish, as had been previously shown for frogs by Witschi.[6] But in neither case was the mortality nearly so great as in these experiments. The increased mortality was thus merely something incidental to any abnormal treatment; but the two treatments, of delay inside and delay outside the body, exert quite different effects in other respects upon the unfertilised ova.

The sex-ratio of adult (2- and 3-year old) trout, both brown and rainbow, reared in captivity is, I am informed by Mr. Stevens, Manager of the Midlands Fishery at Nailsworth, close to 66 per cent. ♂♂ in his experience. What brings about this marked increase in the number of males is not known (in all recorded experiments the sex-ratio of young fish 6-10 months old is close to 1 : 1). Differential elimination of females after attaining maturity would appear to be the only method by which it could come about, but the reason for this remains obscure.

I should like to take this opportunity of expressing my thanks to Mr. Stevens, without whose interest and help I could not have carried out the work. The expenses were defrayed out of a grant from the Royal Society.

JULIAN S. HUXLEY.
New College, Oxford.

P.S.—I have just heard from Mr. Rowland Hazard, the owner of one of the largest trout hatcheries in the United States, that the sex-ratio of adult fish in his experience varies considerably from year to year. This year it has been about 58 per cent. ♂♂ in 40,000 fish, but in most years the excess of males is less.

[5] Huxley, 1923, *Science*, 58. 291.
[6] Witschi, 1922, *Biol. Zentralbl.* 42. 97.

Is the Pentose of the Nucleotides formed under the Action of Insulin?

WE have read with interest the letter from Mr. C. Berkeley in NATURE of November 17, p. 724. Referring to the substance found in animal tissues after insulin, which gives the α-naphthol reaction, but is without reducing action on copper salts, he suggests that our failure to find reducing power after hydrolysis by acids may be due to a pentose constituent going over to furfurol and being lost by volatilisation.

There are reasons which make it unlikely that this is the case. We find that on boiling a solution of the substance in the presence of 8 per cent. hydrochloric acid for three hours, there is no measurable change in the optical properties of the solution. This does not exclude the possibility of loss of pentose sugar owing to conversion to furfurol, since the optical properties of the residue may have been altered, with the result that no change would be observed. On the other hand, the substance gives little indication that it contains a pentose. The modification of the α-naphthol test in which strong hydrochloric acid is used in place of sulphuric would be likely to indicate the presence of pentoses, by a rapid appearance of a purple colour.

Using this test, a positive reaction is obtained only shortly after the sugar has been extracted from the tissue, and then only faintly. The substance is dried with difficulty at room temperature *in vacuo* over sulphuric acid. At the end of this period the α-naphthol reaction (using sulphuric acid) is given with diminished intensity, and in the course of weeks it may disappear entirely. The α-naphthol test is extremely sensitive, and since many proteins and their derivatives give a positive reaction, it is perhaps necessary to emphasise that the intensity of the colour given by the substance in question, as well as the method of extraction employed, point to the substance being of a true carbohydrate nature. Indications have been obtained that the substance is present in normal tissues.

Dudley and Marrian (*Biochem. Jour.* 17, p. 435, 1923) have shown that glycogen disappears almost entirely from the liver and muscles after insulin convulsions. The fact that the blood sugar of animals in convulsions may be restored to the normal level, and the animals be recovered, by injection of such substances as adrenalin or pituitrin, without injection of glucose, suggests that the carbohydrate reserves of the body have been converted into some form other than glycogen. That the Islets of Langerhans tissue contain unusually large amounts of pentose compounds is of great interest; but this

fact need not lead to the conclusion that the function of insulin is to convert the sugar reserves of the body into pentose derivatives.

L. B. WINTER.
W. SMITH.

Biochemical Laboratory,
Cambridge.

Fixation of Human Embryological and Cytological Material.

IT is known that it is very difficult to obtain well-preserved human material. Few medical men realise that five or ten minutes after the tissue has been removed, or after death, plasmolytic changes supervene, and in the fixed and stained sections the chromosomes have clumped badly, and the delicate lipoid cytoplasmic organellæ have become abnormal, or completely macerated. Recently, I have been studying certain human material, and find that nearly every type of histological preparation can be made from two fixing fluids as follows: one of the surgeon's assistants is given two bottles, one of Da Fano's cobalt nitrate formalin fluid, and one of Regaud's formalin-bichromate fluid. Pieces of tissue as large as the thumb may be thrown into these bottles, and afterwards cut into smaller pieces when they have been brought to the laboratory. It is better to change into new fluid at once, especially if the organ is very vascular, and the fixing fluid mixed with blood.

For human material I find that fixation overnight in the Da Fano fluid gives the best results. Next morning some of the pieces are taken through as usual for Da Fano's method ("Microtomists' Vademecum," p. 437), but other pieces are washed in distilled water for ten or fifteen minutes and transferred some to 2 per cent. OsO_4, others to Champy's fluid (chromeosmium). The OsO_4 pieces are used for the Sjövall method (*ibid.* p. 331). From this batch of material, originally fixed in Da Fano, one gets sections which generally show the inner Golgi apparatus (Da Fano and Sjövall), the mitochondria (chromeosmium and sometimes Sjövall), neutral fat and lipoids (chromeosmium), and general nuclear structures and mitochondria (Da Fano fixation, staining in iron hæmatoxylin).

The other batch of material, fixed in Regaud's formol-bichromate, is partly carried through for the Regaud-Bensley-Cowdry method (*ibid.* p. 324), but other pieces of tissue are taken through Schridde (*ibid.* p. 325). These methods give the mitochondria (Regaud), mitochondria and fat (Schridde), and such sections stain nicely in safranin—light green, and in Mann's methyl blue eosin. For secretion and excretion granules, zymogen, yolk, fat, Golgi apparatus, and mitochondria, these two batches of material will give complete results.

For chromosomes, a batch of material in some Bouin formula (*ibid.* p. 306) is recommended.

J. BRONTË GATENBY.

Zoological Department, Dublin University,
November 7.

Linnean Nomenclature.

IN the admirable review of Dr. Daydon Jackson's "Linnæus" (NATURE, November 17) there is one paragraph (last on p. 715) from which I am not sure that I extract all the meaning. This may be because I am a systematic zoologist and not a botanist; but I did begin my work on those lines with the study of Linné's "Philosophia botanica." That book taught me that the *nomen triviale* was no entity, merely a part of the *nomen specificum*, which consists of the *nomen genericum* qualified by the *nomen triviale*. Thus, "man" being the genus, "a good man" is the species; but "good" cannot stand apart from "man," for it is relative to "man" alone. Now take your good man and make him an admiral; he may be a bad admiral. Is that what the reviewer means? Does he imply that, if a species be rightly transferred to another genus, the *nomen triviale* is open to change? If this be his meaning, then it seems to ignore the distinction between a mere name and an epithet. When Jane Smith marries John Brown, she becomes (by custom) Jane Brown. She may thereby even change her nationality, but she remains Jane, and that is how we identify her, although "Jane" by itself is meaningless.

What then, some of us are asking, are the "philosophical positions" from which we have retreated; what are the "sound scientific principles" we have abandoned?

F. A. BATHER.

I REGRET to learn that one of my remarks has proved obscure to zoologists. A note by Linnæus that *nomen specificum sine generico est quasi pistillum sine campana* is accompanied by a cross reference to the denominational canon *nomen specificum sine generico est quasi campana sine pistillo*. The generalisation of the exemplar lends emphasis to the axiom embedded in the canon. That axiom was almost universally accepted by botanists in Great Britain until 1905, when representatives of their science, in international congress assembled, decided by a majority vote that the two portions of a *nomen specificum* may receive differential treatment. I am satisfied that, in reaching this conclusion, the botanists who constituted the majority when that vote was taken abandoned sound scientific principles and retreated from a philosophical position secured by Linnæus for botany. It may be that zoologists regard as justifiable the botanical practice which ignores the axiom accepted here until 1905; if so, there is no more to be said. But, that further misunderstanding be avoided, I may explain that I accept the principle of government by majority: whatever be the merit in civic life of conscientious objection and passive resistance, I regard both as unsuitable methods in descriptive science. This does not deprive me of the right, when dealing with the teaching of Linnæus, to express my conviction that the practical application of a particular Linnean canon which prevailed before 1905 was sound, and that the alternative practice, which obtains in botany to-day, is less satisfactory. I may add that I have not had in mind any of the methods in use in the denomination of individuals, but the teaching of an English naturalist, contemporary with Linnæus, in respect of analogous reasoning.

THE REVIEWER.

Bessemer Steel.

IN a review in the issue of NATURE of November 17, p. 716, of the second volume of Roscoe and Schorlemmer's "Treatise on Chemistry," the following sentences occur:—"The revisers have been perhaps a little too careful in retaining old matter in the text. The full details which are still given of the Leblanc soda process and of the Bessemer process for steel are really of historical interest only now that the last Leblanc plant and Bessemer converter have been shut down."

I have consulted the Statistical Bulletin of the National Federation of Iron and Steel Manufacturers, which gives the official figures of steel production in Great Britain at the present time, and I find that in

September 1923, 37,000 tons were manufactured by the acid, and 9000 tons by the basic Bessemer process. Very large quantities of basic Bessemer steel are being made in Germany and Belgium at the present time.

So far, therefore, as the above quotation relates to the Bessemer process, it is entirely inaccurate and the revisers are quite justified in giving details. The funeral of the Bessemer process has frequently been predicted, but it has never taken place.

H. C. H. CARPENTER.

Royal School of Mines,
South Kensington, London, S.W.7,
November 19.

PROF. CARPENTER is evidently right, and I am glad that he has corrected my mistake in reference to the Bessemer converter,—the statement as to the Leblanc process was, I believe, correct. It would be of interest, however, if Prof. Carpenter could give the date of construction of the last new Bessemer plant erected in Great Britain for steel manufacture. If new plants are not being constructed, the view that the Bessemer process for steel is really "of historical interest only," would not be altogether unjustified, since this process would then rank, like the hansom cab, as one of the products of the Victorian age, of which the usefulness is likely to diminish rather than to increase in the twentieth century.

THE REVIEWER.

The Spectra of Fifth Group Metals.

WE have photographed the absorption spectrum of bismuth and also the spectrum of the thermionic discharge at potentials ranging between 4 and 60 volts. Several stages in the excitation of the arc spectrum, and at least two classes of spark lines, have been recognised; 64 arc lines have been classified. The spectrum of the neutral atom is characterised by wide doublets, and most of the energy-levels so far identified are of *p*-type.

Electrical measurements of the arcing potential and potentials of inelastic impact were made by two of the authors and the late Dr. Oswald Rognley in 1918. They found inelastic collisions at intervals of $2{\cdot}0 \pm 0{\cdot}2$ volts and ionisation at $8{\cdot}0 \pm 0{\cdot}5$ volts. The interpretation is as follows:

The first resonance potential, 2·0 volts, represents the mean of the excitation voltages for several weak spectral lines of the type $mp - np'$. At 4·0 volts, we obtain the strong *raies ultimes*, λλ 3067 and 4722 Å.U. Excitation stages above 5 volts are difficult to separate. The first spark spectrum appears near 14 volts.

The absorption spectrum at 800°–1000° C. shows lines due to the atom, and prominent bands which have not been described previously. A group of seventeen bands lies between 2874 and 2672 Å.U., while a second group extends from 2205 Å.U. toward shorter wave lengths. At lower temperatures the bands disappear though the lines still may be recognised. They lie at 3067, 2276, 2230, 2228, and 1954 Å.U., and all originate on the lowest energy-level of the atom. No absorption lines arising from other levels were observed, even at a temperature of 1050° C.

Practically all the arc lines of arsenic between 3119 and 2000 Å.U. can be classified by means of constant differences found by Kayser and Runge (*Ann. d. Physik*, v. 52, 1894). We have discovered a few additional classifications. This spectrum is remarkable in that it possesses no lines in the visible region. There is a range of 38,000 cm.$^{-1}$ and another of 32,000 cm.$^{-1}$ in which no energy levels have been found. If there are energy levels in these regions, they can probably be detected only by the discovery of new lines, or the utilisation of lines at present listed in the spark spectrum. The potential of inelastic impact, 4·7 volts, given by Foote, Rognley, and Mohler (*Phys. Rev.*, 13, 59, 1919) corresponds to the mean of the wave numbers of the *raies ultimes*. The classification of the spectrum shows that the ionisation potential must be at least 10·6 volts, while the experimental value is 11·5 volts.

ARTHUR E. RUARK.
F. L. MOHLER.
PAUL D. FOOTE.
R. L. CHENAULT.

Bureau of Standards, Washington, D.C.,
November 8.

Tracts for Computers.

I REGRET that certain errata have been found in No. III. of the above Tracts. As they might cause confusion to any one computing from one of the formulæ affected, I have had an erratum slip printed, which can be obtained by purchasers of the above series by sending a stamped and addressed envelope either to Mr. C. F. Clay, Cambridge University Press, Fetter Lane, E.C.4, or to The Secretary, Biometric Laboratory, University College, Gower St., W.C.1.

KARL PEARSON.

Biometric Laboratory,
University College, London,
November 17.

Mesozoic Insects of Queensland.

LEST the reference in NATURE of July 7, p. 20, to Queensland Geological Survey Publication, No. 273, may lead readers to think that the account of the Coleoptera is the first published work on the insects from the six-inch seam containing insect remains at Ipswich, I would point out that a series of papers dealing with these insects has already been published by Dr. R. J. Tillyard (Queensland Geol. Survey, Pub. 253, 1916; and "Mesozoic Insects of Queensland," Nos. 1 to 9, Proc. Linn. Soc. N.S.W., 1917 to 1922).

A. B. WALKOM,
Secretary.

Linnean Society of New South Wales,
Sydney, October 2.

[The paragraph to which Dr. Walkom refers was intended to direct attention to a particular piece of work, and no attempt was made to mention earlier publications on the same subject, though the contributor was familiar with them.—EDITOR, NATURE.]

Hafnium or Jargonium.

THE recent discovery of hafnium in minerals containing zirconium serves to remind us of the discovery of jargonium by Sorby in 1869 (*Chem. News*, vol. 20). He found that many zircons contained as much as 10 per cent. of the new element. The two closely-related elements, zirconium and jargonium, could be most readily distinguished by spectroscopic methods. Sorby and Forbes found that there was such a marked difference in the solubilities of the chlorides in strong hydrochloric acid, that it was possible to make a qualitative separation. Three years later Cochran investigated this subject and suggested that zirconia and jargonia were identical. My object in bringing this matter before readers of NATURE is to suggest that the work of Sorby may possibly entitle him to rank as the discoverer of the new element of atomic number 72, and that jargonium may have priority over hafnium and celtium.

T. L. WALKER.

University of Toronto.

Solid Solutions and Inter-Metallic Compounds.

By Dr. WALTER ROSENHAIN, F.R.S.

METALLURGICAL research during the past twenty years has been largely devoted to the study of alloys, and as one result we now possess a series of more or less complicated equilibrium diagrams representing the constitution of most of the binary and of some of the ternary systems. While, on one hand, increasing accuracy of methods has rendered these diagrams far more complex than was at first supposed, a careful examination of those which are most thoroughly established suggests that, widely as they vary among themselves, there are certain regularities which point to some common fundamental principle which, if once grasped, would exhibit these varied diagrams as parts of an intelligible whole. Fortunately, at the time when this great mass of disconnected knowledge lies awaiting synthetic treatment, the results of X-ray analysis applied to the study of the inner structure of crystals have become available. As the result of an endeavour to apply these results to the explanation of the behaviour of alloys systems, the writer has arrived at a theory which, on a simple basis, promises to afford an easy explanation of many, if not of all, of the properties of alloys, and to afford a much deeper insight into the nature of solid solutions and of inter-metallic compounds, and through them to throw new light on the nature of inter-atomic relationships.

The theory in question has been fully stated in two recent papers, and need only be briefly summarised here.[1] A metallic solid solution is an aggregate of crystals which, when in equilibrium, are homogeneous in composition, so that both the solvent metal and the solute metal are present in the same proportions in all the crystals. The present theory of the constitution of such crystals is based on three fundamental principles, the first of which has now received considerable experimental verification, while the other two appear to follow almost unavoidably. The first is that a solid-solution crystal is built up of the two kinds of atoms, those of the solvent and of the solute, upon a single space-lattice which is, substantially, that of the solvent, so that the atoms of the solute may be regarded as being simply substituted for an equal number of atoms of the solvent on the "parent" lattice. Measurements of the lattice-constants of certain groups of solid-solution alloys and comparison of the results with the measured densities of the alloys have strongly confirmed this view. The evidence already obtained indicates that this is the inner structure of practically all inter-metallic solid solutions, but some room for doubt may still exist in regard to certain metalloids, such as carbon or phosphorus.

Next, in a crystal built up in this manner of two kinds of atoms upon a single, simple space-lattice, the inference can scarcely be avoided that a certain degree of distortion of the lattice must result. The nature of this distortion must depend upon the character of the two kinds of atoms concerned; there may be either expansion or contraction of the parent lattice, and this may be either mainly local or mainly general. The degree and nature of this distortion will depend upon the extent to which the solute atom differs from the solvent, and also upon the general character of the solvent lattice, but these are details which need not be considered here. We may pass on to the third fundamental conception—that the extent to which any given space-lattice can be distorted, and particularly expanded, is strictly limited—that there is, in fact, for each pair of atoms a limiting distance beyond which the bond between them—whatever its nature—ceases to act. This rule of a limiting maximum lattice constant or parameter leads to a series of interesting inferences. Thus, a uniform undistorted lattice of a pure substance will be uniformly expanded by heat until the limiting parameter is attained; at this point the atoms throughout the lattice will lose their power of cohesion and the crystal melts. In a solid solution crystal, the lattice may be locally expanded by the presence of solute atoms; under thermal expansion those expanded regions of the lattice will reach the limiting parameter at a temperature where the less expanded portions of the lattice are still well below the limiting value; the result will be commencement of fusion in those regions of the crystals richest in solute and the formation of a liquid richer in solute than the remaining solid. This consideration explains why, in solid solutions, we generally find a melting range instead of a single melting point. Where the solute atoms cause expansion of the lattice the melting temperatures will be depressed by successive additions of solute. On the other hand, where the presence of the solute atoms causes a contraction of the solvent lattice, there will be a rise of melting point and the first liquid to be formed on fusion is richer in solute than the residual solid. These latter inferences have been strikingly verified in such cases as those of solid solutions formed by the addition of palladium to silver or of nickel to copper.

A considerable number of further inferences can be drawn from the three fundamental principles of the present theory of the inner structure of solid solutions—for example, the striking inverse relationship which is found to hold between the solubility of one metal in another and its hardening effect upon it, and the relationship between the hardness, high melting point, and high elastic modulus of a metal on one side and its power of forming solid solutions on the other. The theory has even made it possible to suggest an explanation of the properties of metals and alloys in regard to electrical conductivity. Whatever the true mechanism of electric conduction, there can be no doubt that it is associated with the movement of electrons through the metal; it is now suggested that where the atoms lie on perfectly straight lines on the space-lattice the movement of electrons is entirely unhindered and the metal in that state should exhibit super-conductivity. This can only be fully realised very near the absolute zero, since at higher tempera-

[1] "Solid Solutions," Second Annual Lecture of the Inst. of Metals Division, American Inst. Mining Engineers, New York, Feb. 1923; and "The Inner Structure of Alloys," Thirteenth May Lecture to the Inst. of Metals, London, May, 1923. Journ. Inst. Metals, 1923, ii.

tures the thermal agitation of the atoms disturbs their perfect alignment even in a pure metal. Since it is sufficient for one line or at most a few lines of atoms to be perfectly straight at any given instance—since such a single line would conduct infinitely well—super-conductivity must set in at a temperature slightly above and not only at actual absolute zero. In a solid solution crystal, however, the atoms can never attain perfect alignment, owing to the lattice-distortion, and consequently the electrical conductivity of a solid solution will always be relatively very low, and even at absolute zero, real super-conductivity cannot occur. Further, since the solid-solution lattice is considerably distorted to begin with, the disturbing effect of thermal agitation will be relatively much less than in a pure metal; in certain circumstances, indeed, thermal expansion may partially relieve the distortion—in those cases, in fact, where solid solubility increases with rising temperature. Consequently, in solid solution alloys the temperature coefficient of electrical conductivity will be much lower than in pure metals, while in some special cases it may even become negative. The theory, as comparison of these inferences with well-known facts at once indicates, offers at all events a good qualitative explanation, and at a later stage even quantitative prediction of electrical properties should be possible. The difficulty here, and indeed throughout the theory, in arriving at numerical results lies in the fact that while the average distorting—*i.e.* expanding or contracting effect of dissolved atoms on a lattice—can be measured with considerable ease and accuracy by the aid of X-ray spectrometry, the maximum local distortion cannot as yet be determined directly. When this difficulty has been overcome, considerable further progress should become possible.

We may now briefly consider inter-metallic compounds. These are known to metallurgists from the occurrence of certain kinds of singular points on equilibrium diagrams and from characteristic features of micro-structure and of physical properties, but there are a number of alloys in which the existence of definite compounds has hitherto been regarded as doubtful. Again, the results of X-ray analysis, combined with the indications of the above theory, prove helpful. Very typical of inter-metallic compounds is the body $CuAl_2$ found in copper-aluminium alloys. It is a hard, brittle body, tending to crystallise in well-formed long needles. Its atomic structure has been determined by Dr. Owen and Mr. Preston at the National Physical Laboratory. The lattice-structure is shown in the accompanying diagram (Fig. 1). The most striking feature is that certain pairs of aluminium atoms approach one another within a range, centre to centre, of only 2·42 Ångström units. In an aluminium crystal the lattice-constant is 4·85 Å and the closest approach is 2·86 Å, and it would be quite impossible, by the application of external pressure, for example, to force the atoms so closely together as they are placed in the compound. The inference, which is justified by comparison with the known lattice structures of other chemical compounds, is that the very much closer approach of atoms in this manner is a characteristic, if not *the* characteristic, feature of chemical combination as distinct from the "cohesion bonding" which occurs in the building up of a crystal. It would seem, in the present case, that the copper atom which is combined with the two aluminium atoms has taken away or absorbed something from the aluminium atoms which now allows them to come much closer together. This may well be the absorption of certain exterior electrons by the copper atom; whatever the detailed mechanism may be, it is probably the essence of chemical combination, and furnishes us at once with a definite criterion for distinguishing between solid solutions and compounds. At first sight one might perhaps expect that intermediate classes of structure should be found, in which the inter-atomic distances might be only slightly less than in the typical solid solutions. If our current views of the structure of the atom in "shells" or layers of electrons is correct, however, this should not be the case; we should find either substances in which there is nothing more than "cohesion bonding" without closer approach of the atoms, or bodies in which the atoms are drawn closer by a definite step.

There is a further distinction which can be inferred from the present theory. In a body of the solid

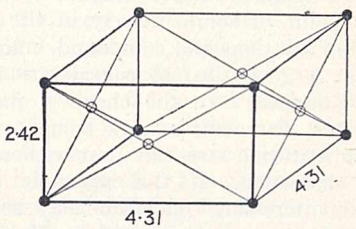


FIG. 1.—Lattice structure of $CuAl_2$.
● Cu. ○ Al.

solution type, atoms of one kind are readily replaceable by atoms of the other; in a compound, on the other hand, it would be difficult to conceive of any atom being replaced by an atom of the other constituent. In the $CuAl_2$ structure, for example, it is scarcely possible that any of the aluminium atoms could be replaced by a copper atom. This very definite inference is verified by reference to the equilibrium diagrams of alloy systems in which typical well-defined compounds are to be found—these bodies never exhibit any appreciable amount of dissolving power for their constituents. If we may extend this view to those cases which, metallurgically, are still regarded as doubtful, it will at once serve to classify them into compounds and solid solutions respectively. A well-known group of alloys of this kind is the copper-zinc alloys (brasses), which exhibit a series of solid solutions generally called the alpha, beta, and gamma phases. These are micrographically distinct, and vary widely in many of their properties, and it has been thought that each was based upon a definite chemical compound possessing a wide range of dissolving power for copper and zinc.

In one of the papers mentioned above (May lecture) the writer suggested that these bodies need not be, and probably were not, based on definite compounds, but that they would probably be found to be based upon what might be termed allotrope lattices of copper. In the case of iron and nickel, for example, it is known

that the presence of a sufficient proportion of nickel will maintain the iron in the face-centred cubic lattice of the gamma phase at a temperature at which, in the absence of nickel, the iron would have reverted to the body-centred cube of the alpha phase. Presumably the iron remains in the gamma condition because in that condition it can retain a larger proportion of nickel atoms on the lattice, and because this arrangement involves less potential energy than any alternative. In the same way it was thought that the usual face-centred cubic lattice of copper might, when in the presence of more zinc atoms than can be carried on that lattice without undue distortion, be transformed into another lattice—still essentially a lattice of copper—but capable of carrying a larger number of zinc atoms, and that at a still higher concentration of zinc a further modification of the lattice might occur. Each successive modification would, in such a case, be expected to show an increasing approximation to the hexagonal lattice of zinc itself. Actual determinations of the lattices of the beta and gamma phases of the copper-zinc system, made by Owen and Preston in consequence of this suggestion, have completely verified it. The two phases show no compound lattice, but a modified copper lattice.

Another point of some interest in the distinction between solid solutions and compounds may be briefly considered. A good deal of consideration has been given by Tammann [2] to the chemical properties of solid solutions, Tammann's work being based on the idea of a substitution structure, but without reference to lattice distortion. If this principle is applied, however, an interesting conclusion may be drawn, to which attention was first directed by Mr. Preston, in regard to what may be termed "symmetrical" solid solutions. In any alloy system forming a continuous series of solid solutions between two metals, alloys must occur in which the two kinds of atoms are present in some simple ratio such as one to one, two to one, three to one, etc. According to the particular nature of the lattice system in each case, some of these simple ratios will allow the atoms to arrange themselves in a perfectly symmetrical manner. Such perfectly symmetrical atomic arrangement, however, is not likely to be attained or approached except in specially favourable circumstances. Very gradual cooling from fusion and a considerable rate of diffusion are essentials, but there is the further condition that the symmetrical arrangement in question should be a simple one. Thus in any lattice, an arrangement in which alternate layers or planes of atoms consist each exclusively of one kind of atom would seem to be such a simple arrangement. In the face-centred cubic lattice a one-to-one ratio allows of such an arrangement, all the atoms at the cube corners and those at the centres of two opposite faces being occupied by one kind of atom and the remaining four face-centres by the second kind of atom. In such a lattice, another simple symmetrical arrangement, but one less easily formed by the process of diffusion required by the present theory, is that in which all the face-centres are occupied by one kind of atom and all the cube corners by the other, this implying an atomic ratio of three to one.

The special interest which attaches to such perfectly symmetrical arrangements is that, if fully attained, there will be in such a lattice a perfectly uniform atomic spacing. The consequence must be, if the present theory is correct, a single melting-point and relatively low hardness and electrical resistivity. In some alloy systems, this state of affairs is so closely approached that it becomes plainly visible on the equilibrium diagram as experimentally determined, and the presence of a compound at the simple atomic ratio in question has sometimes been inferred—wrongly, according to the present view. In other systems, where diffusion is slow and uniform geometrical arrangement, therefore, is practically unattainable, the ideal condition is never reached experimentally, but the "solidus" curve shows an inflexion towards the "liquidus" in the neighbourhood of the "symmetrical" composition—in several examples near the one-to-one ratio of atomic concentration. In some alloy systems two such inflexions, corresponding approximately to two such ratios, have been observed. Although these inflexions have become increasingly definite in the best-determined diagrams, so that they could not be ascribed to experimental error, no explanation has as yet been offered. The fact that these details are only to be seen clearly in recent diagrams, prepared by methods of extremely slow cooling of the alloys, tallies well with the requirements of our theory.

Inferences from the substitution and lattice-distortion theory could be pursued at much greater length; so far, no failure of such an inference, when tested by means either of older well-established fact or by special experiments, has yet been found. There is thus some hope that a small but real step has been taken towards the better understanding of the nature of alloys, and particularly of solid solutions and intermetallic compounds.

[2] Tammann, *Zeitschr. f. Anorg. u. Allgem. Chemie*, July 1919.

Weather Influences in the British Isles.

By C. E. P. BROOKS.

THE sun is the only source of terrestrial weather in the sense that the difference between the amount of solar radiation received in different latitudes is the driving force of the atmospheric circulation. The complexity of the earth's surface combined with its rotation about an axis introduces corresponding complexities into this circulation, but H. H. Clayton considers that "if there were no variation in solar radiation the atmospheric motions would establish a stable system with exchanges of air between equator and pole and between ocean and land, in which the only variations would be daily and annual changes set in operation by the relative motions of earth and sun; the existing changes we call weather have their origin chiefly, if not entirely, in the variation of solar radiation." It has been found that some parts of the

earth, especially the tropics, respond readily to these solar variations, while in other parts the solar variation is almost completely masked by secondary modifications. Hence we may classify weather influences into two classes: solar, in which the influence of solar variation is directly recognisable, and terrestrial, depending on causes which at first sight are entirely due to the influence of the land, sea, or atmosphere. These two classes shade into each other, with no definite line between them.

The weather of the British Isles, apart from seasonal temperature changes, is almost entirely terrestrial in its control, being dependent on the distribution of pressure over the North Atlantic and Arctic Oceans and the continent of Europe. This distribution is constantly changing, and we experience a succession of "depressions" and "highs" which pass across or near these islands, bringing our notoriously variable weather. Careful examination of a series of daily weather charts shows, however, that the most rapid changes are generally only in details, the main features of the pressure distribution changing comparatively slowly, and four main types of weather have long been recognised. These are named after the cardinal points whence blow the winds characteristic of the type—southerly, westerly, northerly, and easterly.

In the southerly type, pressure is high over Europe and low over the North Atlantic. Depressions are continually appearing over the ocean, but their centres fail to reach the British Isles, so that we are situated between a depression to the west and an anticyclone to the east, a condition which brings southerly winds and warm weather. The amount of rainfall depends on whether the high or the low pressure predominates over the British Isles; it decreases from west to east. In the westerly type, pressure is high in the south and low in the north, and depressions appear from the Atlantic and pass rapidly eastward, generally along a track somewhat to the north of Scotland. This type brings fresh westerly winds; spells of a day or two of very fine weather alternate with spells with more or less rain, the actual amount being least when the storm tracks lie farthest north. If in addition to high pressure to the south an anticyclone develops over Iceland, with a trough of low pressure between, the depressions pass directly across the British Isles and very rainy weather is experienced, sometimes with destructive gales. On the other hand, when the southern anticyclone extends so far north as to include Great Britain, very fine weather is experienced, which, if prolonged, as in 1921, may give rise to a serious drought. A moderate development of the westerly type forms about seventy per cent. of our weather.

The northerly and easterly types are more or less reversals of the southerly and westerly types; the easterly type proverbially brings us our most unpleasant weather. These weather types may persist for periods varying from a few days to weeks, and unfortunately there is generally little means of knowing, when a type first becomes established, how long it is likely to continue. Some cases are more favourable, notably the formation of a large anticyclone centred directly over the British Isles. In such a case a long spell of fair weather is very probable, and when this distribution was established on September 26, 1921, a long-range forecast of fair weather for the next fortnight over eastern and central England was issued by the Meteorological Office, and was justified by results. The original division of weather into four types has been extended by the critical analysis of long series of daily weather charts, the most recent classification being that made by E. Gold,[1] and much material is now available for statistical study.

An understanding of British weather depends on an understanding of the causes which lead to the establishment and modification of weather types. We may carry the study a step further by referring to the conflict between "polar" and "equatorial" air, envisaged by the Norwegian meteorologists in their researches on cyclones; but a better insight into ultimate causes is given by the older conception of "centres of action," according to which the dominant factors in the pressure distribution are three: the area of low pressure which is generally found in the neighbourhood of Iceland or southern Greenland, and is termed the Icelandic minimum; the area of high pressure which occupies the eastern Atlantic near and south of the Azores, termed the Azores anticyclone; and in winter, the area of high pressure which is centred in Siberia and extends in a west-south-westerly direction towards the Azores anticyclone.

If we could forecast the position and intensity of these three centres of action during any month, we should be well on the road to true long-range weather forecasting. That is not yet the case, but a certain amount of information has been gleaned which encourages further research. The Siberian winter anticyclone appears definitely to be due to the extreme "continentality" with its low temperatures and hindrance to the outflow of air; it is, in fact, a "pool" of cold air. Such a continental anticyclone itself intensifies the cold of winter, and once formed is difficult to dislodge. There is nothing more favourable to the establishment of anticyclonic conditions than a covering of snow, and an extensive snowfall over northern or eastern Europe early in the winter may cause a persistent westerly extension of the Siberian anticyclone, influencing the weather of the British Isles for several months.

The other two centres of action are still more important, and they are intimately connected with each other. When pressure is high at the Azores it is generally low near Iceland, and vice versa; when the Azores anticyclone advances northward the Icelandic minimum generally does likewise, but there are exceptions to both these rules. There have been cases, notably February 1895, when the distinction between the anticyclone and the depression was wiped out, and for a whole month pressure was higher at Iceland than at the Azores. The existence of these two centres of action is connected in some way, not yet fully understood, with the general circulation of the atmosphere, but there can be no question that the details of their position and intensity are modified by local effects, and especially by variations of sea temperature, and in the case of the Icelandic minimum by the presence or absence of floating ice, and we

[1] London, Air Ministry, Meteorological Office. Geophysical Memoirs, No. 16. Aids to forecasting: types of pressure distribution, with notes and tables for the fourteen years, 1905–1918. By E. Gold. London, 1920.

have to broaden our survey to include these two factors.

The primary facts about the circulation of the waters of the North Atlantic Ocean are familiar to most people, and for our purpose can be generalised into two processes. First, a great mass of warm surface water is driven westwards near the equator by the Trade winds, ultimately being deflected northward by the coast of America and forming the Gulf Stream; secondly, this warm water is spread out south-east of Newfoundland, and is driven eastward by the prevailing winds towards the European coast. Consequently, any increase in the strength of the Trade winds should be followed after a considerable interval by a rise in the temperature of the sea north of Scotland. This has very little direct influence on the temperature of these islands, but it intensifies the Icelandic minimum and draws it south-eastward, causing low pressure and much cyclonic activity in the North Sea, with strong south-westerly winds over Holland, Germany, and Denmark, and northerly winds over Iceland. Thus, P. H. Gallé [2] found that when ships' observations showed an increased strength of the Trades during spring and summer, the following winter was warm over Holland and Germany, but cold over Iceland and Greenland. This refers to observations over the whole Trade belt. Unfortunately, direct observations of the strength of the North-east Trade are difficult to obtain, but we may employ instead the mean pressure at the Azores, which may be taken as a measure of the development of the North Atlantic anticyclone, with which the Trade wind is associated. The interval between the occurrence of high pressure at the Azores and of low pressure near the Faroes is about a year, which is the average time required for the completion of the oceanic circulation between these points.

The influence of floating ice on the pressure distribution is equally marked. The great ice-factory of the northern hemisphere is the Arctic Ocean north of the Eurasian coast, and delivery is effected by a current which sets from near Spitsbergen down the east coast of Greenland and round Cape Farewell. Each spring this current carries great masses of sea-ice, and in some years with strong north-westerly winds much of this ice is carried to the coasts of Iceland. From 1901 to 1919 there were 43 months during which ice lay off Iceland for more than five consecutive days, and in the majority of these months pressure in Iceland was more than 2 mb. above normal. The mean deviation of pressure from normal during the whole of the ice-days (to the number of 701) was +6·7 mb. Since there is no reason to suppose that the high pressure brings the ice, this result indicates conclusively that the ice and the cold surface water associated with it are effective in raising the pressure over Iceland and producing a northerly type of weather in the British Islands.

W. Weise [3] has recently made a further step. The ice takes about 4½ years to travel from the Arctic Ocean north of Siberia, where it is formed, to the East Greenland current, and he found that low temperature at Obdorsk and Turuchansk in autumn is followed after this interval by a large amount of ice east of Greenland, and vice versa. Thus an important factor in our spring weather is determined by conditions 4½ years previously in the north of Siberia.

The influences which control British weather are many and diverse, and it is not wonderful that the small fluctuations of the solar constant elicit no obvious response. Yet they can sometimes be traced; for example, at times of increased solar radiation (and many sunspots) the tracks of depressions appear to be on the average rather further south than with diminished radiation (and few sunspots). From 2 to 4½ years after sunspot maxima the Azores anticyclone tends to spread northward in summer over Spain and the Bay of Biscay, or even over the British Isles, giving conditions favourable to drought. Various other solar effects have been suggested in British weather, but none are definite enough for use in forecasting. The same conclusion must apply to "weather cycles." The search for the golden cycle in weather is curiously similar in its history to the search for the philosopher's stone—it has not been found, and we are more and more compelled to the belief that it does not exist; but in the search for it much information of value in other respects has been acquired. Periodicities in weather there undoubtedly are, but they are usually either so small in amplitude as to be of academic interest only, or they show baffling changes of phase and amplitude. Even the classical "Brückner cycle" of 35 years is only recognisable when we add the rainfall of ten consecutive years together, and its absolute uselessness for forecasting is shown by the position of the dry year 1921—one year before a maximum. The standard deviation from normal of a month's rainfall in London is about sixty per cent., while the variation attributable to the Brückner cycle is less than three per cent. A similar criticism applies to Sir William Beveridge's periodicities in the price of wheat.

Ocean currents and floating ice are thus the most important factors in British weather. Given a foresight of these two elements, we could make a reasonable guess at the general type of weather likely to prevail, though not the changes from day to day. Both ocean currents and ice are themselves also subject to modification by pressure distribution, and consequently we have a chain of cause and effect connecting a succession of months or seasons. We know the normal oceanic circulation and the normal pressure distribution. If in a given month we knew also the deviation of pressure from the normal distribution, we should be able to infer the abnormalities which will be produced in the oceanic circulation and hence to calculate the pressure deviations for the following month. If the process were sufficiently well understood we could carry our calculations forward long enough to give useful forecasts; at present the subject has scarcely reached even the experimental stage. A large statistical basis is necessary, and it is only within the last few years that this has begun to be supplied by the *Réseau Mondial*,[4] a compilation of monthly means of pressure, temperature, and rainfall over the globe.

[2] On the relation between fluctuations in the strength of the Trade winds of the North Atlantic Ocean in summer and departures from the normal of the winter temperatures in Europe. Amsterdam, Proc. R. Akad. Wetenschap, vol. 18, No. 9.

[3] Die Einwirkung des Polareises im Grönländischen Meere auf die nordatlantische zyklonale Tätigkeit. Berlin, *Ann. Hydrogr.*, vol. 50, 1922, p. 271.

[4] London, Meteorological Office, British Meteorological and Magnetic Year-Book, Part V. 1910–1914 issued.

Obituary.

MR. T. PRIDGIN TEALE, F.R.S.

IN the death on November 13, at the age of eighty-two, of Mr. T. Pridgin Teale, medicine and sanitary science have lost a leader, and society has lost a very interesting man. For some generations the Teales had been medical practitioners in Leeds, and Mr. Pridgin Teale's father—of the same name—had likewise a very large consulting practice in surgery in and beyond the county of Yorkshire. The family were in part of Huguenot descent (Pridgin = Prujean), and to this strain no doubt Pridgin Teale owed much of his social charm and vivacity.

Of Pridgin Teale's eminence as a surgeon there is no need to speak; for the particulars of his professional work our readers will look to the medical journals; it is our place to speak of his work as a man of science, and especially as a reformer in sanitary practice and in economy of fuel. For twenty years he was president of the North-Eastern Branch of the Sanitary Inspectors' Association, and to that body he delivered many addresses full of that vigour and acute practical intelligence so characteristic of him. He was as ardent in teaching and persuasion as he was ingenious in suggestion and contrivance. In his well-known fire-grate constructions it is interesting to know that Mr. Teale was in intimate association, on the æsthetic side, with Mr. de Morgan. Since the days of Mr. Teale's most active life many changes have passed over sanitary science, but among the earnest and inventive pioneers in these subjects, Pridgin Teale's name will scarcely be forgotten.

To his friends Pridgin Teale was one of the most attractive of men. Absolutely sincere, unselfish, blithe, and enthusiastic, he was one of the most charming of companions and the most loyal and generous of friends. C. A.

BRIGADIER-GENERAL G. E. PEREIRA.

THE death, at the age of fifty-eight, of Brigadier-General G. E. Pereira is a severe loss to Asiatic geography, owing to the wide range of his Chinese travels. He served at home in the Grenadier Guards until 1899, when he was sent on special service to China and was attached to the Chinese regiment in the British Protectorate of Wei-hai-Wei. He accompanied the Japanese army in Manchuria in 1904, and was military attaché at Peking from 1905–10.

General Pereira made good use of the intimate knowledge of the Chinese and fluent mastery of the language acquired during these services, in long journeys in China and Chinese Turkestan. His best known expedition was his walk overland in 1921 from Peking to India across Tibet and through Lhasa. In this journey he obtained much valuable information, especially accurate heights of some of the passes in eastern Tibet. In 1922 he started on what was intended to be his last expedition, and crossed from Bhamo in Burma by the chief road through south-western China to the Yangtze at Sui-fu. He descended the Yangtze by boat, and visited the island of Hainan in connexion with his ethnographic studies. He returned up the Yangtze to Yunnan-fu, whence in company with Dr. Thompson he set out for south-eastern Tibet in the hope of reaching Amnemachin, which is thought to be the highest peak in the Kwen-lun Mountains, near the upper bend of the Hwang Ho. He had seen this mountain in 1921, and his descriptions led to the report that it might be the highest mountain in the world. Considering, however, its geographical relations, General Pereira's own estimate of 25,000 ft. is probably more correct. The two travellers reached A-tun-tze last August, and letters from Pereira were full of enthusiasm and hope for a successful journey to the Kuen-Luns. He reached Yakalo, the French mission station, well known as the residence of the Abbé Desgodins, by the Salt Mines on the Mekong. His last letters were dated there on September 15, and his fatal illness was probably on the borders of autonomous Tibet.

General Pereira had published but little, and those interested in Chinese geography hoped that he would devote his leisure to a general account of his extensive travels. He was an enthusiastic adherent of the traditional view that the Himalaya end in Assam, and some of his last letters from A-tun-tze re-stated his views on that problem. Amongst his scientific contributions was obtaining for the Natural History Museum its second Chinese skin of the Panda, one of those interesting animals living in southern China the affinities of which are American.

MR. W. H. DUDLEY LE SOUËF.

THE October issue of the *Victorian Naturalist* contains an appreciation of the life and work of Mr. W. H. Dudley Le Souëf, Director of the Melbourne Zoological Gardens, who died on September 6, at the age of sixty-six. Mr. Le Souëf was a prominent member of the Field Naturalists' Club of Victoria, and his extensive travels over the Australian continent studying the habits of or collecting native animals, birds, etc., provided material for numerous papers which he contributed to the Club. In most of these the main interest centred on the birds, but other branches of natural history were not neglected. He compiled a list of Victorian reptiles published in the *Victorian Naturalist* of 1884, and was the author, with Mr. A. H. S. Lucas, of two standard works, "The Animals of Australia," and "The Birds of Australia." In another volume, "Wild Life in Australia," he brought together the accounts of his many expeditions which had appeared from time to time in the *Victorian Naturalist* and the *Emu*, the organ of the Australasian Ornithologists' Union, of which he was one of the founders. His interest in Australian ethnology led him to take part also in expeditions to King Island, the Kent Group, and to Albatross Island. Mr. Le Souëf was an enthusiastic student of Nature, who was always willing to bring natural history before an audience, generally illustrating his lectures by lantern slides from his own photographs. For many years he was Assistant Director of the Melbourne Zoological Gardens, and in 1902 he was made Director, in succession to his father. Under his care the Gardens have become the most important collection oi animals in Australia.

Current Topics and Events.

THE satisfaction that has been expressed with the recommendation that the Imperial Institute should be maintained at South Kensington is accompanied with a still wider regret that the collections are to be abolished to make room for the War Museum. The Committee which has made these recommendations appears to regard the collections as of use only as trade samples and accepts the view that those at the offices of the Australian agencies in the Strand are more useful. The Imperial Institute collections, however, are much wider in their scope. The Imperial Conference urged the need of extended teaching of the geography of the Empire, and the Imperial Institute collections are unique as an illustration of the life, resources, and scenery of every country within the Empire. It is the only collection in Great Britain which can be compared with the geographical museums of Germany. The Institute is naturally of less value to the great Dominions, which can afford well-equipped research departments and show rooms in the centre of London, than it is to the smaller colonies and dependencies. Hence Australia in pre-War times contributed to the Institute only 500*l.* per annum against 1000*l.* given by Ceylon. The smaller dependencies, and especially those in the tropics, are in increasing need of the help that may be given by an Imperial co-operative organisation. Emphatic testimony to the educational value of the galleries is quoted in the minority report, in which New Zealand offers an increased subsidy if they be maintained. The collections are also condemned on the ground that they are only of value to people in London, a drawback shared by all national metropolitan institutions. The leasing of the galleries is recommended as a means of raising 8000*l.* per annum for the general revenues of the Institute. For this amount costly collections made and presented by governments and individuals are to be scrapped, and a building largely raised by private subscriptions, and the site given by the Commissioners of the 1851 Exhibition for an Imperial scientific institution, are to be handed over to a War Museum. Mr. H. M. Lidderdale, Secretary to the executive council, has been appointed Acting Director pending the reorganisation of the Institute.

THE *Times* in its issue for November 28 publishes a very interesting photograph showing the eggs of a deinosaur against their natural background; in fact, they can scarcely be said to have been removed from the beds in which they were so happily preserved. The discovery, made by Mr. Roy Chapman Andrews when exploring a desert region in Mongolia for the American Museum of Natural History, has excited much interest among naturalists, and it is now authoritatively announced that surplus specimens, after complete examination and description, will be disposed of for about 400*l.* apiece. This price cannot be regarded as excessive, and the sum realised will be used towards defraying the expenses of the expedition. When placed on exhibition in a public museum, the egg should certainly be accompanied by a copy of the photograph utilised by the *Times*, showing its companions practically *in situ*. By that time, the scientific report on the occurrence will be available, and will no doubt contain all necessary illustrative material. The relationship of the deinosauria to the crocodiles and to the birds makes the discovery of their eggs not in itself surprising; but the fact that one egg at least contains an embryo furnishes hope for the revelation of new links in the chain of reptilian descent. Public interest should now be still further attracted to the fine collection of deinosaurian remains in the Natural History galleries of the British Museum at South Kensington, and to the admirable guide recently issued in connexion with them (see NATURE, April 29, 1922, p. 561). We can already conceive a wall-painting in the American Museum of Natural History, depicting the Gobi region in Mesozoic times, with a maternal deinosaur affectionately bringing up its young.

AMONG the scientific bequests of the late Hon. N. C. Rothschild, whose death was referred to in NATURE of November 10, p. 697, those relating to the distinguished naturalist's great collection of Siphonaptera, or fleas, are of special interest not only to entomologists, but also to students of insect-borne disease. Including as it does some 40,000 specimens of fleas in alcohol, and 3550 microscope slides, representing in all about 600 species, the collection must prove of priceless value to all who in future years desire to investigate questions connected with the epidemiology of bubonic plague, and its transmission by various species of fleas. Although actually presented to the Trustees of the British Museum in 1913, the collection was, by arrangement, allowed to remain temporarily in the possession of its founder; and even now a further period will elapse before the specimens, which occupy eight large cabinets, are finally installed at South Kensington. During the interval, the catalogue of the collection, which will include an illustrated description of every species represented in it, will be completed by Dr. K. Jordan, the value of whose work on Siphonaptera, as collaborator with the late Mr. Rothschild, has obtained world-wide recognition. To provide for the permanent maintenance of the collection, Mr. Rothschild has left to the Trustees of the British Museum 10,000*l.* upon trust, in order that the income thereof may be utilised to pay the salary of a qualified custodian. In the testator's will, the request is made that Mr. F. J. Cox, his assistant, should be employed in the latter capacity. Mr. Cox is known to possess a wide knowledge of Siphonaptera, and it was by him that, at the instance and expense of Mr. Rothschild, the small collection of fleas already belonging to the Museum was catalogued and arranged some years ago.

IT is rumoured, but we hope without foundation, that a suggestion has been made to the Albanian Government that exclusive rights of excavating in Albania should be assigned to French archæologists, with possession of a considerable proportion of the finds. Although no one would wish to question the

right of the Albanian Government to make such arrangements as it thinks best for the investigation and preservation of the antiquities of that country, such a course as is proposed cannot, on the face of it, be considered in the best interests of science. It is not intended to cast any reflection upon the ability or disinterestedness of the archæologists of France or any other country; but scientific investigation should be free from the trammels of nationality. The position in the Balkans is already one of some difficulty, as recent legislation in Greece has restricted the number of excavations which will be permitted to the Schools of Archæology beyond those already in being, while in Serbia concessions for excavation are not to be granted at all to foreigners. In view of the great importance of the whole Balkan area for archæological studies, any further restriction, such as this proposal to confine excavation in Albania to scientific workers of one nationality only, would be peculiarly unfortunate.

A NECESSARY consequence of any increased interest in, and consideration of, science and scientific workers by the general public will be an examination of the part that science has played in producing the bad, as well as the good, features of modern civilisation. It is natural that the advance of science in penetrating the mysteries of the universe, or its essential part in promoting the development of material resources and making possible mechanical production of commodities necessary for peace or war, should be a satisfactory subject of contemplation to the scientific worker. But the public will not only ask about the responsibility of men of science for the development of fertilisers or of poison gases, but also what they think is the relation between the present possible level of productivity and the present destitution in every civilised state. Prof. F. Soddy anticipated such questions as these in his "Cartesian Economics" lectures, and he developed them in a lecture entitled "The Inversion of Science," given at the Guild House, Eccleston Square, on Thursday, November 29. He pointed out the strange coincidence of the perfection by James Watt in 1774 of the steam engine which was to revolutionise all the methods and possibilities of production, and the elaboration in 1776 by Adam Smith in "The Wealth of Nations" of a system of economics founded on the conditions prevailing in the pre-scientific stage of society, which has nevertheless continued to be applied, with the result of an almost unlimited capacity for production that cannot be exercised because of a completely erroneous standard of values. Prof. Soddy held that wealth must cease to be reckoned by any artificial standard, whether of gold or of the arbitrary judgment of financial magnates, and be calculated on the actual or potential production of the necessities of life.

DURING the War many unsuccessful experiments were tried to bring to a stop from a distance motor cars or aeroplanes. According to an announcement in *La Liberté*, a French engineer has given practical proof of an invention that enables him to stop the motors of an aeroplane or a motor car at a distance of about 50 yards. It is quite possible that the emission of very strong Hertzian waves might interrupt the proper functioning of magnetos at this distance, but we cannot infer that it would be equally simple to stop the motor of an aeroplane in full flight at a distance of a few miles. In any event the problem of protecting the magnetos of the motors from interference by suitably screening them would be an easy one.

THE transmission of a broadcast programme across the Atlantic by the British Broadcasting Company in the early hours of November 26 was a fairly successful one. From 3 to 3.45 A.M. the B.B.C. sent out a concert from London on its normal wave length and power. This was broadcasted again simultaneously by the other British stations, each on its own wave length. All the stations, with the exception of Birmingham, Manchester, and Aberdeen, were clearly heard in America. During the winter months trans-atlantic telephony and broadcasting is generally successful during night-time. During the early hours of November 27, American stations broadcasted. Several of them were heard in different places in Great Britain, but the atmospherics unfortunately were very much in evidence and so the experiments could not be regarded as successful. On December 22 the Radio Society of Great Britain will make experiments, in conjunction with American amateurs, between 1 and 3 A.M. The G.P.O. has given permission to some amateur stations to increase their normal power (10 watts) to 1000 watts for these tests.

WE regret to note an announcement in the December issue of *Discovery* that this number is to be the last to appear. All who are interested in the spread of a knowledge and appreciation of the results of scientific investigation among the general public will regret the disappearance of this publication. Since it was founded in 1920, *Discovery* has consistently maintained a high standard of scientific accuracy, and has placed before its readers in clear and non-technical language a large number of articles, necessarily varying considerably in merit, which were selected with the express intention of keeping readers abreast of the latest movements of thought in the scientific world. It was started under favourable auspices at a time when the events of the War had impressed upon the public mind the value of scientific research from a practical point of view. Its committee of management consisted of representatives of the most important of the scientific and learned societies, and amongst its contributors it has numbered some of the most prominent of the scientific men of the day. Yet notwithstanding these facts, and notwithstanding a wide appreciation of its merits as a popular scientific publication, it has failed through lack of public support.

IT was stated in our issue of December 1, p. 803, that the Science Collections from the Western Galleries of the Science Museum, South Kensington, had been removed to three unfinished galleries of the new Science Museum building, and that one of these galleries has now been thrown open to the

public. In this are the following exhibits: *Astronomy*: Sundials, astrolabes, and similar instruments, transit instruments, equatorials, astronomical photographs, telescopes, original apparatus and instruments made or used by the Herschels. *Surveying*: Instruments illustrating the development of the theodolite and level, including Ramsden's three-feet theodolite. *Meteorology*: Almost the whole section as previously exhibited, with a recent acquisition—a plaster cast of an early Korean rain-gauge. *Chemistry*: Historical apparatus and specimens, including apparatus of Faraday and Graham; Hartley's original spectrograph; replica of Priestley's original oxygen apparatus; models of chemical works. *Optics*: Microscopes, telescopes, spectacles, polariscopes, early moving-picture devices. *Sound*: Early talking machines, including Edison's original phonograph; instruments used in sound-ranging. *Botany*: Models of flowers. About eighty per cent. of the Science Collections will be in storage until more space becomes available.

IT is announced in the *Times* that 13,000,000 francs (more than 160,000*l*.) was collected for the benefit of French scientific laboratories on the occasion of "Pasteur Day."

DR. F. W. WILLWAY, J.P., Newfoundland, provides an interesting running comment on the film production "Nanook of the North" at the Polytechnic Hall, London. His talk, based upon personal experience, takes the place of the customary captions and makes more real this untouched and unrehearsed picture story of the actual life of the Eskimos on the west side of Ungava. The musical accompaniment to the closing scene, an Arctic blizzard, enhances the effect so strongly that the impression of desolate brutality lasts long after the vision ceases. Mr. Flaherty's picture is assuredly one to see.

RECENT additions to the National Portrait Gallery include the portraits of three former fellows of the Royal Society, namely:—Sir George Howard Darwin, K.C.B. (1845-1912); Sir Henry Charles Englefield, Bt. (1752–1822); and Mr. Philip Metcalfe (1735–1818).

THE Huxley medal of the Royal Anthropological Institute for the year 1923 has been awarded by the Council to Dr. E. Sidney Hartland, the well-known authority on folklore and the author of "Primitive Paternity" and other pioneer works on social anthropology. Unfortunately, the state of Dr. Hartland's health in the earlier part of the year has precluded him from preparing the Huxley memorial lecture, which it is usual for the recipient to deliver on the occasion of the presentation of the medal. The Huxley medal for the year 1924 has been awarded to Dr. Henri Verneau, of Paris, by whom the Huxley memorial lecture for 1924 will be delivered in November next.

MR. JOSEPH BARCROFT has been elected Fullerian professor of physiology at the Royal Institution in succession to Sir Arthur Keith. M. le Duc de Broglie, Dr. C. L. Guillaume, and Profs. Debye, Einstein, Groth and von Laue have been elected honorary members of the Institution.

THE British and Foreign Sailors' Society, Incorporated, The Passmore Edwards Sailors' Palace, 680 Commercial Road, London, E14, supplies Christmas parcels regularly to more than 600 lighthouses and lightships; in addition it maintains 650 ships' libraries afloat, and parcels of literature and magazines are regularly placed by the Society on outgoing ships. Gifts of literature, books, magazines, etc., would be welcomed at the Society's headquarters.

THE following officers and committee of the University of Durham Philosophical Society for the Session 1923–24 have been elected: *President*: Rt. Hon. Earl of Durham; *Vice-Presidents*: Hon. Sir Chas. A. Parsons, Sir Theo. Morison, Dr. T. H. Havelock, Dr. H. Stroud, Prof. H. Louis, and Mr. W. Hall; *Committee*: Commander C. J. Hawkes, Dr. H. V. A. Briscoe, Dr. G. R. Goldsbrough, Dr. J. A. Smythe, Mr. S. H. Collins, and Mr. Rhys Thomas; *Editor*: Dr. G. W. Todd; *Librarian*: Dr. F. Bradshaw; *Secretaries*: Mr. J. W. Bullerwell and Mr. B. Millard Griffiths. The second edition of the "Dr. Theodore Merz" Memorial Number of the Proceedings is now in the Press.

AT a meeting held in June last, it was decided to establish a memorial to the late Prof. A. D. Waller and Mrs. Waller in the form of a fund for scientific research to be administered by the Council of the London (Royal Free Hospital) School of Medicine for Women (NATURE, June 16, p. 818). Prof. Waller was also lecturer in physiology at St. Mary's Hospital Medical School for nineteen years, and it is now proposed to establish an additional memorial in the form of a research room, to be known as the Waller Research Laboratory, in connexion with the Physiological Department. A large and distinguished committee of British and foreign scientific workers has been formed to carry out the memorial schemes. Subscriptions marked accordingly if they are intended for the St. Mary's Hospital Medical School memorial, should be sent to the hon. treasurer of the fund, Prof. J. Mellanby, St. Thomas's Hospital Medical School, London, S.E.1.

MR. W. H. HOFFERT has been appointed by the Council of the University of Leeds to be research chemist to the Joint Research Committee of the National Benzole Association and the University in succession to Prof. E. C. Williams, who resigned his appointment on September 30, on his election to the Ramsay memorial chair of chemical engineering in the University of London. Mr. Hoffert took a first class at Oxford in 1914, in the final honour school of natural science (chemistry), and was also awarded a research scholarship at Jesus College. In 1919 he was appointed to a research fellowship of the Salters' Institute of industrial chemistry. More recently, he has worked as research chemist to a Lancashire firm engaged in the coal tar industry, and has also had experience at H. M. Fuel Research Station, Greenwich. Mr. Hoffert will work in the Department of Coal Gas and Fuel Industries of the University of Leeds, under the supervision of Prof. J. W. Cobb, particularly in connexion with the possibilities of increasing the home supplies of motor spirit from coal.

PROF. A. SMITHELLS resigned in June last the chair of chemistry in the University of Leeds, which he had held with much distinction since, in 1886, he was appointed in the old Yorkshire College. His part in promoting the foundation of the University of Leeds, in bringing technological studies into relation with other work of the University, in furthering chemistry and its technical applications, and in linking up the University with the community it serves, is well worthy of commemoration, and a committee has been appointed to raise funds for this purpose. With the money obtained it is proposed to have a portrait of Prof. Smithells painted for presentation to the University, and to establish in his name, and by his advice, a fellowship or scholarship within the University—two means by which his connexion with the University will be handed down to posterity. Subscriptions, made payable to the treasurer of the Smithells Fund, should be forwarded to Mr. A. G. Lupton, Beechwood, Roundhay, Leeds.

MR. PAUL C. STANDLEY, associate curator of plants in the National Museum, Smithsonian Institution, has left Washington for Panama, where he will make investigations of the plant life of the Canal zone and its immediate vicinity. This work, undertaken in co-operation with the Department of Agriculture, has for its object the preparation of a descriptive and illustrated account of the plants occurring in the region. Botanical exploration of the Isthmus of Panama was begun about 1790 by Luis Née, a Frenchman, who accompanied the famous navigator Malaspina on his voyage around the world. A very extensive collection also was obtained by the Smithsonian Biological Survey of the Panama Canal Zone in 1910–11, and more recent collectors have forwarded to the National Museum noteworthy collections, so that at the present time more than 2000 species of plants are known from the region. From a botanical point of view the Isthmus has not been thoroughly explored, however, and it is probable that further work there will increase this number by 50 per cent. Panama is particularly rich in palms, and has a good representation of orchids and ferns. After spending about two months in Panama, Mr. Standley will go to Costa Rica to make further collections of plants.

IN the course of his presidential address to the Institution of Civil Engineers delivered on November 6, Sir Charles Langbridge Morgan had a good deal to say in encouragement of the numerous young men seeking to enter the civil engineering profession, often with an equipment of scientific knowledge and general education which would have been regarded as exceptional in his own early days. Sir Charles traced the development of transportation in Greater London during the past fifty years, and gave a number of interesting tables relating to local railways, suburban sections of main-line railways, tramways, omnibuses, etc.; these carried a total of 1,036,806,934 passengers in 1900 and 3,125,321,122 in 1920. From the developments which have taken place, and others projected, Sir Charles refuses to believe that the profession of civil engineering has entered upon a permanent decline. No one can deny that there is reason for temporary discouragement of young men who are at present confronted with extraordinary difficulty in obtaining work. If the older members were to shut their eyes to the seriousness of the position of junior members of the profession, they would be failing in their duty. It is the part of such bodies as the Institution of Civil Engineers to do all that can be done by organisation, encouragement, and co-operation to hasten that recovery of the whole profession to which all look forward.

A GUIDE, with code and instructions, relative to wireless weather telegraphy in Great Britain and the countries of Europe and North Africa, has recently been issued by the Meteorological Office of the Air Ministry (M.O. 252, H.M.S.O. 2*s*. 6*d*. net). The details of the meteorological messages transmitted by the several countries are arranged on a uniform plan. Times of sending are explained and the meanings of the symbols used, so that any one having the suitable equipment can receive both reports and forecasts. The issue of particulars of the messages from different countries is brought up to date, and amending notices will be issued as required from time to time. Purchasers of this new edition of the guide will be informed when fresh notices are issued if they notify the Director of the Meteorological Office that they desire to receive the information. Use can be made of messages transmitted to the Meteorological Office by the aid of which the daily weather reports and forecasts are prepared for the Press and the general public. In addition to this a "general inference" is issued at 9.15 A.M. and 8 P.M. based on observations taken at numerous local and foreign stations as well as over the Atlantic. An example is given of the "general inference," and it is stated that "the first transmission of this report is made at ten words a minute for the benefit of amateurs." The message is in plain language, and can be readily understood by others than meteorologists. The general inference is in effect a picture in words from which a general survey of the prevailing and controlling weather conditions can be obtained.

THE annual reports of the Smithsonian Institution of Washington contain not only full statements of the activities of the Institution during the year, but also a large general appendix which consists of a miscellaneous collection of memoirs covering a wide range of subjects. This appendix forms fully three-quarters of the volume for 1921, which has recently been issued, and it provides a valuable collection of noteworthy scientific papers issued during the year. Many of the items are original and by American workers, while others are translations and reprints. Among the latter are: "Cosmogeny and Stellar Evolution," by Mr. J. H. Jeans, from NATURE of June 30 and July 7, 1921; and "The Age of the Earth," by Lord Raleigh, Prof. W. J. Sollas, Prof. J. W. Gregory, and Dr. Harold Jeffreys, from NATURE of October 27, 1921. The translations included are: "The Diameters of the Stars," by A. Danjon, from *L'Astronomie* of November and December 1921; "The Historic

Development of the Evolutionary Idea," by Branislav Petronievics, which is a translation of the first chapter of Petronievics' work, "L'Évolution universelle"; "The Heredity of Acquired Characters," by Prof. L. Cuénot, from the *Revue Générale des Sciences* of October 15, 1921; "The Indian in Literature," by Herman F. C. ten Kate, from papers published in the Dutch magazines *De Gids* (1919) and *De West-Indische Gids* (1920); and "The Alimentary Education of Children," by Prof. Marcel Labbé, from the *Revue scientifique* of September 10, 1921.

THE Christmas lectures at the Royal Institution, which are to be delivered this year by Sir William Bragg, will be published afterwards in book form by Messrs. G. Bell and Sons, Ltd., under the title, "Concerning the Nature of Things."

WE have received from Messrs. Ogilvy and Co., 18 Bloomsbury Sq., W.C.1, the British agents, new editions of Leitz catalogues of microscopes and dissecting microscopes and magnifiers. Microscopes, objectives, magnifiers, and other apparatus of all types are listed, and the purchaser has a wide choice as regards both elaboration and price. In addition, some interesting and instructive details are given of the general properties of objectives and eyepieces and of their classification.

MESSRS. C. BAKER, of 244 High Holborn, London, W.C.1, have recently issued a new classified list of second-hand scientific instruments (No. 79) which they have for disposal. The catalogue contains a large assortment of apparatus, and particularly of microscopes, telescopes, and their accessories. Among the astronomical telescopes (refractors) are a 12 in. equatorial and a 7¼ in., both by Cooke, and an 8 in. by Grubb. A wireless department has been established by Messrs. Baker, and a list of the apparatus available, all of which is new, has been added to the catalogue of second-hand instruments.

IN the Year-book of the Royal Society of Tropical Medicine and Hygiene, Session 1923–24, recently issued, an account with illustrations is given of the Chalmers and Manson memorial medals of the Society. The former, founded by a donation from Mrs. Chalmers, is in memory of Dr. Albert J. Chalmers; the latter, by a surplus of a portrait fund, is in memory of Sir Patrick Manson. The Chalmers medal is awarded biennially, and this year has been presented to M. E. Roubaud, of the Pasteur Institute, Paris. The Manson medal is awarded triennially, and has been presented to Sir David Bruce.

THE Cambridge Philosophical Society is to publish, through the Cambridge University Press, as separa e supplements to the Proceedings, translations of Dr. Niels Bohr's present series of papers "On the Application of the Quantum Theory to Atomic Structure," Part I. of which has already appeared in the *Zeitschrift für Physik*, vol. xiii. (1923). The translation of Part I. will be closely followed by a similar translation of Part II., which it is hoped will appear simultaneously with the German version. Part I. will deal with the fundamental postulates of the quantum theory, and Part II. with the theory of series spectra.

ERRATA.—In our issue of November 10, p. 704, in the Research Item on the Early Proboscideans, for "Schlasser" read "Schlosser"; December 1, p. 806, in the Research Item on the Cheiropterygium in Amphibia, line 3 from end, for "its first 'i'" read "its first 'e.'"

Our Astronomical Column.

THE DECEMBER METEOR SHOWER.—Mr. W. F. Denning writes: "This annual display of meteors may be expected on the night of Wednesday, December 12, when it will probably reach its maximum intensity. The shower is visible, though it supplies very few meteors, during the first week of December, and the radiant point appears to be a moving one like that of the August Perseids. As the moon will be absent from the evening sky during the early part of December this year, it will be possible to watch the oncoming and development of the shower if we get sufficiently clear weather. The position of the radiant on Dec. 1 will be about 98°+34°; on Dec. 5, 104°+33°; on Dec. 10, 110°+33°; and Dec. 15, 116°+32°.

"Occasionally, the shower proves a rich one and supplies about 40 or 50 meteors per hour; but the most abundant displays are usually witnessed in the morning hours, as the radiant is then at a greater altitude than in the earlier part of the night. In 1920, on Dec. 12, the shower returned with considerable strength, though it does not appear to have been well observed, in consequence of unfavourable weather.

"The individual meteors of this stream are moderately swift and short, and as they do not often leave streaks or trains they are rather difficult to record accurately. The radiant point is therefore not often determined as correctly as that of the Perseids or Leonids."

COMPANION TO OMICRON CETI.—The interesting variable Omicron or Mira Ceti has been found by Prof. R. G. Aitken (Harv. Coll. Obs. Bull. No. 792) to have a close companion, at distance 1·01″, position angle 132·3°. The companion was bluish in colour, and on October 19 was fully half a magnitude fainter than the variable. The tardy discovery of a companion to such a well-scrutinised star is remarkable, and suggests that the distance may be increasing. It will doubtless be carefully followed in the hope of obtaining an orbit, which would determine the mass of Mira. It is possible, however, that the pair is an optical, not a physical, double.

PROPOSED OBSERVATORY IN NEW ZEALAND.—The Bulletin of the New Zealand Astronomical Society announces that the University of Yale has offered a large telescope for astronomical observation in New Zealand, provided a good site can be found, the conditions of seeing to be tested with a telescope of 6 or 7 in. aperture, in a similar manner to the tests made before setting up the Victoria telescope in British Columbia. The New Zealand Government has been approached to grant funds for this examination, and has given a hopeful reply. The difficulty appears to be to combine good seeing with convenient access. Most of the towns are near the coast, and the seeing is poor. Various sites are suggested by amateur astronomers, and it is greatly to be hoped that the scheme may go through.

Research Items.

THE CAUSAL ORGANISM OF BRAXY IN SHEEP.—There has been much dispute regarding the essential symptoms and the causal organism of braxy. What may be called the old school considered the disease to be due to an anaerobic, motile, spore-bearing bacillus, giving rise to an inflammatory condition of the fourth stomach. But the latest review of our present state of knowledge, by Dr. J. P. McGowan (*Centralbl. f. Bakteriol., Parasit., und Infektionskr.*, Jena, Bd. 91, 1923), shows that, in face of the criticism of continental workers and of the author himself, this view must be abandoned, for feeding or inoculation with the alleged causal organism fails to produce braxy. It would also appear that the symptoms usually considered to be those of braxy are in reality very rapid post-mortem putrefactive changes. Examination of very fresh carcases shows the abundant presence in pure culture of *Bacillus bipolaris septicus ovium*, inoculation with which reproduced the disease; and this would indicate that braxy is a hyperacute form of hæmorrhagic septicæmia. Sheep are predisposed to attack under conditions of lowered resistance, often dependent upon climatic factors, such as the presence of a large quantity of frosted grass in the food, or exposure to severe day and night fluctuations of temperature. Sheep which are feeding poorly seldom suffer from the disease, and to this fact the author attributes the success of the well-known pig-dung drench and of the "vaccines" prepared from non-causal bacilli, since both treatments throw the sheep seriously out of condition.

INSULIN.—The chemisty of insulin is described in an article by Mr. Norman Evers in the *Chemical Age* for November 3. So far back as 1885 Mering and Minkowski noticed that complete extirpation of pancreas from dogs was followed within a few days by diabetic symptoms similar to those observed in human beings. Lepine suggested that the pancreas gave some secretion which controlled carbohydrate metabolism, and this view gained ground. Schafer suggested the name "insuline" for the secretion produced by certain groups of small cells in the pancreas. Many attempts were made to prepare an extract of the pancreas which on injection would reduce the blood sugar of a diabetic patient, but it was left for Drs. Banting and Best, working under Prof. J. J. R. Macleod at Toronto University, to crown these efforts with success. Mr. Evers describes the original method of extraction in some detail, and considers the subsequent improvements; he also treats of the purification, chemical properties, and of the other sources of the substance. Apparently, for the present, ox and pig pancreas are the only available economic sources. It will be recalled that an article by Prof. J. J. R. Macleod describing the action of insulin appeared in NATURE of October 27, p. 625.

TROPICAL AMERICAN ASCOMYCETES.—Among the Ascomycetes of Tropical America are several puzzling forms of Discomycetes, which in habit recall rather the Basidiomycetous genus, Auricularia. Just before his death the late Prof. Durand had revised a number of these forms, and his findings have been published by Dr. Roland Thaxter, with some notes and two plates of figures added. The long-established genus, Midotis Fr., is now clearly characterised for the first time, whilst some other curious species, including some previously grouped under Cordierites Mont, are now placed in a newly formed genus, Ionomidotis Durand. Seven species of this new genus are described, and a key supplied for their identification.

CONTROL OF DISEASE IN THE PALMYRA PALM.—Something of the problem involved in carrying out remedial methods in phytopathology is to be seen in the report by W. McRae, appearing in the Memoirs of the Department of Agriculture in India, volume 12, No. 11, July 1923. In 1905 Dr. E. J. Butler identified *Phytophthora palmivora*, Butl., as the cause of the serious disease of the Palmyra palm, *Borassus flabellifer* Linn., occurring in the Madras Presidency. This palm is of great importance to the native community both for its fruit and for its use as the source of a fermentable liquid used in the preparation of toddy. For the latter purpose the leaves at the apex of the shoot are cut. Older leaves are sometimes cut also for use either as fuel or as a source of fibre. Control of the disease has involved the cutting, removal, and burning of the green tips of diseased trees and then, as experience showed it possible, the removal of outer diseased leaves from less severely affected trees, which then frequently recovered from the disease. The author concludes that, during the fifteen years in which the control operations which he reviews have been in progress, some three-quarters of a million palms have been saved, and he affirms definitely that the disease has been reduced from a grave menace in 1908 to a controlled problem at the present time. The operations, carried out by native workers under the supervision of a special staff recruited from the Revenue Branch of the District Administration, are estimated to have cost 20,000*l.* for the period 1916–1921. Until the application of the Pest Act, everything had to be done with the acquiescence and co-operation of the villagers, the result being so careful an attention to propaganda and education in the reasons for remedial measures that during the first two years' operation of the compulsory clauses contained in the Pest Act only one prosecution has proved necessary.

THE THEORY OF ISOSTASY.—At the meeting of the Royal Geographical Society on November 12, two papers discussing the theory of isostasy from very divergent angles were presented. The briefer one, "Doubts and Suggestions on Terrestrial Isostasy," by Captain Alberto Alessio, is critical of Hayford's method of treating Pratt's hypothesis: his assertion that the field of force of gravity, being observed only at a limited number of points, can be produced in an infinite variety of ways by appropriate distributions of density may be assented to; but he brings forward no arguments of sufficient weight to explain away the value of Hayford's simple general hypothesis as to the distribution of density under mountain or oceanic regions, as a means of accounting for variations in the gravitational field. The second paper, on "Abnormal Densities in the Earth's Crust disclosed by Analysis of Geodetic Data," is by Prof. W. Bowie, of the United States Coast and Geodetic Survey, who has continued Hayford's isostatic researches. It is a valuable and interesting résumé of the present state of the theory, indicating both its many successes and the extent to which it is to be regarded as a simplification—for purposes of preliminary analysis and computation—of the probable real facts. The anomalies or differences of the observed gravity data from the values calculated by Hayford's method are shown to be much less than those from the values calculated by Bouguer's method, in which no account is taken of the isostatic compensation. It is also shown that the Bouguer anomalies increase rapidly for elevated stations, while the "isostatic" anomalies show a purely normal accidental distribution. Even so, a considerable class

of cases in which the isostatic anomalies suggest decided departures from isostatic equilibrium can be reasonably accounted for by what may be regarded as a second approximation to the facts; the simple Hayfordian theory is that the compensating excess or defect of density is distributed uniformly throughout a column of a certain depth, independent of locality. Prof. Bowie has shown that in many cases there is geological evidence for the existence of heavier or lighter rocks (as the case may be) nearer the surface, and that these are capable of accounting for many of the anomalies referred to, without supposing the isostatic compensation to be incomplete.

CARBONISATION OF COAL.—The Fuel Research Board has issued a report (Technical Paper No. 8) on "The Steaming of Wigan Arley Coal in Vertical Gas Retorts" (H.M.S.O., 9*d*. net). It sets out the results which were obtained when this particular coal was carbonised with gradually increasing quantities of steam in the Glover-West vertical retorts of the Fuel Research Board's experimental station at Greenwich. The coal is one largely used for gas-making in Lancashire, and the tests on it were carried out "at the request of the Preston Gas Company, the Wigan Coal and Iron Company, Ltd., and Messrs. West's Gas Improvement Company, Ltd., these firms combining to bear the cost of 300 tons of coal for the purpose." A large amount of detail as to the results obtained finds its place in the text of the report, and particularly in tables given at the end, from which it is plain that an attempt has been made to secure as much information as possible during the tests for the guidance of gas engineers who may be thinking of using this coal. It is interesting to note that some data have been acquired for the fuel consumption, as reported thus: "The amount of heat required per ton for the carbonisation of this coal, including the sensible heat in the products, varied from 13·0 therms with 5 per cent. steam to 18·25 therms with 20 per cent. steam. The intermediate points were not obtainable owing to the amount of heat which was taken up by the setting when only three retorts were in use being unknown."

TEMPERATURE-MEASURING INSTRUMENTS.—A useful booklet of 71 pages has been issued by the Cambridge and Paul Instrument Company, in which a concise account is given of the various temperature-measuring instruments made by this firm. A perusal of its contents shows that the number of useful devices applicable to the measurement of temperature is continually increasing, so that the user has now a much wider choice than heretofore. Descriptions are given of dial and index thermometers, the latter being provided with an electric alarm attachment for ringing a bell when the temperature differs from that at which it is desired to work. With both these types continuous records may be taken on charts by means of a moving pen. In connexion with platinum resistance thermometers, direct-reading indicators for any assigned range are provided, in which the movements of the pointer depend upon the extent to which a Wheatstone bridge is thrown out of balance by the varying resistance of the platinum at different temperatures. Thermo-electric pyrometers, with base-metal and rare-metal couples and suitable indicators and recorders, are described; a form used for measuring surface temperatures, and methods of cold-junction control, being of special interest. Amongst radiation and optical pyrometers, a description is given of a recent pattern of the disappearing filament type, capable of reading to 2100° C. A new feature is the introduction of devices for the automatic control of temperatures, either of gas or electric furnaces or tanks of liquids. Control is effected from the indicator by means of a relay, which comes into action when the required temperature is reached, and operates a mechanism which regulates the supply from the source of heat. The instruments described under this head represent a distinct advance in temperature-measuring appliances.

"FISHING" IN OIL-WELL DRILLING.—Fishing is a term employed by the driller to cover a multitude of different operations connected with the drilling of oil-wells, but it is invariably synonymous with trouble of some kind or other, and always calls for the greatest skill and ingenuity on the part of the operators concerned. Technically speaking, the processes of side-tracking of tools, casing, or similar obstruction, frequently necessary in emergency, also come within the purview of "fishing jobs." The recovery of lost or "stuck" tools, runaway tools, broken ropes or rods, lost or broken casing, the removal of "frozen" pipe or other obstacle impeding the drilling of the well—these are some of the many kinds of trouble experienced by the driller. Fishing methods differ with the type of drilling system in vogue, with the efficiency of the drilling crew, and to a large extent according to the country in which the oil-field is situated. It should be borne in mind that operations of this character are usually lengthy, tedious, and expensive, since while they are being carried out the well certainly cannot be earning any money; consequently producers are becoming more and more alive to the necessity for reducing fishing operations to the absolute minimum, by the employment of the most skilful drillers, equipped with the most up-to-date tools and devices for achieving the desired results. Drilling is becoming more and more of a science, less of routine manual labour; it is therefore valuable to have the advantage of a paper such as Mr. Albert Millar's, read on November 13 before the Institute of Petroleum Technologists, dealing with the Galician-Canadian pole tool fishing methods, which provided a natural sequel to his previous paper on the same system of drilling for petroleum.

MERCURY AS A WORKING SUBSTANCE FOR BINARY FLUID TURBINES.—The possibilities of the use of mercury in this connexion were discussed in a paper read by Mr. William J. Kearton before the Institution of Mechanical Engineers on November 16. No fluid exists which possesses the ideal conditions for a single fluid turbine; hence the use of two fluids—one having a high boiling-point to be used in a high-temperature turbine, and the other with a low boiling-point to be used in a low-temperature turbine. Mercury may be used for the first fluid and steam for the second. It is stated that an experimental mercury-vapour turbine has been built in the United States by the General Electric Company to the designs of Mr. Emmett, and that a second turbine has recently been put into operation. There does not appear to be any published information on the subject in Great Britain. A considerable amount of experimental work has been done by chemists and physicists on the properties of mercury, but all the data required for a complete study of the problem are not at hand. A large amount of research work, particularly in connexion with the determination of latent heats at high temperatures, remains to be done. A considerable part of Mr. Kearton's paper is taken up with a discussion of the properties of mercury, and the results obtained by many workers are reviewed. The author has calculated tables giving the relation of temperature, vapour pressure, sensible heat, latent heat, total heat, entropies of the liquid, of evaporation, and of the mercury vapour; these tables appear in the paper, and are supplemented by diagrams showing the properties graphically.

The Royal Society Anniversary Meeting.

INSTITUTION OF RESEARCH PROFESSORSHIPS.

AT the anniversary meeting of the Royal Society held on November 30, the report of the Council was presented and the president, Sir Charles Sherrington, delivered his address. The report of the Council refers mainly to the chief benefactions made to the Society for the promotion of scientific investigation. These are the gift of 100,000*l.* made by Sir Alfred Yarrow in February last, a bequest of 50,000*l.* by Dr. Ludwig Mond, which came to the Society through the death of Mrs. Mond in May last, 500*l.* a year for at least five years from the Worshipful Company of Armourers and Brasiers, the Foulerton gift of 20,000*l.* and the bequest by Miss L. A. Foulerton of the residue of her estate, and the Messel bequest of four-fifths of the residuary estate. The income from the present investments of the four funds available for the endowment of scientific research is approximately as follows: Foulerton gift, 1000*l.*; Foulerton bequest, 4050*l.*; Messel fund, 1575*l.*; and Yarrow fund, 5450*l.* No income has so far been received from the Mond fund, but, according to the terms of the will, it is anticipated that there will be an annual income of about 2500*l.*

Upon the receipt of Sir Alfred Yarrow's gift, a committee was appointed by the Council to consider and make recommendations as to the general use and administration of the Foulerton, Messel, Yarrow, and Mond funds. Following a recommendation of this Committee, the Council resolved that in the first place the remaining sums of 250*l.* to be paid in respect of the yet unpublished volumes of the Royal Society Catalogue of Scientific Papers be paid out of the income of the Mond fund, and that after this the deficit of the Royal Society's publication fund should be met each year by contributions from the Messel fund and from the Mond fund, these contributions being made in so far as convenient in proportion to the total incomes of these two funds. It was further resolved on the recommendation of this Committee that the chief remaining part of the income from the various funds be used in the endowment of certain Royal Society professorships, these to be awarded to men only of proved ability for independent research; and regulations have been adopted both for the endowment of these professorships and for the endowment of scientific research in other ways out of the residue of the various funds. Detailed regulations for the administration of these four funds and for the appointment to and tenure of Royal Society research professorships have been adopted by the Council, and a separate Committee has been appointed to make recommendations as to the administration of the Yarrow fund.

Photo] *Elliott and Fry, Ltd.*

Prof. A. Fowler, professor of astrophysics, Imperial College of Science and Technology.

Mr. G. I. Taylor, fellow and lecturer in mathematics, Trinity College, Cambridge.

YARROW RESEARCH PROFESSORS OF THE ROYAL SOCIETY.

Sir Charles Sherrington devoted his address almost entirely to an account of the institution of these research professorships and the policy adopted by the Society in regard to this means of securing the advancement of natural knowledge. It is felt that professorships endowed in the way described, so as to be mobile both as regards the University at which they are held and the subject of research, are of enormously greater value than professorships or fellowships tied for all time to a particular university and a particular subject.

The portions of the president's address referring to the use of these endowments, and to the work of this year's medallists, are printed below in a slightly abridged form.

SIR CHARLES SHERRINGTON'S PRESIDENTIAL ADDRESS.

At the anniversary meeting it cannot be out of place to iterate the main object of the Society's foundation—"the improvement of Natural Know-

ledge," by discovery, and as a never-failing means to that end, the furthering of research. A reference made to it at last year's anniversary dealt particularly with the funds at the disposal of the Society for assisting that great purpose. To-day, in reviewing, however briefly, the events of the past year, the Society recalls with lively gratitude the noble gift received from one of its fellows, Sir Alfred Yarrow. It is a gift specially directed towards this same essential aim of the Society's existence. The terms of Sir Alfred's letter accompanying the donation were no less generous and public-spirited than the gift itself. The letter stressed "that the money be used to aid scientific workers by adequate payment and by the supply of apparatus or other facilities, rather than to erect costly buildings."

The receipt of this splendid gift was followed at no long interval by the accruing to the Society of the valuable bequest from its past fellow, the late Dr. Ludwig Mond. The accession of these funds to the means at the Society's disposal for advancing research has enabled, and suggested, systemisation of its provision for that end. Consideration was undertaken of some adjusted scheme whereby the disbursements the Society could hope to make for the furthering of research should keep suitably in sight the whole ambit of the Society's purview of natural knowledge, thus making for advance over a wide scientific front. For such a plan the Foulerton, Messel, Yarrow and Mond funds, to mention them in their historical sequence, taken in conjunction and following the wishes of their individual donors, lend themselves well. The scope of destination of these funds extends from physics, chemistry, and engineering, on one hand, through biology, to, on the other hand, "Medicine and such sciences as are connected with the discovery of the causes of disease and the relief of human suffering." The mere scant enumeration of the circle of the natural sciences suffices to show them as a band of brothers, and seeing them as such is to remember their call is for research, and not even solely for science's sake itself, but for that of humanity as well.

In addition to the question of the breadth of field there remained that also of the particular form which help for research might take in order to be best effective in whatever field rendered. The consideration given to this has been very full and careful. It will be recalled that from the Donation fund and from some other funds of smaller amount, and also through the Committee administering the annual Government grant, the Society is able annually to make disbursements helpful for apparatus and material in response to applications in regard to particular items of research. Moreover, the Society has of research studentships five in addition to the Sorby fellowship. All and each of these have rendered and are rendering valuable aid to scientific research in their several respective ways. Broadly taken, their destination is to workers of promise in the earlier period of their career; and such workers are thus provided with opportunity for proving the powers of their promise. This year, in addition to the above, a generous and public-spirited step taken by the Worshipful Company of Armourers and Brasiers enables the Society to participate responsibly in the management of yet another endowment of somewhat similar scope.

Bearing in mind this relatively satisfactory provision already existent for these needs and recognising, further, the far-reaching outside provision available from Governmental and a number of public and private beneficiary sources, to meet requirements of a similar kind, the opinion arrived at after thorough consideration has been that a form of help specially called for, and specially likely to be effective in advancing discovery, would lie in the creation of greater opportunity for fully experienced investigators of already proven first-rate capacity in research. It is felt that increase of opportunity afforded to such investigators is likely to attain, with a prospect of comparative certainty, its recompense in the achievements such investigators will accomplish.

To open up facilities for this class of investigator would seem particularly the province of the Society, and one in which its help could pursue required directions with especially whole-hearted conviction, because the Society, in virtue of its own organisation, has special opportunity for cognisance of the powers and scientific circumstances of representatives of this class of investigator. Over an ample field, and at many points in that field, the Society lives in contact with their endeavours, conversant with work they have already done and often with work they are, in fact, prosecuting, and could prosecute more fully had they increased opportunity for so doing. The desirability for encouragement of research from the Society to take this kind of shape seems enhanced by circumstances of the present time, including as this present time does the likelihood of an immediate future which will be one of anxiety for finding ways and means. In institutions, university or other, for the most part such investigators occupy positions to which their opportunities for research attach rather as a secondary adjunct to calls of other nature upon their strength and time. Under an institution's financial stress the demand made by it upon members of its staff who have multifold duties other than research, is likely to be increased in directions away from research. This is a situation of hardship to the investigator and of detriment and mischance to the due advance of science itself.

Institutions, whether university or other, which are seats of learning, show themselves, in instance after instance, desirous for their personnel to prosecute research, but also, in instance after instance, embarrassed to secure to them adequate time for doing so. Yet the research activity of these men—or, for that matter, women—is a main source of that improvement of natural knowledge which it is the Society's great business to promote. A spring of indispensable supply for the production of new knowledge is thus stemmed or curtailed. Therefore, it is felt that the Society, by securing, in co-operation with this or that particular institution, ample freedom of time for a distinguished member of the personnel there to prosecute research undividedly, may extend a form of help toward the advance of discovery particularly desirable and welcome. It is felt that by so doing the Society can gear most usefully its own motive help into the general existent running machinery for the production of new scientific knowledge. The hope is, and the belief is, that its action may thus provide exactly a something which other institutions might have special difficulty in providing. The action it is taking marks a course which, although entered upon tentatively and to be judged finally by experience, is yet inaugurated with the foundation of three research professorships of the Society. The regulations for these appointments have been drawn up with intention to give the professors the utmost freedom to carry out research in the way dictated by their individual attainment, temperament, and inclination. The Council has not thought fit to insist that the professors either shall teach or shall not teach; the sole restriction laid down is that to research shall their main energies be devoted.

At the anniversary meeting last year I had the pleasure of referring to the appointment, then literally scarcely more than one hour old, of Prof. Starling as Foulerton professor. This year has seen him Harveian Orator of the Royal College of Physicians and, as regards the Society, entered fully upon the actual

activities of the Foulerton professorship. Now at this present anniversary, the pleasurable privilege falls to me of announcing the appointments of Prof. A. Fowler and Mr. G. I. Taylor to the Yarrow professorships. I may be allowed here a brief reference to their work. I follow the alphabetical order of their names. Prof. Fowler is known the world over as a spectroscopist whose researches have been of the greatest value to astronomy, to physics, and to chemistry. Entering on science first as a pupil of, and then as an assistant to, Sir Norman Lockyer, his earlier researches were, at that provenance made natural, astrophysical in kind, although the special technique which he developed was a technique of methods purely laboratory. He achieved extraordinary success in identifying lines observed in stellar spectra with lines which he was able to reproduce in the laboratory; he was able thus to assign the lines to their chemical origin. For example, the origin of the bands which dominated the spectra of what were then described as stars of Secchi's third class had been a mystery for many years. Fowler was able to show that they were due to titanium oxide. He accounted for many of the bands in the sun-spot spectrum by showing that they belonged to magnesium hydride. Again, he made an interesting study of the spectra of comets. The spectrum of the head had been observed by Donati in 1864 and had been fully studied by Huggins and others. It remained for Prof. Fowler to make a study of the tail spectrum of comets. He noticed first that the observed spectrum coincided with one which had been obtained in the laboratory arising from an impurity in low-pressure hydrogen. Finally, after much effort and laborious work, this spectrum was found to originate in carbon monoxide.

While these are perhaps some of the more striking of Prof. Fowler's successes in the region of astrophysics, he has also done a great deal of highly useful work in adding to our knowledge of the spectra of known terrestrial substances. Special mention may perhaps be made of his study of the spectrum of scandium, which proved to be important both in solar prominences and in sun-spots; of magnesium, in which he discovered new series of spectral lines; of strontium, in which he added several lines to the already known triple series; and of the active modification of nitrogen discovered by the present Lord Rayleigh.

At the time that these investigations were carried out, there was no reason to suppose an immediate future of practical importance for the results obtained, but with the advent of Bohr's theory of atomic structure, they have been found to provide exactly the material required for full discussion of the new theories of atomic structure, and for the acquisition of new positive knowledge as to the details of atomic mechanism. Perhaps his success of most striking general appeal has been his direct experimental proof that the so-called ζ-Puppis series of hydrogen originate from helium and not from hydrogen at all. This result incidentally provided a striking confirmation of Bohr's theory of the origin of spectra.

In this field of research Prof. Fowler stands unrivalled. Recently he has been examining the changes which take place in the spectra of elements as one electron after another is removed; the results obtained are of fundamental importance. His last paper, on the "Spectrum of Trebly Ionised Silicon," will still be fresh in the minds of many of our fellows.

Branches of physical science other than those benefiting by Prof. Fowler's work have formed the field of research of the Society's other Yarrow professor, Mr. G. I. Taylor, namely, mathematics, engineering, and geophysics. Mr. Taylor started his scientific life as an applied mathematician, and the Society is still fortunate in receiving from him frequent mathematical papers on hydrodynamical themes. Before the advent of Mr. Taylor to this field, it was almost a foregone conclusion that the results of mathematical research in a large part of hydrodynamics would not be confirmed by experiments; Mr. Taylor has opened an era in which experiments and analysis give confirmatory results. From abstract hydrodynamics he was led to research in practical problems of geophysics and meteorology. He has a distinguished record in aeronautical science, dating from the time when, acting as Meteorological Adviser to the Air Force, he was led to study the motions of the air, the causes and effects of eddies and the complicated phenomena to which these give rise. The application of much of his work to problems connected with aircraft is very direct. As the result of mathematical calculations he designed a parachute possessing many advantages in practice; quite recently he has published an important theoretical investigation as to the manner in which the forces on a model aeroplane in a wind-channel are affected by the eddies set up at the channel's mouth. Some contributions by him have proved of high value to the theory of the propeller. He has taken a leading part in the development of a theory which goes far to account for the forces of an aeroplane in terms of the circulation round it, and the series of trailing vortices shed from its wings.

Mr. Taylor has been equally successful in the application of mathematics to engineering problems. In collaboration with Mr. A. A. Griffiths, he was the first to utilise the fact that the equations which determine the torsion of an elastic bar are identical with those representing the displacement of a thin membrane stretched over a hole of suitable shape when slightly distorted by uniform pressure. By micrometric measurements of the distortion of such a membrane, he was able to deduce the torsion stresses inside a bar of specified cross-section, a procedure having practical applications of the greatest importance.

In the last Bakerian lecture delivered before the Society, Mr. Taylor, in conjunction with Miss Elam, studied the strains in a single crystal of aluminium when stretched to breaking point, using a most ingenious combination of micrometric measurements and X-ray analysis. In this way he was able to trace the internal motions in the crystal and to explain the striking difference between the fracture of a bar of ordinary metal and that of a single crystal, such as he examined. In this, his most recent work, he has opened up a field which promises to be of far-reaching importance to the science of the strength of materials, and, I venture to think, of great practical value to the working engineer.

The record of both of our new professors gives every justification for hoping that in the unfettered freedom of the Yarrow professorships they may find the opportunity for still more ample fulfilment of brilliant work. It is fortunate that they will both continue their researches in the laboratories from which their outstanding work has issued in the past, and of the traditions of which their reputations already are, indeed, a part.

Finally, may I in general terms return once more to summarise that leading motive, which has actuated the launching of these new professorships. Our universities and other scientific institutions have been wont—indeed in many cases by force of circumstances are compelled—to regard teaching as the primary occupation of professoriate and staff and to envisage their occupation by research as merely secondary to their occupation in routine teaching. The Society has inverted quite deliberately that

order of precedence of professorial function. By this inversion the Society of set purpose desires to recognise research as a definite profession and to advance, and to maintain, the principle that the labourer is worthy of his hire no less when engaged in research than when engaged in class instruction.

Yet one word more upon this subject. Munificent as the gifts are which the Society has received, enabling it to do what it is doing toward this end it has at heart, may we not venture to hope that the funds already to hand for that purpose will prove but the auspicious starting-point for yet others of similar destination. To say this is but to echo the concluding sentence of Sir Alfred Yarrow's memorable letter. With such aspirations, our desire is that in due course either the Royal Society or other bodies may have it in their power to endow the research of all those individuals whose life ought, in the best interests of the community, to be devoted to scientific research as the main purpose of their life-career.

THE MEDALLISTS.

COPLEY MEDAL. Prof. Horace Lamb.—For forty years Prof. Lamb has been recognised as one of the most prominent and successful workers in applied mathematics in Great Britain. He is the foremost authority on hydrodynamics, not only in Great Britain but the world over. Prof. Lamb's scientific activity, originally centring around the subject of hydrodynamics, has radiated thence into most branches of physical science and he may be regarded as the outstanding representative to-day of the school founded by Stokes, Kelvin, Clerk Maxwell, and Rayleigh. In recent years he has made important contributions to seismology, the theory of tides, and other branches of geophysics. Specially perhaps should be mentioned the assistance he has given of recent years to the Aeronautical Research Committee. Mathematical questions involved in the flow of air round aircraft, in the action of propellers, and the stresses in aeroplane structure, are of fundamental importance, but are exceedingly difficult; and here, as elsewhere, Prof. Lamb's mathematical skill and power of clear exposition have proved of the highest value.

ROYAL MEDAL. Prof. Charles James Martin.—Prof. Martin is distinguished for contributions both to physiology and to pathology. Investigating snake venoms, he differentiated two groups in virtue of their action, one nervous, the other, so to say, humoral. His work on heat-regulation in monotremes threw light on the evolution of the thermotaxis of warm-blood animals. More recently his researches have lain in the colloidal chemistry of proteins, and in protein-metabolism. As Director of the Lister Institute he has contributed to many investigations, in addition to those actually issued in his name. Thus he has been intimately associated with the inquiry into the influence of accessory food factors of diet in the prevention and remedying of "deficiency" diseases, such as scurvy and rickets, an inquiry the success of which may be regarded as one of the recent triumphs of preventive medicine.

ROYAL MEDAL. Sir William Napier Shaw.—In the great advances made during the last twenty-five years in the science of meteorology, Sir Napier Shaw has been amongst the foremost pioneers. During his twenty years' administration at the Meteorological Office, that Office saw three marked steps forward: two of these were changes in its quarters; the third and greatest was the change in outlook of the work of the Office, whereby it assumed, under Sir Napier Shaw's stimulating influence, the character of a scientific institution for the interpretation of meteorological phenomena. With the assistance of his scientific staff, he has developed the physical and dynamical aspects of the subject, and has done much to concentrate attention upon the thermodynamics of meteorology, wherein the motions of the water-laden air are interpreted as the action of a thermodynamic engine. His contributions to knowledge of the air and its ways have been largely responsible for changing the basis of meteorology from one of empiricism to one of science.

DAVY MEDAL. Prof. Herbert Brereton Baker.—Prof. Baker's researches in various fields of chemical investigation, his examination of highly purified tellurium from various sources for the possible presence of higher members of the same group of elements, and the redetermination of its atomic weight, are of outstanding merit. It is, however, his remarkable researches on the influence of traces of water in modifying chemical change, whether of the nature of combination or of decomposition, which constitute perhaps his especial distinction. The results obtained by complete drying were as remarkable as they were unexpected, because they were in direct opposition to those which followed careful drying by usual methods. The bearing of Prof. Baker's researches on theories of chemical change is as important as his conclusive experimental demonstrations of the phenomena themselves.

HUGHES MEDAL. Dr. Robert Andrews Millikan.—Dr. Millikan has long been regarded as one of the most skilful experimenters in physical science. He is awarded the Hughes medal especially for his determinations of the electronic charge e and of Planck's constant h. When physicists were still ignorant of the value of the electronic charge to within 5 per cent., Dr. Millikan, by a method of the utmost ingenuity, arrived at the value $4{\cdot}774 \times 10^{-10}$ E.S.U., for which he claimed an accuracy of one part in a thousand, a claim which has stood the test of time. His determination of h was not only remarkable in itself, but was of still greater value as finally vindicating the Einstein-Bohr view of the nature of the photo-electric phenomenon.

University and Educational Intelligence.

EDINBURGH.—Dr. Theobald Smith, of the Rockefeller Institute for Medical Research, New York, United States, gave an address in the University on Tuesday, November 27, on comparative pathology. He emphasised the common basis—theoretical and biological—of human and animal pathology; the divergence in methods of treatment of human and of animal patients is determined in the case of the latter by economic considerations. He urged that individual treatment of animals should be replaced more and more by preventive measures, and that future stock-owners should be brought to realise this by a sound education in the principles underlying disease.

LIVERPOOL.—Sir Heath Harrison, Bart., founder of the chair of organic chemistry in the University, has generously contributed a further sum of 2500*l.* towards the endowment of the chair.

DR. C. E. WEATHERBURN, of Ormond College, Melbourne, has been appointed professor of mathematics at Canterbury University College, Christchurch, New Zealand.

THE Annual General Meeting of the Association of Women Science Teachers will be held on Saturday, January 26, at University College, London. In the afternoon Miss Elles will lecture on "The Scientific Interpretation of Scenery" and the meeting will be open to all who are interested in the subject.

IN London, Ontario, the corner stones of the new arts and science buildings of the University of Western Ontario (formerly known as the Western University of London) were laid on June 18 last by the Premier of the Province. The cost of the buildings, more than a million dollars, is being provided for chiefly by grants from the provincial and county governments. The University has grown rapidly in recent years, its student enrolment (610) being three times as large as before the War.

A PROFESSOR of botany and director of the biological laboratories in the University College, Colombo, Ceylon, is required. Candidates should hold a first-class honours degree of a British University, with botany as the principal subject, or equivalent qualifications, and have a competent knowledge of plant physiology, with an acquaintance of botany as applied to agriculture either as plant pathology or genetics, or soil biology. Further information of, and application forms for, the appointment are obtainable until December 15, from the Assistant Private Secretary (Appointments), Colonial Office, Downing Street, S.W.1. The completed application forms must be returned by January 1.

AMONG "significant movements in city school systems" described in Bulletin No. 8 of 1923 of the United States Bureau of Education is the increase in size of the school buildings and grounds. In the larger cities buildings with 24 or more rooms are beginning to appear. This movement is partly due to the insistent modern demand for adequate provision in connexion with city schools for recreation, for physical training, and for practical work. In many cities it has been found that the expense involved in providing for these activities the requisite gymnasiums, auditoriums, manual training shops, home-economics and science laboratories, drawing and modelling studios, and playgrounds, while maintaining class rooms on the same scale as before for ordinary class instruction, is prohibitive. The "platoon," or "work-study-play," or "duplicate school" plan divides the school children of all grades into two groups—A and B. While those of group A are in the class rooms those of group B are in the playgrounds, auditorium, laboratories, or other specially equipped rooms, and vice versa, so that the school can be run with half the number of class rooms required under the ordinary system. Such schemes have been introduced in 53 cities, and in one of these more than 50 "platoon" schools are established.

THE Cincinnati public-schools psychological laboratory is responsible for an interesting attempt to trace the causes of failure in first and second-grade work of children not classified as mentally deficient. The experiment was carried out in an "observation class" of sixteen children from 1917 to 1921, and a detailed account of it has just been published in "Diagnosis and Treatment of Young School Failures"—Bulletin No. 1 of 1923, of the Washington Bureau. Diagnosis should, the writer declares, take account of the child's mental level (as indicated by the various intelligence tests), school history, state of health, general mental tone and attitude (*e.g.*, obsessions, phobias, or anxiety-states), and heredity. Treatment in the observation class resulted uniformly in improvement as measured by mental tests notwithstanding that operative correction of physical defects such as removal of diseased tonsils and adenoids was, owing to parents' objections, in no case effected and unfavourable home conditions remained unchanged. Pleading for a widely extended development of psychological and medical clinics and other extra-class-room resources, the writer remarks, "The community-wide contacts of the school and its hold on the family through the child give it a strategic position for the discovery and diagnosis of mental, physical, and social ills which no other agency can possibly equal."

THE annual meetings of the Geographical Association will be held in Birkbeck College, London, on Wednesday, Thursday, and Friday, January 2, 3, and 4, 1924. The programme includes the following items:—Jan. 2, Prof. P. M. Roxby will open a discussion on "Regional Study in the University and the publication of its results"; Jan. 3, Mr. L. Mac D. Robison will give an address on Ceylon; Sir Richard Gregory will give his presidential address on "British Climate in Historic Times"; joint conference between the Royal Meteorological Society, the Geographical Association, and the Science Masters' Association, to consider the place of meteorology in education. Sir Napier Shaw will preside. Subjects of discussion: "The Place of Meteorological Observations in the School Course," and "The Teaching of Meteorology and Climatology in Schools from (1) the physical and (2) the geographical standpoint"; and M. Em. de Martonne, professor of geography in the University, Paris, will speak (in English) on "A Study of Transylvania"; Jan. 4, conference on railway geography. Mr. Alexander Bell, Assistant General Manager, L. and N.E. Railway, in the chair. Opened on behalf of the Geographical Association by Mr. Ll. Rodwell Jones and Mr. C. B. Fawcett.

IN 1919, arising out of a suggestion put forward by the Universities Bureau of the British Empire as to the desirability of establishing a scheme for the interchange of students between the Universities of Great Britain and America, the Imperial College of Science and Technology, S. Kensington, with the generous assistance of two of its governors, Sir Arthur Acland and Sir Otto Beit, initiated as an experiment a project designed to afford to selected Imperial College students a year's post-graduate study either at an American university, or in American works. The hope of the founders was that the awards might not only prove mutually advantageous to the students of the two countries, but also that a closer acquaintance would tend to foster a spirit of good fellowship and mutual understanding between the students of the two countries and the countries themselves. The original scheme contemplated 6 scholarships of 300*l.* each for one year, which the Imperial College made 400*l.* a year, and later Sir Alfred Yarrow generously contributed a sum sufficient to provide 4 additional scholarships. In all 12 scholars were sent to America, 10 with, and 2 without emoluments; 6 of these went to the Massachusetts Institute of Technology, 2 to Columbia University, 1 each to Cornell, Harvard, and Yale Universities, and 1 spent the year with the Tennessee Iron Coal and Railroad Co., and other works. Five of the scholars were awarded the degree of master of science at the conclusion of the year, and arrangements were made in three cases by the American institution for the students to remain for a second year. Judging from the reports which have been received, the experiment has been an undoubted success. The awards have been discontinued as the funds have been exhausted.

Societies and Academies.

LONDON.

Royal Anthropological Institute, November 6.—Prof. C. G. Seligman, president, in the chair.—Miss M. A. **Murray**: The Percy Sladen Memorial Fund Excavations at Borg en Nadur, Malta. The apsidal building found last year was completely excavated, and further excavations were carried on to the east and south. The main entrance to the megalithic enclosure was cleared; on each side of the gateway was a tall megalith, and just within the enclosure on each side was a small chamber built of megalithic blocks. In an angle of each of these chambers a pot of the Bronze-age was found, evidently in position. The enclosure wall curves away from the main entrance towards the south and west; but there was not time to clear this completely. The outer blocks of the apsidal building were laid bare; they occur only round the west end and the north-west apse. Originally, they were probably six feet or more in height; now, however, they are about three feet high, as the tops have been broken off to bring them to the level of the field. Numbers of small flint implements were found in all parts of the site, chiefly in and near the apsidal building. To the west of the apsidal building the so-called "Neolithic stratum" was clearly marked, the earth being of a different colour from that above and below, and Neolithic potsherds occurring in large numbers. As this part of the excavation was at the boundary of the next field, it was not possible to continue the excavation further in that direction. It is hoped that the Maltese Government will buy the fields which contain the megalithic structures, and thus ensure that all the buildings of Borg en Nadur may be completely excavated.

November 20.—Prof. C. G. Seligman, president, in the chair. L. H. **Dudley Buxton**: The inhabitants of Inner Mongolia. The inhabitants of Inner Mongolia may be divided into three classes—Mongols, Chinese, and Manchus. The Mongols only are discussed: they are usually divided into three groups—the Kalmucks, the Buriats, and the true Mongols. This classification is based on linguistic relations alone. The majority of the true Mongols have adopted the Lamaistic form of Buddhism, but a number of relics of Shamanism survive, some of the rites being strongly reminiscent of Arctic hysteria. All their rites and ceremonies are in close harmony with their geographic environment, and are closely related to their occupations as pastoral nomads. Their physique differs from that of the Kalmucks and from many of the Buriat tribes. They seem to stand intermediate between the Turkish tribes of Central Asia, such as the Turguts and the Taranchi, and the Northern Chinese, although in many ways they are nearer the latter. They probably received a considerable infiltration of Western blood, perhaps akin to that of the Alpine race, possibly at a time which was contemporaneous with the culture represented in Fengtien by the Sha Kuo T'un pottery, although the actual people who occupied this site seem to have been early Chinese. If we regroup the Mongols on the basis of physique, most of the Kalmucks and many of the Buriats fall in a class akin to many of the Turki tribes, and distinguished for their extremely round heads, and to form a separate class which will include probably most of the true Mongols and the Buriats and possibly some of the Kalmucks. These are closely allied to the yellow races, although they, too, probably have a strain of white blood in their veins.

Physical Society, November 9.—Dr. Alexander Russell in the chair.—A. L. **Narayan**: Scattering of light by carbon dioxide, nitrous oxide, and some organic vapours. The light scattered laterally by the molecules of gases is not completely polarised, but contains a component polarised at right angles to the direction which is predicted by theory for a spherical molecule, the two components being conveniently referred to as the "wrong" and the "right" components respectively. Sunlight was used for illuminating gases and vapours, enclosed in a jointless tube. The strengths of the components were compared both by direct photometry and by photometric comparison of their effects on a photographic plate. Lord Rayleigh's results were confirmed, particularly in the case of carbon dioxide and nitric oxide. The difference in the scattering power of these two gases is contrary to the prediction of the Lewis-Langmuir theory of the atom.—A. **Ferguson**: On the measurement of the surface tension of a small quantity of liquid. If a small quantity of liquid, 1 c.c. or less, be placed in a vertical capillary tube, its surface tension may be determined by applying pressure to the upper end of the tube, and measuring the pressure necessary to force the liquid into such a position that the meniscus at the lower end of the tube is *plane*. Interfacial tensions may also be determined in this way.

The Faraday Society, November 12.—Sir Robert Robertson, president, in the chair.—A. J. **Allmand** and A. W. **Campbell**: The electrodeposition of manganese. The electrodeposition of manganese from aqueous solutions of its sulphate and chloride has been studied, and the effects of changes in composition of electrolyte, current density, temperature, and type of cell investigated. Pure manganese in coherent form can be prepared in small quantity with a current efficiency of 40-50 per cent., but attempts to prepare larger amounts in coherent form were unsuccessful.—S. **Glasstone**: The cathodic behaviour of alloys. Pt. I. Iron-nickel alloys.—A. L. **Norbury**: The volumes occupied by the solute atoms in certain metallic solid solutions, and their consequent hardening effects. When an element is distributed in solid solution as single atoms replacing single atoms of the solvent in the space-lattice of the latter, the hardening effect is, in general, proportional to the difference in size of the solute and solvent atoms. This relationship does not hold in certain exceptional cases—for example, silicon in copper and sodium in lead, which appear to arise when the solute has an exceptionally strong chemical affinity for the solvent. In such cases the solute probably exists in solid solution in the form of molecules of an intermetallic compound having a different space-lattice from that of the solvent. When an element forms a solid solution with another element, there is a contraction or expansion which seems to be large or small according to whether the chemical affinity between the elements is large or small.—J. B. **Firth** and F. S. **Watson**: The catalytic decomposition of hydrogen peroxide solution by blood charcoal. Blood charcoal previously heated to 120° C. shows moderate catalytic activity in the decomposition of hydrogen peroxide solution, but the activity is considerably increased by previous heating in a vacuum at 600° C. and 900° C., and is still further increased by previous sorption of iodine from solution. The activity of an activated charcoal consists of two types: α activity, which is very rapid, but ceases after a few minutes, and β activity, which may persist for several hours. In ordinary blood charcoal α activity is absent. The introduction of iron into sugar solution prior to carbonisation increases the

activity of the charcoal considerably, and it is suggested that the iron acts as a spacing agent. The proportion of hydrogen peroxide decomposed is determined by *both* the activity of the charcoal and the concentration of the solution.—E. E. **Walker**: The influence of the velocity of compression on the apparent compressibility of powders. The influence of the duration of the load on the volume ratio of compressed powder has been investigated, and the isobaric curve has been correlated with the value of the ratio resistance to impact to resistance to static load. The exceptional readiness with which powdered ammonium nitrate shrinks depends chiefly on the high value of its velocity coefficient.—L. **Anderson**: (1) An investigation of Smoluchowski's equation as applied to the coagulation of gold hydrosol. Colorimetric determinations of the rate of coagulation of gold sols by hydrochloric acid, potassium chloride, barium chloride, and aluminium chloride have been carried out, and a region of rapid coagulation is found in which Smoluchowski's equation holds fairly well. A slower region of coagulation is found in which the equation is inapplicable. On the whole, the equation in its present form is strictly limited to rapid coagulation. (2) The effect of sucrose on the rate of coagulation of a colloid by an electrolyte. The coagulation of gold sols by hydrochloric acid, barium chloride, and potassium chloride in the presence of varying amounts of sucrose has been investigated. It is concluded that sucrose exerts a definite peptising effect upon colloidal gold, and also that it exerts a specific augmentation of coagulation in the case of hydrogen and barium ions over and above that of increasing the activity of these two ions. It exhibits apparent antagonistic action towards ions and gold sols. The experiments indicate in general that the coagulating power of an ion is dependent upon its activity rather than upon its concentration, a conclusion which brings the typical colloid phenomenon of coagulation into line with the kinetics of chemical change in homogeneous (molecular) systems.—H. H. **Paine** and G. T. R. **Evans**: A method of measuring the rate of coagulation of colloidal solutions over wide ranges. The rate of coagulation of colloidal copper solutions has been studied for a wide range of electrolyte concentrations by making use of the retarding effect of starch. Very rapid coagulations can thus be brought into the region of observation by ordinary methods. A "transformation factor" can be obtained which enables one to calculate what the rate of coagulation would have been for the pure colloid. The results agree closely with the equation deduced by Freundlich for the variation of the rate of coagulation with the concentration of the electrolyte, and confirm the existence of a maximum rate of coagulation.—J. A. V. **Butler**: Studies in heterogeneous equilibria. Pt. I. The conditions at the boundary surfaces of crystals and liquids are discussed with the view of applying statistical methods to elucidate the kinetics of surface processes and to co-ordinate a number of different cases of heterogeneous equilibrium. A molecule near the surface is under the influence of two opposing attractive forces, that of the surface and that exerted by the liquid. In general, these result in a balance point at which the direction of the resultant force reverses. Suitable approximate statistical equations are deduced on this basis and applied to the simplest cases of solubility. The integration constants of the isochore for solubility calculated by means of the equations obtained for potassium, sodium, hydrogen, and silver chlorides, are of the same order of magnitude as the experimental values.

Royal Statistical Society, November 20.—Sir J. **Athelstane Baines**: The International Statistical Institute and its fifteenth session. The International Statistical Institute originated at the jubilee meeting of the Royal Statistical Society. During the War, its work was in abeyance, with the exception of that carried on by the Permanent Office, which had been established only a short time before hostilities began. The Institute was able to convene its fifteenth session to take place at Brussels last October. At the request of the League of Nations, through the Economic Section, proposals for the organisation of statistics for international comparisons were submitted to the Institute, and forwarded, as adopted, to the League. The subjects dealt with were statistics of trade, of agricultural production, and of fisheries, together with suggestions as to the use and form of index-numbers bearing on the economic situation. It is possible that the counsel of the Institute may be sought by the League systematically as time goes on, since the need of a qualified adviser, independent and impartial, upon international questions involving a statistical basis, is becoming annually more apparent.

PARIS.

Academy of Sciences, November 12.—M. Albin Haller in the chair.—J. **Costantin**: The collection and culture of *Pleurotus Eryngii*. Suggestions for the cultivation of this edible mushroom (and other species of Pleurotus) on waste land.—H. A. **Lorentz** and Edouard **Herzen**: The relations between energy and mass according to Ernest Solvay.—E. O. **Lovett**: A functional property of certain surfaces.—Armand **Cahen**: New continued fractions attached to certain operations.—Serge **Bernstein**: Quasi-analytical functions.—Jean **Chazy**: The gravitation field of two fixed masses in the theory of relativity.—Carl A. **Garabedian**: A method of series.—Charles **Nordmann**: The "turbulence" of the wind and the flight of hovering birds. Discussion and criticism of the views of Vasilesco Karpen on this subject.—Emile **Belot**: Some consequences of the fact that all stars, including the sun, must have passed through the nova phase.—J. **Rouch**: Researches on shoals with the aid of the divergent drag. This instrument, invented by Admiral Ronarch during the War for removing submarine mines, has been successfully applied to the detection of submerged rocks in the neighbourhood of the port of Brest.—René **Lucas**: Magnetic moments of rotation and molecular magnetic orientation.—R. **Ledoux-Lebard**, A. **Lepape**, and A. **Dauvillier**: The use of heavy gases in radio-diagnosis. Radiographs of a frog, before and after breathing krypton, show that this gas is as opaque to X-rays as the tissues of the animal.—Léon **Guillet**: The electrical resistance of commercial aluminium. The purest commercial aluminium has a specific resistance of 2·8 micro-ohms, and this increases with the amount of impurities. Silicon appears to cause a greater increase of resistance than iron. Mechanical treatment has only a slight effect on the resistance.—W. **Kuhn**: The decomposition of ammonia by ultra-violet light and the law of photo-chemical equivalence. The number of quanta absorbed per molecule of ammonia is between 2 and 2·5: this number is increased as the light is made more nearly monochromatic and is independent of the pressure and, in the interval 10° and 20°, of the temperature.—Pierre **Bedos**: Ortho-cyclohexyl-cyclohexanol. This is prepared, with good yield, by the interaction of cyclohexene oxide and cyclohexyl magnesium chloride. Only one of the two possible stereoisomers is obtained: other methods of preparation of this alcohol have given a mixture of the two isomers.—

P. **Gaubert**: The determination of minerals by the microscopical examination of the streak left on a hard body. The microscopical examination of the streak produced on a plate of ground glass or quartz can be used as a means of rapid identification of a mineral or of its constituents. It has the advantage of using only a minute weight of the material without damage to the specimen.—Sabra **Stefanescu**: The activity and correlation of the molars and maxillaries of mastodons and elephants.—René **Souèges**: The embryogeny of the Plantagaceæ. The development of the embryo in *Plantago lanceolata*.—J. **Dauvergne** and Mlle. L. **Weil**: A method of propagating by cuttings in a sterile liquid medium.—J. **Beauverie**: The yellow rust of wheat (*Puccinia glumarum*) in 1923.—Henri **Coupin**: The swelling of seeds and the osmotic pressure of the medium. From experiments on the swelling of seeds in sugar solutions of varying concentration it is shown that the osmotic pressure of the cells of seeds is generally high, from 20 to 45 atmospheres.—H. **Colin** and H. **Belval**: The levulosanes in cereals.—Ph. **Joyet-Lavergne**: The cytoplasmic structure of *Adelina dimidiata*, a parasite of *Scolopendra cingulata*.—Pierre **Danglard**: The vital coloration of the vacuolar apparatus in the marine peridians.—Jules **Amar**: Transformism and heredity.—L. **Fage** and R. **Legendre**: The lunar rhythms of some nereidians.—C. **Levaditi**, S. **Wicolau** and Mlle. R. **Schoen**: Etiology of encephalitis.

Official Publications Received.

Records of the Botanical Survey of India. Vol. 8, No. 4: Flora Arabica. By Prof. Ethelbert Blatter. Part 4: Labiateae-Ceratophyllaceae. Pp. 365-450. (Calcutta: Government Printing Office.) 1.6 rupees.

Report of the Botanical Survey of India for 1922-23. Pp. 10. (Calcutta: Government Printing Office.)

A Report of the Fifth Congress of the Far Eastern Association of Tropical Medicine held in Malaya, September 3-17, 1923. Edited by Dr. J. W. Scharff. Pp. 90. (Singapore: Government Printing Office.)

Statements laid before the Committee on Beri-Beri Control and the Resolution recommended by the Committee as amended by the Council and passed at the General Meeting of the Fifth Congress of the Far Eastern Association of Tropical Medicine. Pp. 12. (Singapore: Government Printing Office.)

Forest Bulletin No. 53: Summary of Results of Treated and Untreated Experimental Sleepers laid in the various Railway Systems of India, brought up to date. By R. S. Pearson. Pp. 28. (Delhi: Government Central Press.) 6 annas.

University of California Bulletin. Third Series, Vol. 16, No. 11: University of California Publications, Price List 1923. Pp. 89. (Berkeley, Cal.: University of California Press.)

Proceedings of the Cambridge Philosophical Society. Vol. 21, Part 6. Pp. 569-812+viii. (Cambridge: At the University Press.) 10*s.* 6*d.* net.

Livingstone College. Annual Report and Statement of Accounts for the Year 1922-23. Pp. 24. (Leyton, E.10.)

The Manchester Steam Users' Association for the Prevention of Steam Boiler Explosions, and for the Attainment of Economy in the Application of Steam. Memorandum by Chief Engineer for the Year 1922. Pp. 23. (Manchester.)

Diary of Societies.

MONDAY, DECEMBER 10.

VICTORIA INSTITUTE, at 4.30.—W. Dale: Egypt in the Days of Akhenaten and Tutankhamen.

ROYAL GEOGRAPHICAL SOCIETY (at Lowther Lodge, Kensington Gore), at 5.—Dr. A. T. Doodson: The Work of the Liverpool Tidal Institute.

BRITISH PSYCHOLOGICAL SOCIETY (Education Section) (Annual General Meeting) (at London Day Training College), at 5.30.—Prof. Wynn-Jones: Vocational Tests in Music.

SOCIETY OF ENGINEERS, INC., at 6.—Annual General Meeting.

ROYAL SOCIETY OF ARTS, at 8.—Prof. A. F. Barker: Recent Progress in the Wool Industries (Cantor Lectures) (2).

TUESDAY, DECEMBER 11.

INSTITUTION OF PETROLEUM TECHNOLOGISTS (at Royal Society of Arts), at 5.30.—L. R. McCollum: The Modern Rotary Drilling System.

INSTITUTE OF TRANSPORT (Metropolitan Graduate and Student Society) (at Institution of Electrical Engineers), at 6.—C. Anderson: Ministry of Transport Requirements, with reference to Railway Companies.

INSTITUTE OF MARINE ENGINEERS, INC., at 6.30.—Adjourned Discussion on Paper read by E. W. Blocksidge at the Shipping and Engineering Exhibition on Life Saving Appliances on Large Passenger Steamers.

ROYAL PHOTOGRAPHIC SOCIETY (Scientific and Technical Group), at 7.—W. Clark: The Sensitivity of the Silver Halide Grains of a Photographic Emulsion.—Communications from the Eastman Kodak Research Laboratory.—L. A. Jones and E. Huse: The Relation between Time and Intensity in Photographic Exposure.—J. B. Capstaff and N. B. Green: A Motion Picture Densitometer.

QUEKETT MICROSCOPICAL CLUB, at 7.30.—J. E. Barnard: Some Problems in Medical Microscopy.

ILLUMINATING ENGINEERING SOCIETY (at Royal Society of Arts), at 8.—G. Herbert, R. A. Ives, and others: Discussion on Some Applications of Illuminating Engineering in Practice.

ROYAL ANTHROPOLOGICAL INSTITUTE, at 8.15.—G. Hewett: The Dusun of British North Borneo.

WEDNESDAY, DECEMBER 12.

INSTITUTION OF CIVIL ENGINEERS (Informal Meeting), at 7.—W. P. F. Fanghaenel, W. N. Booth, and others: Discussion on The Lighting of Factories.

ROYAL SOCIETY OF ARTS, at 8.—Sir Frank Baines: The Preservation of Historic Buildings and Ancient Monuments.

ROYAL SOCIETY OF MEDICINE (Psychiatry Section), at 8.30.—Dr. W. L. Templeton and Dr. H. J. Macbride: The Malaria Treatment of G.P.I.

THURSDAY, DECEMBER 13.

LONDON MATHEMATICAL SOCIETY (at Royal Astronomical Society), at 5.—H. B. C. Darling: The Trinomial Quintic.—H. D. Kloosternan: Representation of a Number in the Form $ax^2+by^2+cz^2+dt^2$.—Prof. Tadahiko Kubota: Some Inequalities concerning Ovals and Ovaloids.—W. L. Marr: The Occurrence of a Linear Determinantal System of Points.—Major P. A. MacMahon: Properties of Prime Numbers deduced from the Calculus of Symmetric Functions.

CHILD-STUDY SOCIETY (at Royal Sanitary Institute), at 6.—Miss Kate Stevens: My Trip round the World.

INSTITUTION OF ELECTRICAL ENGINEERS at 6.—D. Brownlie: Pulverised Fuel and Efficient Steam Generation.

SOCIETY OF DYERS AND COLOURISTS (London Section) (at the Dyers' Hall, Dowgate Hill), at 7.—A. E. Woodhead: Colour Solvents and their Application to Textile Fibres.

OPTICAL SOCIETY (at Imperial College of Science and Technology), at 7.30.—T. Smith: The Primary and Secondary Constant Magnification Surfaces of Thin Lenses.—W. Swaine: A Suggested Standard Trial Case and Simplification in Ophthalmic Policy.—B. K. Johnson: Exhibition of an Optical Revolution Counter.—D. Baxandall: Exhibition of the Troughton Dividing Engine (from the Science Museum, Kensington).

C.B.C. SOCIETY FOR CONSTRUCTIVE BIRTH CONTROL AND RACIAL PROGRESS (at Essex Hall), at 8.—Prof. E. W. MacBride: The Inheritance of Mental Defects.

INSTITUTE OF METALS (London Local Section) and INSTITUTION OF BRITISH FOUNDRYMEN (at Institute of Marine Engineers, Inc.), at 8.—A. H. Munday: Some Foundry Problems.

ROYAL SOCIETY OF TROPICAL MEDICINE AND HYGIENE (Laboratory Meeting) (at London School of Tropical Medicine, Endsleigh Gardens), at 8.15.

FRIDAY, DECEMBER 14.

ROYAL ASTRONOMICAL SOCIETY, at 5.—Dr. J. H. Jeans: Internal Motions in Spiral Nebulæ.—J. W. Gifford: Telescopic Triple Object Glass of High Relative Aperture.—J. S. Plaskett: The H and K Lines of Calcium in O-type Stars.—J. H. Reynolds: The Galactic Distribution of the Small Spiral and Spheroidal Nebulæ.

INSTITUTION OF MECHANICAL ENGINEERS, at 6.—Prof. A. H. Gibson and H. W. Baker: Exhaust-Valve and Cylinder-Head Temperatures in High-speed Petrol Engines.

MALACOLOGICAL SOCIETY OF LONDON (at Linnean Society), at 6.

JUNIOR INSTITUTION OF ENGINEERS, at 7.30.—S. Bylander: L.C.C. Regulations for Steel Framed Buildings.

SATURDAY, DECEMBER 15.

BRITISH PSYCHOLOGICAL SOCIETY (Annual General Meeting) (at University College), at 3.15.—Miss H. M. Wells: A Note on the Psychological Significance of the Psycho-galvanic Reaction.—J. Kay: Visual Perceptual Tests.

PUBLIC LECTURES.

SATURDAY, DECEMBER 8.

HORNIMAN MUSEUM (Forest Hill), at 3.30.—Dr. E. M. Delf: Sunlight and Life.

MONDAY, DECEMBER 10.

UNIVERSITY COLLEGE, at 5.30.—Prof. J. N. Brönsted: Some Chapters in the Recent Development of the Theory of Electrolytic Dissociation. (Succeeding Lectures on December 12 and 14.)

TUESDAY, DECEMBER 11.

ROYAL COLLEGE OF SURGEONS OF ENGLAND, at 4.—F. W. Twort: The Influence of Environment on the Life of Bacteria. (Succeeding Lectures on December 13, 17, 18, and 19.)

ROYAL INSTITUTE OF PUBLIC HEALTH, at 5.—Prof. D. Levaditi: Harben Lectures. (Succeeding Lectures on December 12 and 13.)

KING'S COLLEGE, at 5.30.—Miss Hilda D. Oakeley: The Roots of Early Greek Philosophy: Ethical.

WEDNESDAY, DECEMBER 12.

ROYAL INSTITUTE OF PUBLIC HEALTH, at 4.—H. D. Herring: The Disposal of the Dead, with Special Reference to Cremation.

WESTFIELD COLLEGE (Hampstead), at 5.15.—Prof. Craigie: The Making of a Dictionary.

THURSDAY, DECEMBER 13.

KING'S COLLEGE, at 5.30.—Prof. Seton Watson: The Balkan States and Europe (League of Nations Union Lecture).

UNIVERSITY COLLEGE, at 5.30.—Miss M. A. Murray: Matrilineal Descent.

SATURDAY, DECEMBER 15.

HORNIMAN MUSEUM (Forest Hill), at 3.30.—Miss M. A. Murray: My Excavations in Malta.