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Research Workers in Industry.

In a letter published in Nature of July 5, Mr. K. Hickman refers to the passing of the old academic feeling that there is something vaguely discreditable in a discovery which could be put to practical use. Relations between the universities and industry have undoubtedly become much closer in recent years, and increased contact has enhanced mutual respect, but there is still in some quarters a disinclination to accord to a piece of industrial research the same respect or academic recognition that would be paid to a similar research carried out in the university itself. The publication of scientific work carried out by industrial organisations of the type that Mr. Hickman cites will accelerate the passing of this attitude, although it must be admitted that industry in Great Britain is more reluctant to allow publication than is the case in the United States of America.

To leave all scientific research to industry would, however, be a dubious policy. There are large sections of industry where the value of scientific research is unrecognised, and there are other sections where the research department is still the first to be curtailed at any time of stringency. Even in those sections of industry where the most enlightened view of research prevails, in the main the lines of research which are undertaken must have some relation to production or economic possibilities. Few research workers in industry have not had repeatedly to pass by problems of scientific interest in favour of more urgent industrial ones. This inevitable limitation is recognised by some industrial firms, and an appreciable proportion of the purely scientific research carried out in British universities has probably been suggested or inspired by contact with industry. It may be a tragedy that the universities are unable to provide the whole environment of research, leisure and remuneration necessary to secure the best men to train young scientific workers for industry ; it is no less a tragedy if they do not offer conditions which attract the best brains for a career of scientific research.

The realisation that the conditions and remuneration offered to those adopting a career of scientific research do not, to say the least, ensure attracting the ablest young men of science, or still more, in the absence of a definite bent, induce the most promising young men to undergo training in science in preference to training for careers

in law, medicine, or applied science, is responsible for much of the anxiety as to the position of fundamental research. There is no lack of candidates for positions in industry. Only in a few cases in recent years have the principals of technical colleges and similar institutions found themselves with more applications for graduates than they were able to supply. The unemployment situation, of course, affects the employment of science graduates in industry, and the existence of unemployment on a large scale in Europe seriously prejudices the employment of alien scientific workers anywhere. This is our reply to a correspondent from Bucharest, who, quoting the remark "not even a handsome salary has been able to attract a really first class organic chemist of the younger generation", from the leading article on "The Position of Fundamental Research" in NATURE of May 31, asks what prospects exist in Great Britain for an alien scientific worker fully qualified to occupy an academic or an industrial post. The engagement of an alien is quite naturally resented when unemployed nationals are available, and particularly when, as has frequently been the case, the alien is willing to accept a salary and conditions which scientific workers in Great Britain have declined.

The efforts of the British Association of Chemists have done something to redress the employment of alien chemists to the prejudice of British chemists. While no barrier exists to the engagement in industry of an alien chemist or other scientific worker, if it can be shown that he possesses special qualifications which are not possessed by available British workers, the Ministry of Labour, the permit and approval of which are required for any such appointment, is unlikely to sanction the engagement of an alien at a salary lower than that which a British man of science of equal standing could reasonably be expected to accept. Such a permit is, moreover, usually given for a limited period and on condition that a British chemist, for example, is appointed to study under the alien.

Purely scientific appointments would, of course, largely be influenced by similar considerations, and only an improvement in the general European employment situation and an abatement, through the efforts of the Committee on Intellectual Co-operation and others, of national prejudices, of which the growth of tariff barriers is only another example, is likely to promote the employment of scientific workers by other than their own nationals.

Discursive Meteorology.

Manual of Meteorology. By Sir Napier Shaw, with the assistance of Elaine Austin. Vol. 3: *The Physical Processes of Weather.* Pp. xxviii+445. (Cambridge: At the University Press, 1930.) 36*s*. net.

THE New English Dictionary defines a manual as a small book for handy use, a concise treatise, an abridgment, a 'handbook'; 'often used as a title for books'. Probably the average reader thinks of a manual as a book of a systematic character, fairly complete and, probably, rather dry and colourless, kept at hand for information on any topic within its scope that may arise from time to time. But while Sir Napier Shaw is not careless in his choice of words, his book somewhat belies the hopes and the fears which its title might inspire; for it is both worse and better than this suggests.

On one hand, the work is far from being complete or systematic; but the author forestalls comment on this score, by a candid account of his thoughts while choosing a sub-title for this, the third of the four projected volumes of his manual:

"As far as may be" (he says) "we desire to give an insight into the physical processes that are operative in the control of weather. Our purpose is in fact to call the attention of the reader to the processes which can be recognized as physical, in the hope that he will be sufficiently interested to seek for any additional guidance that he may find necessary in the recognized treatises on the different parts of the subject. The achievement of that purpose implies the selection of a number of subjects from the recognized text-books on physics. Our presentation may be incomplete and disjointed; and for that reason a suggestion was made to define the scope of the volume with the title 'Miscellanea physica', but that was found to be more recondite than wise."

The title, however, does less than justice to the volume, in that much of the book is delightful 'popular' science, using the adjective in a wholly complimentary and respectful sense. Sir Napier is probably capable of doing for meteorology what Sir James Jeans and Sir Arthur Eddington have done for astronomy—make it a subject of keen intelligent interest to a considerable lay public, not by a mere recital of natural marvels, but by an attractive and simplified yet serious exposition of its progress and present problems. This, however, is not his object in the manual. His aim is rather to expound his subject in a wide discursive way, primarily for the benefit of the meteorologist and physicist; and though the book is not mathematical

in character, he does not shirk formulæ and difficult ideas. But he reverts frequently to fundamental principles—too often lost sight of during attacks on complicated problems—and often illuminates the mysteries of meteorology in a vivid and attractive way. In doing so he makes effective use, from time to time, of quotations from great writers of a past generation, with whose works present-day students may have little direct acquaintance.

The book is divided into ten chapters. The first three are only slightly connected with the remaining seven: they are devoted to gravity waves in water and air; sound waves; and atmospheric optics. They will be among the most interesting to the lay reader, because of the pleasant way in which they are treated; to the serious worker, however, they may appear superficial, omitting much that might, and perhaps should, be included in any general discussion of these topics. Another chapter (ix.) which stands slightly apart from the rest of the book is devoted to electrical energy in the atmosphere; this deals with atmospheric electricity and thunderstorms in an interesting way, without attempting to reconcile opposing views.

Here and there, in these and other chapters, the details are treated rather too casually, though usually with no serious ill result. Two examples must suffice: on p. 102 McLennan's work on the green auroral line is cited in a quotation from an article on the physics of the globe by another writer; here a direct reference to, or quotation from, McLennan himself would surely have been better. Again, on p. 74, in connexion with the blue of the sky, the size of molecules receives mention as follows: "Molecules are much smaller than the particles which form clouds. According to Rutherford and Geiger there are $\cdot 272 \times 10^{20}$ in a cubic centimetre. Whetham suggests that there are not more than ten million in a row of the length of a millimetre." The last sentence may leave the uninstructed reader with the impression that good authorities incline to think, but at present only tentatively, that the diameter of a molecule is not less than 10^{-8} cm.; but the middle sentence, which the physicist will recognise as referring to the number of molecules in a cubic centimetre of gas at normal temperature and pressure (in which actually the molecules are rather widely separated from each other), may seem to invoke the name of Rutherford in favour of a diameter rather larger than 10^{-7} cm.

A feature of the book is the considerable number of technical terms and usages adopted in it, many of them of the author's introduction. Every science requires its own technical terms and symbols, but one cannot always sympathise with the author's complaint of unsuitability and redundance in those of physics, on which he partly bases the advocacy of new terms and units. Some of his own usages arouse criticism, in particular, that of *tt* to denote absolute temperature (not only in the form 300° *tt*, but also in formulæ); why should not meteorologists adopt the now growing physical practice of writing 'K' to denote the Kelvin absolute scale, just as 'C' and 'F' are used for the Centigrade and Fahrenheit scales?

The scientific importance of the book must be judged, however, mainly with reference to the six chapters that deal with the atmosphere as a heat engine. Their scope and nature may be indicated by quotation of the chapter titles: Radiation and its problems; the controlling influence of radiation; air as worker; the liability of the environment; side-light on convexion and cloud; convexion in the general circulation (Ch. x.). It is impossible here to discuss these chapters in any detail, but the author may be congratulated on his courage in attempting an extraordinarily difficult task, and on the degree of success which he has achieved in it. The development of heat engines for industrial purposes has occupied large numbers of able minds for several generations, and despite all the facilities for experiment and trial, finality in this field still lies far ahead. The meteorologist is confronted with an infinitely more difficult problem, that of unravelling the workings of the atmospheric heat engine. Like the engineer, he has been forced to invent measuring instruments for the input and output of energy; the author has conferred a benefit in making a knowledge of this work, and its results, more readily available than would otherwise be the case. He shows how meteorological circumstances, themselves ultimately controlled by the supply of solar radiation, modify the effective input of this radiative energy into the atmosphere, by letting it reach the ground in some places and on some days, while in other cases it may be largely turned back into space by reflection from clouds without being able to exert much influence on the atmosphere.

The greatest difficulties that arise in the meteorologist's quest are those encountered when the influence of radiation on meteorology is examined, in conjunction with the secondary influences of the earth's spin, the distribution of land, water, and ice with the associated water vapour, and also the dust present in the air. Sir Napier here introduces us to "a succession of notes of interrogation; the

one undeniable achievement in that part of the subject" (dealing with the balance of radiation) "is apparently that within 2 per cent, by suitable redistribution, the radiation which is gained from the sun is lost again to space within the month".

In attempting to trace the energy in its transformation in the atmosphere, it is necessary to combine the theory of heat and heat engines with hydrodynamical theory; in this volume, however, the author confines himself to "the assistance meteorology can expect from the theory of heat before making an appeal" (in volume 4) "to those universal providers the general equations of motion". This may seem like presenting "Romeo and Juliet" with one of the two lovers left out of the play; but the author may justly reply that they are not together on the stage in every scene, and he has at any rate thrown valuable light on some of the heat processes in the atmosphere, by his discussion of them from the entropy point of view, using entropy-temperature diagrams. Opinions may differ as to the relative merits of different ways of regarding and representing a given set of facts, but in the present state of meteorology it is good to have the phenomena examined from many angles; in the application and development of his own special views and methods, Sir Napier here shows all his accustomed thoroughness.

In conclusion, a tribute of admiration and respect may be paid to the devotion with which the author has followed his chosen plan of gathering together into these volumes the knowledge gained in his long and active service to his science; his readers will hope ere long to see the completion of this work by the publication of the remaining volume.

Soil Genesis and Morphology.

The Great Soil Groups of the World and their Development. By Prof. Dr. K. D. Glinka. Translated from the German by C. F. Marbut. Pp. iv+235. (Ann Arbor, Mich.: Edwards Bros.; London: Thomas Murby and Co., 1928.) 15*s*. net.

TO paraphrase the words of Wurtz regarding chemistry, "Pedology is a Russian science; it was founded by Dokutschajeff of immortal memory". Such a statement would receive a much more general assent than that of Wurtz, because in no other science is the influence of one country so marked: the Russian names of some of the important soil groups have already become so anglicised that such a word as 'podsolised' is widely used and understood.

In recent years, much of the Russian work on soils has been made accessible to English-speaking people by the issue by the Russian Academy of Sciences of a series of bulletins in English; whilst their American colleagues have assisted in respect of the work of Gedroiz and Glinka. A large selection of the papers of the former has been translated and issued privately in a series of multigraphed bulletins dealing with soil chemistry and physics, and in the volume under consideration, Dr. Marbut has done the same for Glinka. This book deals with pure pedology—soil genesis and morphology—and is one of the first in English on the subject. As stated in the preface to the original, Glinka wrote it in German in order to bring Russian views on pedology before western readers. It was published in 1914, and no subsequent edition appears to have been published. In 1917, Ramann published his small book on the same subject based largely on Russian work: it was translated into English by Dr. C. L. Whittles in 1928, and these two translations appear to constitute the entire pedological library in English. Both belong to the pre-War period.

The post-War interest of English-speaking students in pedology has been greatly strengthened by the meetings of the International Society of Soil Science inaugurated in Rome in 1924: both Ramann and Glinka were present at the meeting, and the respect and affection in which they were held by all nationalities was memorable. Ramann, then an old man, died soon afterwards. Glinka, much younger, took an active part in the International Congress held in Washington in the summer of 1927, and was to have presided over that being held in Russia this month. His death in the November following the American meeting was a great loss to soil science and to a large number of friends in many countries.

Dr. Marbut has carried out his task of translation in a self-effacing manner. The original is faithfully followed, and there is an absence of editorial footnotes or square-bracketed insertions by which translators so often convey their own views. He has, however, found it necessary to translate the title according to American nomenclature, "Typen der Bodenbildung" becoming "Great Soil Groups". This is presumably due to an important difference in the meaning of 'soil-type' as used by American and continental writers; the former use 'type' as the smallest subdivision in soil classification, and the latter as the largest. This unfortunate lack of uniformity has probably gone too far to correct. (It may be mentioned

that Great Britain is apparently following America as regards the use of ' soil-type ').

The publishers are evidently not optimistic as to sales, as the book is multigraphed and not printed; only one side of the paper is used, and this results in a somewhat bulky volume, notwithstanding that the second part (120 pages), dealing with the soil-zones of Russia, is omitted altogether. The same applies to the 63 photographs and the soil map of Russia. It would have been well, perhaps, to mention these omissions in the translator's preface. More important and somewhat inconvenient is the absence of both table of contents and index.

As has been stated, the translation follows the original faithfully: its course is leisurely, space being found for a quotation nearly half a page long, from J. S. Mill, on classification.

The greater part of the book is devoted to *ektodynamomorphic* soils, that is, those in which climatic and other external factors in soil formation predominate over internal ones such as geological composition. Glinka accepts moisture conditions as the dominant factor in classification, and distinguishes six classes the moisture contents of which are optimum, average, moderate, insufficient, excessive, and temporarily excessive, respectively. *Endodynamomorphic* soils are those in which external factors have not yet exerted their full influence and which are therefore immature: they are dealt with only briefly.

The profiles are described with a wealth of morphological detail and are supported by a mass of analytical data almost bewildering in their profusion. It is to be hoped that future authors will give more guidance in interpreting such data, and will perhaps effect considerable economies in space. For example, it does not seem necessary to recalculate a long table of figures to show the results of analysis on an ignited basis as well as on the original soil, especially as no conclusions are drawn from them. The reviewer also hopes that the time is coming when the analysis of complete (unfractionated) soils will be a rare event. A soil can be separated into parts having various functions, and it is the analysis of the separated parts which alone can throw light on the relation of composition to properties and mode of formation. The analysis of a whole soil seems analogous to passing the whole body of an animal through a mincing machine and analysing the resulting mixture of bone, fluids, and soft parts, a procedure which would effectually conceal the facts of physiological chemistry.

The book will undoubtedly further the object of the translator in making the pioneer work of Glinka and the Russian school more widely known. It is to be hoped that it will also bring home to our own pedologists the lack of an original treatise in English on the subject, and so stimulate the production of a modern account of the soils of the British Empire.

Campbell Swinton's Reminiscences.

Autobiographical and other Writings. By Alan A. Campbell Swinton. Pp. ix + 181 + 18 plates. (London, New York and Toronto: Longmans, Green and Co., Ltd., 1930). 10*s.* 6*d.* net.

IN the preface to " Rob Roy " Sir Walter Scott remarks that no introduction can be more appropriate than an account of the singular character whose name is given on the title-page, who owed his fame in great measure to his residing on the very verge of the Highlands, and who possessed the advantage of descent from a clan famous for their misfortunes, and for the indomitable spirit with which they maintained themselves. Equally appropriate as an introduction to an enchanting story—though this time of men and things that have influenced the advance, during the last half-century, of physics and engineering—is the autobiography of Campbell Swinton. His kindly hand, that had just completed the writing of this book, has vanished; his friendly voice is still, yet his name will be perpetuated, not as he hoped in the legend of his descent, but in the useful part he took in the border struggle of natural science and its applications. Readers of this attractive volume of reminiscences may not all be acquainted with the fact that the author's thoughts were ever oscillating between the memory of his family's antiquity and the most recent activity in optics, telephony, turbines, or public affairs that required comment from him. His progenitors ranged through about eight centuries, from Hernulf son of Odard, son of Liulf. His happiest moments were when somebody could be beguiled into hinting that to refer too often to personal ancestry is to be a bore; for then he would laugh heartily, and cite the dictum of Silvanus Thompson, that all the élite of the intellectual world are bores, including ourselves.

Campbell Swinton was born in Edinburgh in 1863. He was educated there and in France, until eighteen years of age, when he came to England. His impressions of schoolboy life in a Scottish educational establishment remained to the end clear, penetrating, and embittered. He states in this volume that he " always loathed games, from earliest childhood ", and he looked back with horror

upon the three years at a school where all spare time had to be given to compulsory games. Being the kind of boy he was, his school may have been an unfortunate choice on the part of his parents. In the next phase of his career, however, they made full amends by apprenticing him, in 1882, to Sir William Armstrong, for this gave to his activities full scope. Upon mechanical and electrical devices, photography, and the last word concerning the last miracle in natural phenomena, he was ever intent, but as he applied himself to mathematics with as little zest as he did to games, his movements were in some directions restricted. Nevertheless, as he possessed shrewd native knowledge of quantities, his judgment on broad issues was usually sound.

Those who knew Campbell Swinton best were aware that although he sought information in discourses at the Royal Society, the Royal Institution, and the Royal Society of Arts, about material things, his mind was set as much upon determining who's who as upon what's what. Circumstances, and his propensities, as well as his descent, brought him into the company of people of distinction and some of eminence. One consequence was that he accumulated anecdotes and photographs, many of which illustrate if they do not adorn this tale. His wide and intimate knowledge of the facts of progress, particularly of those relating to electrical science, render his contributions to history, here and there, very precious. For example, what he did in tribute to the work of David Hughes, and what he now has written concerning Graham Bell, Swan, R. W. Wood, Lane Fox, and Creed, shows with what perception and equity he could hold the balance. Concerning his own contributions he is modest and amusing, with the result that the autobiography is a fitting reminder of one who did much for his time, and did it pleasantly.

Photo-electric Cells.

Photo-electric Cells: their Properties, Use and Applications. By Norman Robert Campbell and Dorothy Ritchie. Pp. vii + 209. (London: Sir Isaac Pitman and Sons, Ltd., 1929.) 15*s.* net.

WITH the remarkable growth in the application of the photo-electric cell to almost all branches of industry, the need for a book dealing specially and fully with it has become increasingly acute. This want is now well filled by the publication of the volume under review. It is a striking fact that while the immense literature dealing with the selenium cell is concerned mainly with its use, the yet larger literature on the photo-electric effect is concerned almost entirely with theoretical considerations. As the authors state in their preface, the aim of their book is to redress the balance.

The subject matter falls naturally into three parts, which deal respectively with the theory and properties of photo-electric cells, their use, and their application to various special problems.

In the first part the authors have largely avoided the error of introducing too much theory—a fault which sometimes occurs in books which are essentially practical. We say 'fault' because it seems to us that the right place for general theoretical considerations is in a theoretical text-book, and that in a practical book on photo-electric cells only such general theory of the photo-electric effect as is essential to ensure the rational and most efficient use of the cell should be introduced. In the reasonable amount of theory given in Part 1 there are few criticisms that we would make; perhaps the most serious one is that the authors' statement that the photo-electrons are the 'free' electrons of the metal (p. 12) is not one which is generally accepted. Part 1 is crammed with useful information; Chapters v. and vi., dealing with the electric discharge and voltage current characteristics, are intensely interesting and need only to be read to be appreciated by those who use photo-electric cells. The last chapter in Part 1 is on the choice of a photo-electric cell, and here the authors' known preference for the vacuum rather than the gas-filled type is emphasised, perhaps too strongly. For though they admit that gas-filled cells are the only kind worthy of consideration for many important purposes, they say that they "need skilful handling, and are never wholly trustworthy"—a statement which seems rather exaggerated.

Anyone who intends to use photo-electric cells for the first time cannot possibly do better than read Part 2 of this book, where, after dealing with some general principles of their use, electrostatic and valve amplification circuits are discussed. The latter are specially interesting, although even already they do not represent the latest ideas, as Dr. Campbell showed at the recent joint meeting of the Physical and Optical Societies, when photo-electric cells were the subject under discussion.

In the third section, dealing with the applications of photo-electric cells, there are four chapters on the measurement of luminous flux, illumination, colour and light absorption.

There are extremely few misprints, and such small mistakes in an extremely valuable book can easily be rectified in a second edition, which we hope and expect will soon be necessary. F. C. T.

Our Bookshelf.

A German-English Technical and Scientific Dictionary. By A. Webel. Pp. xii + 887. (London: George Routledge and Sons, Ltd., 1930.) 36*s*. net.

THERE is every reason to suppose that this dictionary will quickly assume and long retain a place on the most easily accessible shelves of both private and public libraries. The translation of technical German is a task which falls frequently to the lot of scientific people; most of the members of the scientific professions probably have what is euphemistically called a 'reading knowledge' of the language (if they have not they would be wise to repair the omission), but probably comparatively few are in possession of an exhaustive and intimate acquaintance with the less common words and niceties of expression appropriate to their subject. To most people a good dictionary is frequently a necessity in ascertaining the exact meaning of technical expressions, and most people require that the dictionary shall not only serve their subject, but also be up-to-date. It is sometimes alleged that the English equivalents of German technical terms are easily guessed; this is no doubt sometimes true, but more often a delusion and a snare, and in any event scientific people have little use for guesswork. Mr. Webel has provided us with a substantial book of reference, and he has striven to clarify the alternative technical meanings by indicating the branches in which they are used and sometimes by including formulæ, properties, or systematic nomenclature. The publishers, too, have seen to it that the type and paper are such as to be convenient in use.

The true test of a dictionary is, of course, service, and a reviewer can scarcely report critically on performance until he has used the book constantly for a long period. The vocabulary is, however, obviously fairly exhaustive as regards chemistry, mineralogy, and botany, and substantially adequate as regards general words and terms in allied and applied sciences. Random tests with a few dozen terms encountered in chemistry and chemical technology were highly satisfactory, except perhaps in one or two cases in the field common to chemistry and medicine. There are sixteen pages of abbreviations, and 143 pages of botanical names with their English and German equivalents. Every word has been provided with a five-figure code number. The author's friends were indeed well advised in persuading him to publish what was originally intended to be a private work of reference. A. A. E.

The Bridle of Pegasus: Studies in Magic, Mythology, and Folklore. By Warren R. Dawson. Pp. xv + 203. (London: Methuen and Co., Ltd., 1930.) 7*s*. 6*d*. net.

IN this volume Mr. Dawson has gathered together a number of essays on various subjects of cognate interest. Each deals with some manifestation of the magical idea in antiquity, usually in Egypt, which is then followed up in its historical setting to modern times. As will be anticipated by those who have followed Mr. Dawson's previous work, his subjects are for the most part connected more or less immediately with medicine and its practice. Thus one chapter deals with the use of the mummy as a drug—an interesting example of the working of the mind in transferring the supposed attributes of one substance to another under the influence of a magical concept. Another deals with the use of birthwort as an example of the progress of medical botany in twenty-three centuries.

The first two chapters are ingeniously suggestive. In the first the author deals with the rite of Amphidromia in Ancient Greece, in which the father on a certain day after a birth ran around the hearth with the child in his arms. This custom he brings into relation with the modern belief in the fairy changeling, and suggests that it was a test of the genuineness of the child. May it not have been something more, and does this explanation give full weight to the significance of the hearth? May it not have been both a test and a ceremony in the nature of bestowing the 'freedom' of the family on the new member. The second chapter suggests that the Harpies of Greek legend may have been a distorted memory of the great fruit-eating bats of India—an ingenious explanation of a curious example of the monstrous in Greek lore.

In dealing with nose-rubbing and salutations, Egyptian ritual practice is suggested as the origin of the kiss. The physiological explanation is set aside; but surely the author here ignores certain obvious facts. Even in smelling, to which the Egyptian philological evidence points as the original form of the salutation, there is a fundamental sexual and physiological element, which is strengthened in the transfer of the salute from the nose to the mouth. Both smelling and licking are so obviously gratificatory in the animal world that it is difficult to believe that in man the gratification—and there can be no question as to the fact—is derivative as a secondary character from a ceremonial practice.

The Terminology of Physical Science. By Dr. Duane Roller. Pp. 115. (Norman, Okla.: University of Oklahoma Press, 1929.) 1 dollar.

THIS little book, not much more than a pamphlet, is praiseworthy as an attempt to fill a gap increasingly felt as science teaching extends. It discusses the meaning of a number of terms found troublesome to the students of the physics department of the University of Oklahoma. The author also aims at simplifying innovations which have not yet gained general usage. Force, gravitation constant, radiation are examples of terms thus discussed, at greatest length. There are three shorter chapters on pronunciation, suffixes and prefixes, and the names of the elements—all quite elementary, but none the worse for that.

The book and its obvious utility remind one of the problem which is already serious in all countries where modern science is being taught to persons of another language and culture, for example, India, China, Egypt and other Arabic-speaking lands. Are such people to try to find equivalents in their

own speech for Western terms, or are they to adopt the original words of the founders and thus ultimately create a common fund of scientific terminology? There surely can be no two answers to this question. Every consideration, of clearness, of filiation to the original conception, of the community of men of science all over the world, points to the latter course. Dr. Roller's work should be an encouragement to those engaged in such classes to do something of the same kind. His is purely physical; no doubt in other branches other people elsewhere have tried the same thing. There was once a useful popular book by Stormonth on scientific terms. Is there a more recent work on similar lines? F. S. M.

X-rays. By Dr. B. L. Worsnop. (Methuen's Monographs on Physical Subjects.) Pp. ix + 101. (London: Methuen and Co., Ltd., 1930.) 2*s.* 6*d.* net.

IT is appropriate that one of the early volumes of Methuen's Monographs on Physical Subjects should deal with X-rays, which have proved so powerful a tool of modern physics in the elucidation of the fine structure of atoms and of the solid state. Whilst Dr. Worsnop's book gives a good general survey of the subject, it lacks the almost faddy attention to detail that one expects from an editor. For example, in the excellent bibliography of books, only one date is given, and in the text a reference appears as merely "*Physical Review*, 1923". The essential features of X-ray tubes could have been as well illustrated with the modern as with the old-fashioned sealed types (Figs. 1 and 2), in which the large spherical bulb prevents a close approach of one end of the collimating system to the focal region. Shearer and line-focus tubes are not mentioned.

Although a later volume in the series is devoted specifically to X-ray crystallography, the use of crystals as gratings for the study of X-rays is of such importance as to necessitate a brief account of some crystallographic details. These are not all explained so clearly as is desirable in a book intended for students. For example, a highly symmetrical arrangement of spots such as that shown in Fig. 7 is not an essential feature of a Laue photograph, since it is obtained only in very special circumstances. The section on crystal structure, pp. 24-26, should be rewritten with a clearer distinction between general results and those applicable only to orthogonal crystals. The final chapter wisely deals with the recent successful experiments on reflection, refraction, and ruled-grating diffraction in which the early attempts were failures.

Microscopic Pharmacognosy. By Prof. William Mansfield. Pp. x + 211. (New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1929.) 15*s.* net.

THIS work contains detailed descriptions of the minute structure of nearly a hundred of the more important vegetable drugs. The text consists of descriptions of the different tissues of the plants dealt with, the species being described under both botanical and pharmaceutical names. The species are divided into one of several main categories according to the part of the plant used—whether leaf, stem, root, or bark, etc. An important feature of the book is the clear full-page drawings of the anatomical structure of each plant described, which show the more important diagnostic characters.

As some of the plants dealt with are not official drugs, according to the U.S. Pharmacopœia, their inclusion in the work might be objected to on the ground that their exclusion would have made room for other more important drugs. However, as the space occupied by them is small and is devoted to such everyday substances as insect powder (*Chrysanthemum cinerariæfolium*), horehound (*Marrubium vulgare*), etc., their inclusion is not a serious matter. The work is a useful addition to the literature of medicinal botany, and will serve as an authoritative text in microscopic pharmacognosy for students of pharmacy and as a reference book for pharmacists and drug analysts.

Gari-Gari: der Ruf der afrikanischen Wildnis. Von Hugo Adolf Bernatzik. Pp. vii + 144 + 80 Tafeln. (Wien: L. W. Seidel und Sohn, 1930.) 10*s.*

IN this volume the author describes a journey through the Sudan in which he attained the ambition which had held him since his boyhood—a hunting and fishing expedition in Africa. His visit to the Sudanese tribes—Shilluk, Nuer, and Dinka—inspired him with an enthusiasm for the black man of the Sudan equal to his interest in its wild life. He describes their tribal life, their daily routine, their dances, and their festivals and feasts as he saw them, in something more than an impressionist spirit. While the book has no small merit as a description of the country and its people, its special attraction lies in its illustrations. These, 160 in number, in their happy choice of subject and in their technical excellence, form a collection which is probably unique in any printed book on the Sudan.

Experimental Physics: a Laboratory Manual. By Prof. A. E. Caswell. Pp. ix + 181. (New York: The Macmillan Co., 1928.) 6*s.*

ALTHOUGH it is usual for every teaching laboratory to have its own scheme of practical work, description of a course adopted elsewhere will often suggest useful changes either in general procedure or in the details of certain experiments. Prof. Caswell's book offers several such hints, notably for experiments in mechanics; impulse and momentum, and the general properties of machines are studied by two neat devices involving flowing water, the extension of a wire is measured by an optical lever method, and the density of air found from the mass of an old incandescent lamp before and after it has been cracked open. Two good calorimetric experiments are also described with ordinary gas burners, and an electrolytic method given for mapping fields of force.

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.*]

Microphotometric Analysis of Movietone Sound Records.

IT occurred to me while attending tests of a new modification of a fog alarm at Buffalo on Oct. 22, 1929, that use could be made of the 'Movietone camera' to obtain valuable information as to the nature of the signals and at the same time provide a permanent record for detailed study. A good instrument is nearly as sensitive as the human ear, and everything pertaining to the recorded sound is registered.

Some years ago I designed, but have not yet actually constructed, a sound unit of variable pitch, the emission of which may be recorded. It is based on the tunable diaphragm of variable frequency described

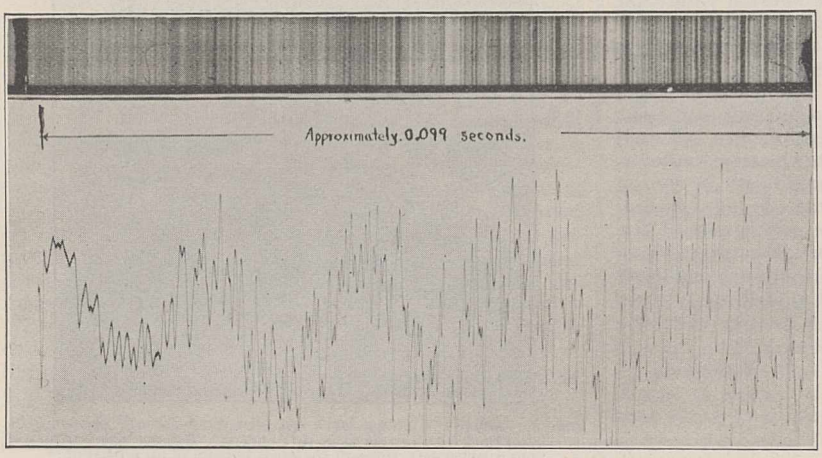

FIG. 1.

in the *Journal of Scientific Instruments*.[1] The formula by means of which emission may be calculated can be found in a short article by me on the characteristics of telephone receivers.[2]

With such a sound standard at a known distance from the movietone microphone, a record of pitch and intensity of pure notes covering a wide range of frequencies and intensities may be recorded on the film immediately before and after the signal to be studied.

By passing the film through a Mohl microphotometer, as is done in the analysis of complex optical spectra, a record capable of interpretation in terms of intensity, quality, and frequency may be obtained.

Fig. 1 is a reproduction of a movietone film of an orchestra and the microphotometric record of the music recorded. I am indebted to the courtesy of Dr. G. O. Langstroth, of McGill University, for his skill in making the above Mohl record.

It is obvious that a more detailed study of this method of sound analysis and measurement is worthy of further study, not only in its application to the study of complex musical sounds, but also in the study of noise, so characteristic of our rapidly developing mechanical civilisation.

LOUIS V. KING.

Macdonald Physics Building,
McGill University, May 31.

[1] "Characteristics of Continuously Tunable Diaphragms." *Jour. Sci. Instr.*, May 1926.
[2] "On the Determination of the Electrical and Acoustic Characteristics of Telephone Receivers." *Journal of the Franklin Institute*, May 1919.

Formation of Streamers in Sedimentation.

DR. C. E. MARSHALL has recently described a method (*Proc. Roy. Soc.* A, 126, pp. 427-439; 1930) by which he claims that the size distribution of particles in a weak suspension of clay or similar material with particles of 2μ-$20\mu\mu$ diameter can be accurately determined. A high-speed laboratory centrifuge is used, each tube being nearly filled with a solution of cane-sugar or urea and a small quantity of the aqueous suspension (which has a lower density) is carefully poured on the top. A determination of the weight of sediment collected on the bottom of the tube in a measured time is used by Marshall to determine the weight of the particles which exceed a certain size, it being assumed that all the particles start from the top of the column at approximately the same time and settle through the solution in accordance with Stokes's Law. In discussing the method the author remarks: "It has not been found possible, so far, to apply these principles with any accuracy to the case of sedimentation under gravity. . . . Owing to slight variations in temperature or concentration the upper liquid sends down 'streamers' of suspension into the heavier liquid below." In advocating the use of the high-speed centrifuge he says: "The boundary between the two liquids actually becomes more sharply defined as centrifuging proceeds, and even if 'streamer' formation has begun, the liquid of low density moves rapidly back into place under its action."

We have repeated the experiments under gravity, and conclude that the explanation of 'streamer' formation is as follows.

As the sugar solution is denser than the suspension the system is initially stable. This stability is only transitory, however, as under the action of gravity the particles pass from the suspension through the interface and enter the sugar solution the uppermost layer of which, being now laden with particles, has a greater density than the rest. It consequently breaks up and 'streams' down through the clear solution. As long as the dense layer is reformed by the entrance of more particles into the sugar solution so long does streaming continue, with the result that many of the clay particles reach the bottom of the vessel very much sooner than if they had settled individually through a stationary solution in accordance with Stokes's Law.

Marshall's statement that streamers do not form during centrifuging is presumably based on the belief that the streamers have a *lower* density than the solution, which is clearly implied in the quotations given above. There appears to be no justification for this belief, and it is difficult to see why liquid lighter than the sugar solution should move rapidly downwards through it for many centimetres in a normal gravitational field. If, however, it be admitted that this streaming liquid is sugar solution containing particles and is therefore denser than the clear solution, it is very singular if it really "moves rapidly back" on centrifuging.

Naturally the arguments based on observed behaviour in a normal gravitation field cannot safely be transferred unaltered to the condition in the centrifugal field used in Marshall's method. A mathematical examination of the fate of the 'streamers' in the latter case presents great difficulties, but an

experimental examination is no doubt feasible. It is to be hoped that Dr. Marshall will be able to show that his ingenious method is not seriously affected by the point to which we have directed attention.

B. A. KEEN.
K. R. SCHOFIELD.
Rothamsted Experimental Station,
Harpenden.

MY belief that 'streamer' formation does not occur to any appreciable extent under the influence of the high-speed centrifuge is based on the following observations:

1. Since publishing the paper to which Dr. Keen and Dr. Schofield refer I have adapted the centrifuge to the determination of the fraction 2μ-1μ, by reducing its speed. This determination can be checked by the pipette method and a good agreement between the two has been found. Since 'streamer' formation would affect this fraction more than any other, the experimental evidence would appear to be against its playing an appreciable part.

2. If a clay is centrifuged for so short a time that the largest particles present can only traverse half the lower liquid, then a satisfactory boundary is found in approximately the calculated position, the lower half of the liquid remaining clear.

The above facts would appear to provide sufficient evidence that the centrifuge method is not affected by 'streamers'. The question as to the true explanation of 'streamer' formation under gravity is one on which I am not prepared to undertake a long investigation. It should be noted that the movement of the 'streamers' downwards under gravity does not exclude the operation of factors other than those considered by Keen and Schofield, and that it is still not certain that the 'streamers' are of greater density than the liquid in which they move.

C. E. MARSHALL.
Dept. of Agriculture,
University, Leeds.

The Feeding of Ammocœtes.

IN accounts of the Cyclostomata it is generally said that the Ammocœtes larva of the lamprey feeds by means of a current of water caused by the action of its pharyngeal cilia, and that food particles, entangled in mucus, are carried back to the gullet in the same way as in *Amphioxus* or in an Ascidian (cf. "Encycl. Britt.", 14th ed., art. Cyclostomata).

The presence of a mucus-secreting gland in the floor of the pharynx, and of a ciliated tract leading forward from the opening of this gland—by way of lateral tracts—to a dorsal ciliated ridge, are arrangements so similar to those found in *Amphioxus* that it is natural to assume that they serve the same purpose, and in the same way, in both animals. When we add that Ammocœtes passes the whole of its life, until metamorphosis, buried in sand or mud, and that it has in its buccal hood a 'velum' and a straining apparatus in the form of tentacles, the resemblance seems almost complete.

During the last two years, I have had access to a fairly abundant supply of larval lampreys, and my observation of the living animals—confirmed by the examination of serial sections—makes it clear that their similarity to *Amphioxus* is deceptive.

The gill-bars of the larval lamprey bear no cilia that could cause a current of water through the pharynx. Indeed, a very cursory examination of a living animal, as it lies at rest, shows that the whole pharynx is in constant motion and acts as a muscular pump. Young larvæ (1 cm. to 2 cm. long) are transparent, and in them the action of the velum can be well observed under the microscope. The two velar folds execute a constant rhythmical movement, backwards and forwards, the right and left folds beating synchronously. The backward motion of one of these folds, seen from above or below, may be likened to the grasping or 'snatching' action of a hand in which the thumb is held parallel with the fingers. When a small larva is immersed in a suspension of Indian ink, and the pumping action of the pharynx temporarily ceases, it is seen that the velar movements alone can maintain a current of water through the pharynx.

I believe, however, that these movements have a second function. The ciliated tracts which sweep round the sides of the pharynx, to meet in the median dorsal ridge, take the form of grooves, each situated on the crest of a salient ridge. I have been able to demonstrate a ciliary current in these grooves, passing forwards and upwards, carrying mucus from the ventral gland. Now, the position and aspect of the lateral grooves place them in the trajectory of the edges of the velar folds when these folds execute their grasping movement; and in this way, I believe, the mucus is dislodged, to pass backwards in strands in the respiratory current.

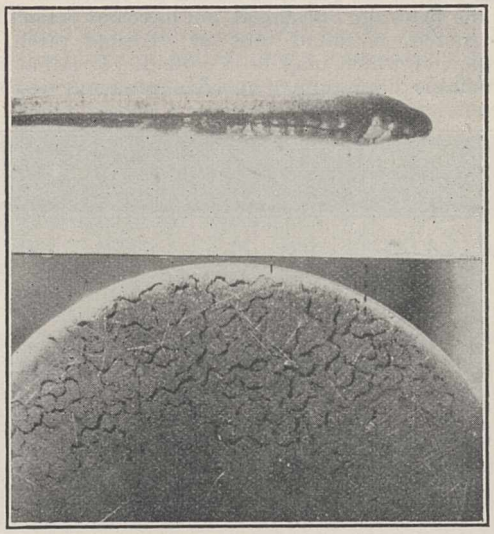

FIG. 1.—Above: a young larva fed on Indian ink and showing the blackened cord of mucus in its pharynx. Below: the burrows of young larvæ seen through the glass bottom of an aquarium.

What can be directly observed in the living animal, fed on Indian ink, is the formation of a single cord of blackened mucus passing down the middle of the pharynx to the gullet, the cilia of which haul it in rapidly, and pass it on to the 'stomach'. The front end of the blackened cord is frayed out into a hollow cone of strands, which in sections can be traced to the ciliated grooves. Thus the whole of the respiratory water with its suspended food particles must pass through a conical net of mucus strands before reaching the gill-clefts.

How strands of mucus, issuing from the circumpharyngeal grooves, become united into a single cord is not plain. The dorsal ciliated tract may initiate this, or a rotatory movement of the œsophageal cilia may twist the originally discrete strands together—but, so far, observation does not support either of these possibilities. What is certain is that the mucus cord, once established, lies quite free in the pharynx,

and does not move under the influence of dorsal cilia as in *Amphioxus*. In larger animals, which are not transparent, I have found it hitherto impossible to determine whether the feeding process is the same. The study of such animals killed while feeding on ink is unsatisfactory, and I propose to apply to them the method of radiography during an opaque meal.

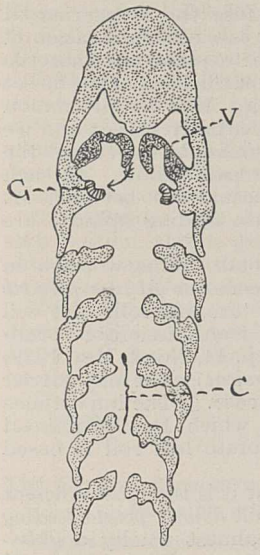

FIG. 2.—Horizontal section of the anterior end of Ammocœtes.

One other point may be mentioned. Though I have tried many times, and always in vain, to verify the existence of the neat U-shaped burrow, open at both ends, in which Ammocœtes is supposed to live, it is true that the animal's track in the sand or mud does persist for some distance as a tube the walls of which do not easily collapse. Ammocœtes appears to produce considerably more mucus in its pharyngeal gland than is used in feeding. Some of this mucus issues from the gills, and, in animals left in a glass dish without sand, tends after a time to become an encumbrance. In more natural surroundings it is removed by the friction of the sand, the particles of which are at the same time cemented together. To this—rather than to a secretion from the skin—I attribute the formation of the burrow.

My drawing (Fig. 2) shows a horizontal section through a young larva, and the letters *V*, *G*, and *C* indicate, respectively, the velum, the ciliated groove, and the cord of mucus.

H. G. NEWTH.

Faculté de Médecine,
Brussels, May 18.

Phagocytosis of Internal Insect Parasites.

DR. W. R. THOMPSON, in NATURE of April 12, presents convincing arguments to the effect that living parasitic eggs and larvæ do not form centres of attraction for the phagocytes of their insect hosts. While this is doubtless true in the majority of cases, it would not appear to be an invariable rule.

A few years ago I made a somewhat intensive study into the bionomics of a number of Hymenopterous and Dipterous parasites of Noctuid larvæ (*Bulletin* 26, Dominion of Canada, Department of Agriculture, 1923). Among these were a number of species of the Tachinid genus *Gonia* which lay minute eggs on vegetation. When swallowed by a Noctuid larva the eggs hatch and the liberated larvæ ultimately pass through the wall of the mesenteron into the body cavity. Here they invariably succumb, enclosed within dense phagocytic cysts, unless they can rapidly travel to, and enter, the supra-œsophageal ganglion of the host. No feeding occurs until the ganglion has been entered.

I have dissected hundreds of unfed larvæ from the body cavity of their hosts. They were invariably surrounded by phagocytic cysts. Many of these larvæ were alive and moving within the cysts at the time of dissection. The latter were occasionally more than three times the diameter of the contained parasites. This would indicate that the foregathering of the phagocytes had commenced at least two days earlier.

Whether the surrounding phagocytes actually killed the enclosed larvæ I am not able to state with certainty. In so far as could be judged, encysted larvæ died within about four days after entering the body cavity. That death was not due to starvation is indicated by the fact that other larvæ have been found, in an unfed condition, still attached to the inner wall of the mesenteron, thirty days after the eggs had been swallowed. The subsequent life of the larvæ that reach the supra-œsophageal ganglion would indicate that they are well able to live a free life in the body cavity without succumbing to asphyxiation. It would thus appear that the rapid death of these small larvæ is due, in some manner, to their enclosure in a phagocytic cyst. It certainly presents an impassible barrier against their all-essential trip to the supra-œsophageal ganglion.

The more successful larvæ travel rapidly to the ganglion and remain here for a few days. During this period, for the first time, a little alimentation is found in their stomachs. They now re-enter the body cavity, where, for many days, they remain unattached to any host tissue and are simply floating in the blood. For as long as they remain healthy they are entirely 'disregarded' by the phagocytes.

Provided they are in a suitable host, these larvæ rarely succumb from any cause other than that of their destruction by fellow-parasites. Whenever superparasitism occurs one larva always attacks and destroys all rivals. After their death it was observed that phagocytic attraction to their dead bodies was less pronounced than it was to living, though unfed, larvæ that had not gained access to the supra-œsophageal ganglion.

Experiments were conducted, also, with the Braconid, *Meteorus vulgaris* Cress. Females of this Hymenopteron were induced to oviposit in Noctuid larvæ that were in varying stages of maturity.

In the case of the more immature hosts the eggs hatched and liberated larvæ which were not 'molested' by phagocytes except in the event of their death. When, however, *Meteorus* was induced to oviposit in host larvæ that were already contracting in preparation for pupation, it was found that, after three days, the eggs had increased in size as do all living eggs when introduced into the body cavity of a suitable host, but that they were all surrounded by dense phagocytic cysts. The embryos in these eggs were all dead when we made our dissections. In this case it is, therefore, possible that they had already succumbed before the phagocytes were attracted to the eggs, even though the enlargement of the latter indicates that they were viable after they had entered the body cavity of the hosts.

E. H. STRICKLAND.

University of Alberta,
Edmonton, Canada,
May 20.

Mortality amongst Plants and its Bearing on Natural Selection.

IN his letter to NATURE, June 28, Dr. R. A. Fisher asserts that there is a concealed fallacy in my statement that "the mortality and therefore the operation of natural selection is almost entirely confined to the juvenile stages of development". But the reasons that he gives for this assertion would appear to involve a failure to distinguish between the effect of mortality on the number of offspring and its effect as a selective agent.

If I understand Dr. Fisher's contention aright it would be true only if the survivors at the later stage of development were an unselected sample of all the heritable variants present in the original progeny and

in the same proportions. Every seedling, for aught we have any right to assume to the contrary, is potentially capable under favourable conditions of attaining maturity and leaving progeny. But if 95 per cent of a species perish in the juvenile state the probability of an heritable variant surviving to leave offspring is only appreciable if the variation be associated with some feature of survival value in the seedling stage or has itself survival value at this phase of development.

Actually, so far as my observations on monocarpic species are concerned, and it was these I chiefly dealt with in my letter, mortality may be confined entirely to the juvenile state, or where death occurred at later stages there was considerable doubt as to its selective character. That the same may be true of polycarpic types is suggested by the extreme rarity or total absence in Nature of individuals of intermediate ages of arboreal species which have died from natural causes, although dead individuals in the seedling and senile phases are sufficiently familiar. In the monocarpic species at least there is the possibility that the question of the relative importance of any selective mortality at different stages of development does not arise, although, as Dr. Fisher rightly emphasises, mortality in the later stages will more profoundly affect the *number* of progeny produced than an equivalent mortality in the earlier.

Prof. MacBride in his interesting letter in NATURE of June 28 justly lays stress on the complexity of the factors involved in the survival of the early stages of development. May I mention one case in illustration of Prof. MacBride's very pertinent remark regarding the causes of survival, that doubtless in every particular case a special investigation would be required. The interesting endemic British plant *Helianthemum Breweri* has, as I have elsewhere pointed out, a peculiar mode of germination ("The Biological Equipment of Species in Relation to Competition", *Jour. Ecology*, 1929). Of the seeds shed by a particular individual at the same time some germinate in the autumn and the remainder in batches in a discontinuous manner of which the last may not germinate until late in the following spring. If the winter be a mild one, the first batch of seedlings will probably survive and by their priority of occupation compete successfully with those seedlings appearing later. If, however, there be a severe winter, all but the final batch may perish. Hence apart from selective mortality between individuals of the same batch the characters which here determine which age class shall be represented in the survivors will vary with the climatic conditions. This is a comparatively simple instance but indicates sufficiently the complexity of the problem of causation in selective survival.

E. J. SALISBURY.

Botanical Department,
University College, London,
July 2.

Transmission of Potato Leaf Roll.

MAY I be permitted to comment on Dr. Whitehead's interesting letter appearing in NATURE of June 28, on the transmission of potato leaf roll by the aphis *Myzus circumflexus* Buckt? We are using this insect in our potato virus transmission experiments at Cambridge and have been doing so for some years. As regards its efficiency as a vector of potato leaf roll, I prefer to say nothing at present, as our experiments are still incomplete. I cannot, however, quite agree with Dr. Whitehead in his recommendation that *M. circumflexus* is a suitable insect for use in studies upon potato viruses, at least in respect to the mosaic group. I have found it a poor transmitter of potato mosaic, and moreover, the saliva contains a toxin—absent apparently in *Myzus persicæ*—which reacts upon several of the Solanaceous plants which we use in virus studies, including the potato. This aphis thus produces, by its feeding alone, a false 'mosaic' which is likely to mislead and confuse the inexperienced worker. Again, as regards the ease of identification of *M. circumflexus*, I would like to point out that the characteristic black markings on the back of the insect are liable to be very misleading. It is no uncommon thing for these markings to be entirely absent and we have had whole colonies of *M. circumflexus* in which the colour was a uniform green or pale yellow. In such cases, the differences to the casual eye between *M. circumflexus* and certain potato feeding aphides are not great.

Dr. Whitehead criticises potato virus workers in regard to their alleged preference for *Myzus persicæ* as the only insect vector of potato leaf roll. He will see in my paper on the insect transmission of potato leaf roll (*Ann. App. Biol.*, **16**, p. 14, No. 2, May 1929) that I state—"That it (*M. persicae*) is the only carrier of leaf roll is probably not the case." The importance attached to *Myzus persicæ*, which Dr. Whitehead deplores, in its relation to potato leaf roll is based on the following reasons:

(1) There is little doubt that it is the most efficient insect vector of potato leaf roll *among potato feeding insects*. (*M. circumflexus* is almost wholly a glasshouse aphis.)

(2) *M. persicae* is one of the commonest aphides occurring on the potato, and in addition is an almost omnivorous feeder; it has been recorded from 52 plant hosts—a fact which, incidentally, renders it exceedingly suitable for virus transmission studies.

(3) Besides attacking the haulm of the potato, *M. persicae* is to be commonly found feeding upon the sprouted tuber in the store, and it is probable that much virus dissemination takes place by this insidious mode of attack. Finally, it is my opinion that *M. persicæ* has a definite affinity for the virus of potato leaf roll, but the evidence is still insufficient to allow of the conclusion that an absolute affinity exists such as appears to be the case between the virus of aster "yellows" for example and its insect vector, *Cicadula sexnotata* Fall.

KENNETH M. SMITH.

Potato Virus Research Station,
School of Agriculture,
Cambridge, July 3.

Eyeball Movements in Tests of Visual Acuity.

IN all published accounts, to which I have access in physiological literature, of testing visual acuity by the discrimination of two points as two and not as one, there is no mention made of a factor which must assuredly play an important part. The three qualities usually considered are the angle subtended, the illumination, and the contrast between the points viewed and their background. In all the discussions which I have read it is tacitly assumed that the eyeball is fixed. Now we know that a limb, and the eyeball is physiologically a limb, cannot be kept in a position of rest unless it is at an extreme of movement, as when the knee is fully extended or when gravity alone determines the posture. The best marksman is aware of the tremor of his rifle when it is supported solely by muscular action; indeed physiological theory demands that such tremor must exist. By no possibility can we assume that the eyeball, held in any ordinary position by muscular action, is free from such tremor. The fact that tremor is not obvious does not proclaim

its absence; when it is obvious we speak of it as nystagmus. Microscopic examination of the pupil tells us that the inner iridic margin, to the observing naked eye apparently fixed, is really in a state of tremor of small amplitude. The only recognition of the possibility of this movement of the eyeball which I have found is an article "The Application of the Physiology of Color Vision in Modern Art", by Henry G. Keller and Prof. J. J R. Macleod in *Popular Science Monthly*, November 1913:

"There can be little doubt that a great part of the peculiar impression produced by pointilism depends upon the slight movements which the eyeballs are constantly undergoing, even during our most intent fixation. This of course produces a certain amount of overlapping of the colors of the retina."

It is obvious that if the eyeball moves during the test fixation, simple geometrical deductions from the subtended angle of the two points cannot immediately be applied to the retinal elements affected.

When double stars are observed we have another disturbing factor, namely, the variable refraction of the air, which gives a further displacement of the images on the retina. W. A. OSBORNE.

The University,
Melbourne.

The Crystal Structure of Hydrogen Iodide and its Relation with that of Xenon.

USING the apparatus already described (see NATURE, Mar. 22, vol. 125, p. 457; *Rend. Acc. Lincei*, vol. 11, p. 679), I was able to obtain good photograms of crystalline hydrogen iodide at about −170° C. An iron anticathode was used. The lines correspond to a face-centred cubic structure with lattice constant $a = 6{\cdot}18$ A. The cell contains 4 molecules hydrogen iodide; the calculated density is 3·59.

It is remarkable that the lattice constant of hydrogen iodide is practically identical with that of xenon as found by A. G. Nasini and myself (NATURE, Mar. 22). This confirms what we then pointed out, namely, that the ionic radius of I^- is identical or very near to the atomic radius of Xe, which was then calculated to be = 2·18 A.

From our present determinations we deduce for I^- the same value, while from the metallic iodides Goldschmidt (Geochem. Verteilungsgesetze d. Elem., *Norsk. Vid. Ak.*, 7; 1926) found 2·20 A. in very good agreement with ours. The dimensions of the HI-lattice seem to be determined by the I-ions only, since the empty spaces amply suffice for the location of the hydrogen ions, the radius of which is surely less than 0·6 A. (Natta: *Giorn. Chim. Ind. e Appl.*, **12**, 36; 1930; *Gazz. Chim. It.*, **58**, 356; 1928).

There appears to be a possibility of obtaining solid solutions between xenon and hydrogen iodide, which would be a first instance of a mixed lattice in which neutral atoms alternate with ions. G. NATTA.

Laboratory of General Chemistry,
Royal Polytechnic, Milan, Italy,
June 8.

Soldering Tungsten.

IT does not appear to be generally known that it is not difficult to solder metals to tungsten; Angerer states that Neusilber (German silver) can be used, but with this exception the general opinion seems to be that welding is the only practical method. In fact, there are a number of metals that will run on tungsten, of which gold, palladium, zinc, and (I believe) nickel are the most important.

Pure zinc is useless, since it crystallises afterwards and may be broken off again; any brass, however, that contains a fairly large percentage of zinc seems to be satisfactory. 'Tobin bronze', a common brazing alloy, is an example. German silver also sticks in virtue of the zinc it contains; it shares with brasses the disadvantages that if it be heated too long the zinc evaporates and renders it useless, and also that of course no joins so made can be baked out in vacuum work.

Gold seems to stick firmly, but does not run very easily as a rule, especially if the borax has once burnt off (borax is a suitable flux for all the metals tried). Palladium runs somewhat better, but it is difficult to get the work hot enough in a flame; it may be applied with an arc (35 volts are enough for small jobs), and neither flux nor reducing atmosphere is essential. Perhaps the most satisfactory method for general use is to apply some gold, using an oxy-coal-gas flame and borax, and then to wrap a little fine palladium wire round the gold, apply fresh borax, and reheat until the palladium has been melted into the gold; as a rule the alloy will then also have run over the whole join. The melting-point may be altered by this means, and the vapour pressure is in all cases very small; work can be glowed out at quite high temperatures.

A patent has been applied for to cover the use of palladium, but in any case this will not affect private work in laboratories. R. D'E. ATKINSON.

Rutgers University,
New Jersey,
June 9.

The First Spark Spectrum of Antimony.

WHILE investigating the relationship of the (*sp*) transition of the successive elements from indium to cæsium in their normal as well as ionised states, it was found that the data were insufficient. It was therefore proposed to investigate the necessary arc and spark spectra of the elements. The first uninvestigated element is antimony in the first state of ionisation. With the help of a one-metre concave grating set according to the Paschen-Runge mounting, I have photographed the entire spectrum from λ8500 to λ3000. The spectrum is analysed and identified as arising from the transitions $(P_1 \leftarrow\!- P_2)$, $(P_2 \leftarrow\!- P_3)$, and $(P_2 \leftarrow\!- Q_1)$. The lines $^3(P_2D_3)$, $^3(P_2P_2)$, $^3(P_2S_1)$ of the $(P_1 \leftarrow\!- P_2)$ transition are 12863, 16714, 19310 respectively. The difference $^3P_1 - {}^3P_2$ is 0·4814.

D. G. DHAVALE.

Department of Physics,
University of Allahabad,
Allahabad, India,
May 15.

Gas Discharge Wave-length List in the Extreme Ultra-Violet.

WE have prepared a list, arranged in order of wave-length, of the published lines in the extreme ultra-violet (λ2500 to λ100) arising from discharges in gases. The elements included are hydrogen, helium, carbon, nitrogen, oxygen, neon, sodium, silicon, argon, and mercury. Thanks to support from the Carnegie Institution of Washington, it has been possible to publish a limited mimeographed edition of the list, copies of which have been sent to a few spectroscopists to whom we thought it might be of particular use. We should be glad to give copies to any others who may write requesting them. JANET M. MACINNES.
JOSEPH C. BOYCE.

Palmer Physical Laboratory,
Princeton University,
Princeton, New Jersey,
June 25.

The Equi-Signal Zone Radio Beacon and Air Navigation.

By Dr. R. L. SMITH-ROSE.

THE application of directional wireless methods to assist aerial and marine navigation has been progressing steadily during the past few years. After passing a period of uncertainty as to its accuracy and reliability, the wireless direction-finder has established itself as a very useful aid to marine navigation. Many hundred ships of all nationalities are now fitted with direction-finders, and a large number of fixed beacon transmitting stations are now in operation in various parts of the world for the specific use of such direction-finding installations.

As an alternative means of obtaining wireless bearings, the rotating loop beacon developed in Great Britain by the Royal Air Force is now undergoing a full scale trial with the installation erected last year at Orfordness, Suffolk. The advantage possessed by this method of operation is that the whole of the directional part of the system is at the transmitting station on shore, and any ship fitted with a radio receiver can take bearings with the aid of a suitable watch or chronometer. From reports already received from various ships which have taken bearing observations upon the Orfordness rotating beacon, it appears that this method of obtaining bearings is likely to prove at least a very useful auxiliary to the wireless aids to marine navigation. A survey of the progress made of recent research on both the above methods of directional wireless and their application to marine navigation was given in a lecture before the Royal Institution, an abstract of which appears in NATURE for April 5 and 12.

In the search for a suitable means of applying directional wireless methods to aeroplanes, two points become of vital importance. The first is that any additional apparatus in the machine, such as a direction-finding installation, is objectionable from the point of view of the otherwise unnecessary weight which it entails. Secondly, the normal travelling speed of aircraft is so high that it is necessary that bearings should be obtainable as rapidly as possible. This factor seriously limits the utility of the rotating beacon method, since bearings on the system are only obtainable at half-minute intervals, during which the position of the machine may have changed by distances of the order of one mile. It is further desirable that the whole of the receiving and recording apparatus in the aeroplane should be as automatic as possible, in order to avoid the infliction of unnecessary duties upon the pilot or wireless operator.

To meet these objections of the ordinary methods of direction-finding, considerable attention has been devoted in the United States during the past six years to the development of a method of course-indicating by wireless, which was patented by O. Scheller in Germany in 1907. Scheller's patent covered essentially the use of a transmitting station which was provided with two equal directive aerial systems pointing in different directions. The transmitter was arranged to send alternately on each aerial two letters with complementary Morse characters, such as *A* (dot dash) on one aerial and *N* (dash dot) on the other. At a receiver situated anywhere on either of the bisectors of the angle between the aerials the two letters would be received at equal intensity and would form a continuous dash. If the receiver is moved to one side or the other of this direction, one letter would predominate and would indicate to the observer to which side the receiver was displaced. In this way the four directions of equal signal strength are well defined, and a ship or aeroplane keeping the two received signals of equal intensity would pursue a straight line course directed to or away from the transmitting station. During the War, attempts were made by E. Buchwald [1] to apply this method to assist the navigation of aeroplanes towards the transmitting station, which for the purpose was constructed with two inverted *L* aerials at an angle of 60° to each other. Some erratic results were obtained at first, due to the effect of the orientation and inclination to the horizon of the trailing wire antenna employed on the aeroplane. It was also found that the finite conductivity of the earth influenced the reliability of the results obtained.

In a later communication, F. Kiebitz [2] described further experiments made in the navigation of ships with this system of transmission. Difficulties were experienced due to a variation in the conductivity of the earth in the proximity of the transmitter, but it was ultimately found possible to obtain a sharply defined course along which the ship was navigated.

The system does not appear to have received further attention in Germany, but in 1924 a paper was published by F. H. Engel and F. W. Dunmore [3] which showed that attention was being devoted to this method of directional wireless by the U.S. Bureau of Standards. Since that date, and particularly during the past two years, considerable research and development of the application of this beacon system in the United States has taken place. The work has been largely carried out at or with the assistance of the Bureau of Standards for the Aeronautics Branch of the Department of Commerce. The technical results of the work have been described in a series of papers published in the *Proceedings* of the Institute of Radio Engineers and the Bureau of Standards *Journal of Research*, and the success of the system is evidenced by the recent proposal to establish a chain of some fifty directive beacons along the chief air routes of the United States.

The American type of radio beacon applies what is essentially Scheller's principle of directive transmission to two coil antennæ crossed at an angle of 135° to each other, the signals being transmitted alternately from each coil. The early type of beacon was supplied from a quenched spark transmitter, and distinctive Morse signals, such as *A* and *N*, were sent from each of the two coils

respectively. In the zone of equi-signals, these two Morse characters would merge or 'interlock' into a steady dash, which thus served as an aural signal to mark out the course defined by the beacon. The polar radiation diagram of each transmitting coil is of the familiar figure-of-eight form, and with two such coils crossed at right angles to each other it is evident that along the four lines bisecting the angles between the coil the equi-signal zones will be of equal strength. By changing the angle between the coils to 135° as stated above, two of the equi-signal zones provide stronger but less well defined signals than the other two. The quality of the equi-signal zone is usually specified by the width at a certain distance in which no inequality of the two sets of signals can be detected. The angular width of this zone for the experimental beacons already developed on the lines indicated below is of the order of 1° to 4°.

In a paper published in 1928 by Messrs. Dellinger and Pratt [4] the continued development of this type of beacon towards its present state is described in some detail. The first modification introduced was to employ two large fixed loops at right angles in place of the rotatable frame coils previously used, and to supply these coils with the necessary oscillatory current through a special type of goniometer. This goniometer comprised two primary coils fixed at right angles to each other and supplied with the necessary signal currents from the transmitter, and two secondary coils also fixed at right angles to each other, one coil being connected to each of the loop antennæ. Each of the two primary coils was supplied by one of the two sets of characteristic signals from the final 'push-pull' stage of the transmitter. The field created inside the goniometer by these primary coils was thus similar in form to the field radiated in space by the previous arrangement of frame coils. The secondary coils served to link up the fixed loop antennæ with this goniometer field and to reproduce it as a space radiation field. The advantage of this arrangement is that, by rotating the pair of primary coils relative to the pair of secondary coils inside the goniometer, the same effect is produced as that formerly obtained by rotating the frame coil antennæ. The whole installation thus enabled the equi-signal zones to be rotated in space by a setting of the goniometer.

The next important development in the course of the work concerned the elimination of the necessity for receiving an audible signal from the beacon. This has been accomplished by supplying each of the two phantom loop antennæ with current of the same carrier frequency but with a different modulation frequency. The modulation frequencies employed have been chosen at 65 and 87 cycles per second. This enables a mechanical vibrating reed to be used as a signal detector in place of the telephones, and by supplying two reeds adjusted to resonate at the two modulation frequencies mentioned above, a simple indicating instrument is provided by means of which the equality of the two signals radiated by the beacon is determined. Along any one of the four equi-signal zones radiated into space from the transmitter the intensity of the received modulation signal is the same on the two frequencies; both reeds of the indicator will therefore vibrate with the same amplitude. Immediately the receiver is displaced to one side or other of this course, the amplitude of one of the vibrating reeds becomes larger than the other. With the receiver and indicator mounted in an aeroplane, it is a simple matter to mark the indicating instrument in accordance with the direction to which the pilot must turn in order to get back on to the course marked out by the equi-signal zone.

By the employment of a third modulation frequency of about 108 cycles per second and a three section goniometer, it is possible to emit a space radiation field which has twelve directions of equal signals on one pair of modulation frequencies. If then the receiver is supplied with three pairs of vibrating reed indicators, it is possible to select each of these twelve courses in turn.

In the above discussion, it has been assumed that the electrical characteristics of each series of circuits in the goniometer and antenna loops are equal and that, therefore, the currents obtained at the various modulation frequencies are the same. If the currents in the antenna loops are made unequal, it becomes possible to alter the angle between adjacent zones of equal signal strength. A somewhat similar effect can be obtained by combining an open vertical antenna with the radiating loops in order to superpose a uniformly disturbed field upon the figure-of-eight polar fields generated by the loops. The possibilities of such combinations in providing means of varying the courses marked out by a beacon are described in a paper by Messrs. Dellinger and Diamond,[5] while a more detailed theoretical discussion of the methods of alining several courses from a beacon on this principle is given in later publications. This paper also contains an account of a method by which small amounts of shift in the course can be obtained by the adjustment of a suitable resistance in shunt to one of the vibrating reeds in the indicator installed in the aeroplane.

The practical application of the methods of alining four course beacons of the aural signalling type is described in a recent paper by F. G. Kear and W. G. Jackson.[6] These methods have been used in the alinement of three radio beacons to cover the air route from Cleveland, Ohio, to New York, a distance of about 400 miles. It appears from this paper, which was published in December 1929, that only the aural type of four-course radio beacon, or 'radio range' as it is termed in the paper, has so far been put into routine daily operation, although the visual type is nearing the end of its experimental development.

Concerning the operation of the type of radio beacon under discussion, reference may be made to an interesting paper published in 1928 by C. C. Shangraw [7] which describes the application of the visual type of two-course beacon by the United States Army Signal Corps, to a long distance flight of more than 2000 miles from San Francisco to Honolulu. A successful flight was made in August 1927 during which the operation of the special

beacons erected near the terminal points was found to be of great service. Over the central part of the course signals from both beacons could be heard, and it was estimated that at the distance of 1200 miles from Honolulu the width of the equi-signal zone was about eight miles, which indicates that the zone employed was unusually sharp (about 0·4°).

Some experiments carried out at an altitude of 2000 feet and described by H. Pratt indicate that at night the radio beacon system may be subject to erratic shift of the beacon course when the distance of transmission exceeds some fifty miles. In general, the changes in direction observed were less than 25°, but they were considered sufficiently serious to make the further study of this phase of the subject an urgent necessity. Apparently the errors are much reduced in magnitude by the use of a vertical antenna in the aeroplane, but this does not effect a complete cure and there will possibly be a limited range, of the order of about a hundred miles, over which this type of beacon may be considered to give results of the highest accuracy.

According to a recent publication,[8] the Airways Division of the U.S. Department of Commerce proposes to build fifty directive radio beacons of the aural signalling type in addition to the nine such stations already in operation. These beacons will all operate on a wave-length band 950-1050 metres (285-315 kilocycles per second) allotted by international agreement to beacon stations, and will be located along the main air routes at distances apart not exceeding 200 miles. In addition, these routes will be equipped with the low power non-directional 'marker' beacons which will give an aural signal to the pilot for a period of one or two minutes as he is flying overhead. These 'marker' beacons serve to inform the pilot as to his exact position along the course, and also to give him any local weather reports or other information of importance to the navigation of aircraft along the route in question.

Simultaneously with the development of these beacons special receiving equipment has been developed for use on the aeroplane. These receivers are designed to be sufficiently sensitive to work from the 6 ft. vertical aerial standardised for the aeroplane, and to give sufficient output for use with either the aural or visual methods of indication. Attention has been devoted to reducing the weight of the whole receiving equipment to the absolute minimum. It is likely that in the near future all mail and passenger carrying aeroplanes in the United States of America will be equipped with such receivers in order to make use of the extensive scheme of beacons now being erected for the specific purpose of assisting the navigation of aircraft.

[1] E. Buchwald: "Scheller's Wireless Route Indicator Applied to Aeroplanes". *Jahrbuch. d. drahtl. Tel.*, vol. 15, pp. 114-122; 1920.
[2] F. Kiebitz: "New Experiments with Scheller's Directional Transmitter". *Ibid.* pp. 299-310.
[3] F. H. Engel and F. W. Dunmore: "A Directive Type of Radio Beacon and its Application to Navigation". *Scientific Papers*, Bureau of Standards, vol. 19, pp. 281-295; 1924.
[4] J. H. Dellinger and H. Pratt: "Development of Radio Aids to Air Navigation". *Proc. Inst. Radio Eng.*, vol. 16, pp. 890-920; 1928.
[5] J. H. Dellinger and H. Diamond: "Radio Developments Applied to Aircraft". *Aeronautical Eng.*, pp. 57-66; 1929.
[6] F. G. Kear and W. G. Jackson: "Applying the Radio Range to the Airways". *Proc. Inst. Radio Eng.*, vol. 17, pp. 2268-2282; 1929.
[7] C. C. Shangraw: "Radio Beacons for Transpacific Flights". *Proc. Inst. Radio Eng.*, vol. 16, pp. 1203-1235; 1928.
[8] *Radio News*, April 1930, p. 906.

The Second World Power Conference at Berlin.

THE Second Plenary World Power Conference which was held at Berlin on June 16–26 was probably one of the most ambitious and one of the most elaborately staged international meetings of recent years, and it is difficult on that account to follow with accuracy the main lines of development which were traced throughout the discussions. In the first place, the weight of documentary material was very large. Prior to the opening of the Conference, about 390 papers submitted by 37 or 38 countries had actually been printed and were available for examination; but during the Conference itself a number of additional papers appeared, mostly from Germany and Austria, with the result that the official collection will probably be rather more than 430. In addition to that, the principal scientific and technical associations in Germany and Austria, and, to some extent also, Russia, had prepared special monographs surveying the position in their respective territories. These monographs did not form an intrinsic part of the Conference, but they should be considered as an additional contribution to the information collected.

The delegates and members assembled at the various sessions totalled about 3900, while the papers were divided into 34 main sections corresponding roughly to the main aspects of national and international power development. During each full day six of these sections came up for examination at six meetings and the average number of speakers lay between 20 and 25, with, in certain cases, more than 30 taking part in the discussions. In all, therefore, during the period of the Conference, more than 1000 actual contributions were made to the work of assessing and judging the material submitted. These statistics are necessary to a comprehension of what might have been and what was actually achieved. In no case did discussion elicit any new information of value or record experiences which were not already described in the papers themselves, and, if one were able to bring the discussions into line with the actual documents, one would find considerable duplication and little real originality.

The importance of the Conference lay, therefore, not so much in any survey of the international power situation it attempted, as in the work of direct personal co-operation which took place unofficially before and after the Conference meetings. It also served to illustrate the reality of the industrial recovery which has taken place in Germany since 1924, since one important feature was the very extensive series of visits to German industrial works which was staged during and after the Conference. It is unnecessary to touch on this

side of its activities since the process of rationalisation and re-equipment of industry in Germany has been followed with great care by economists and by technical experts in Great Britain, and has already been fully recorded.

The Berlin Conference afforded an opportunity for discussion of the achievements of engineers from the principal industrial countries, and some decisions of value regarding British industry may well emerge from it.

The organisers of the Conference worked on a definite plan. They appreciated quite clearly the need for some degree of guidance throughout the complicated mass of material and arranged accordingly. Thus, the original papers were summarised in general reports extending to about 3000 words each. These reports numbered 34, were prepared each by a German engineer or industrialist, and they indicated what were the broad lines of progress and what were the most urgent questions still to be examined. In addition to this work of simplification, the main points of policy and of international progress were covered in a series of seven addresses arranged by the principal countries participating. Thus in the purely scientific sphere must be placed the addresses of Prof. Albert Einstein and Sir A. S. Eddington; in the purely administrative and economic those of Dr. Serruys on rationalisation and its latest forms, and Dr. Oskar Oliven on the Central European main transmission zone; in research considered generally the speech delivered by Mr. H. Foster Bain on the place of minerals in a power sustained world, and perhaps that of Dr. Vallauri on technical and general conditions governing the use of electricity. A seventh address which was due to be delivered by Mr. D. N. Dunlop, chairman of the International Executive Council, on the function performed by power in the evolution of the world, was not delivered owing to the sickness of its author; and in many ways it is a pity that this address could not be given, since, so far as one can understand from the summary given in advance, it did constitute a broad survey which might have served to have placed the details furnished by the original documents and by the discussions into an ordered design capable of immediate appreciation.

The weakness of this whole arrangement was undoubtedly to be found in the quantity of the original papers submitted, in the lack of uniformity shown by the reporters responsible for summarising those papers in the main sections, and for the lack of synthesis in the general addresses themselves. This observation does not apply to the contributions by Prof. Einstein and Sir A. S. Eddington, but it certainly applies to the remaining four speeches, and, through this circumstance, they had practically no value as a guide to deliberations during the Conference. The result was that the International Executive Committee passed no resolutions referring to the work of the Conference, even when arrangements are being made for a Third Plenary Conference to be held in America in 1936 and there may be a Sectional Conference at Stockholm in 1933—this latter still undecided. One was really unable to select from a mass of conflicting resolutions submitted by various countries any single resolution which would embody one contribution by the Second World Power Conference to the progress of power production and utilisation. That in itself is very significant and illustrates the inconclusive nature of the discussions which took place.

It was clear even at Berlin that technical progress in itself is now of less immediate importance than it was, and one felt a vague impression that something should really be done to bring discussions more closely into line with investigation of the real difficulties confronting electrical development and the growth of public utilities. One expert was courageous enough to state that in his opinion we had now reached a definite turning-point in this whole matter of power expansion. We had advanced so rapidly during the last few years that we had not yet taken the measure of that advance, and, through our inability to take that measure, we were in danger of embarking on unnecessary and costly experiment and of introducing a regime of economic as apart from technical inefficiency.

This observation can be confirmed, I think, by examination of the papers and to some extent also of the discussions; and the necessity for a real economic assessment of what has been achieved emerged more and more clearly as the Conference went on. One example of what I mean may be given. One German paper described the possibility of transmitting electrical energy at 380,000 volts pressure from Scandinavia to Germany. A general address given by Dr. Oliven outlined proposals for a European main-transmission system operating at 400,000 volts. At the present moment those proposals are quite fantastic; and they are fantastic not because they cannot be translated into practice technically, but because economic and political considerations are such as to rule them out. Even technically, we have no experience yet of operating conditions on a 380,000 volt circuit. It is in the regime of economics that the greatest obstacles are to be found. The transmission of electrical energy from Scandinavia to Germany would only justify itself if German resources proved themselves inadequate to the power consumption demand of the country, or if the exploitation of such resources were so expensive that it would pay to import electrical energy. It is obvious, however, that Germany would rather import energy from Switzerland, Austria, and even Italy through Switzerland, where it can tap existing power stations and fairly easily accessible existing power resources, than embark on a costly experiment across the Baltic.

The fundamental economic problems are to be found in the effective co-ordination of electrical power production and the control of the new main transmission systems evolved with the view of ensuring the maximum reliability of service and the maximum reduction in costs. Undoubtedly many technical experiments are being carried out. There was an impressive number of papers describing

power storage schemes built in Saxony and in the Ruhr, and in a number of European countries. Again, in the city of Berlin itself and in Hamburg, Diesel plants have been built of very large capacities to meet wide fluctuations in demand, in addition to existing steam power plant; while in Berlin again a steam accumulator battery at Charlottenburg has been attached to the peak-load station. In the Ruhr again, the gas pool created by the big iron and steel and coke oven plants has been in operation for some time. The technical problem appears, therefore, to be approaching solution; it is the administrative and economic which escapes definition.

There are indications also of a definite reaction against the theory of the big unit. There was less discussion in Berlin of giant power stations and giant power units than of the development of an economic load for such stations and such units. The development of such a load enters, at once, into the economic sphere and is inseparable from the consideration and assessment of the general economic activity ruling in the areas of supply. This brings the supply undertaking at once into touch with national economic problems and national economic prosperity.

The Berlin Conference was remarkably weak both in research and pure science contributions and in economic studies. It had a number of papers from the United States dealing with certain phases of power economics, especially in the elaboration of a sound price policy and in the definition of the various types of load, industrial or otherwise. But to give only one indication of what had become really urgent; the Conference failed to touch, even indirectly, on the following:

Whether it is more economic to close down fairly efficient medium-sized generating stations, aged ten years or more, none of which are being operated on a base load within an interconnected system, and build new stations with Diesel engines, or similar plant capable of interrupted operation without serious loss of efficiency?

The question here bears on depreciation factors, on the relation between the capitalised value of efficiency and the capital loss incurred by the closing down of such power stations and on the distribution of costs within the interconnected network itself. This is not a matter for mere calculation, it is really a matter for a genuine survey of the industrial and other potentialities of the area of supply. It is in the last degree the first movement towards a genuine economic assessment. The Conference made no effort to examine the problems in research advanced by C. F. Hirschfield in his paper "Research relating to Power Development" and avoided discussion of broad questions of industrial efficiency, rationalisation, and competitive efficiency based on power.

One outstanding requirement was really the co-ordination of essential information; while, at Berlin, statistical surveys of power resources were not given in any great number, owing to the general impression that preceding conferences had covered this side fairly adequately, yet there was almost a complete lack of statistics bearing on the utilisation of electricity, on the various types of power consumption, and on national productive capacity, measured with reference to power. One or two papers touched on this question tentatively; but this field is almost wholly virgin and requires to be cultivated before the next important forward movement can take place.

We are coming to the end of what might be regarded as a technical cycle and entering on the economic cycle. But, whereas in the case of the technical cycle, some background had actually been established merely through the process of evolution, no such background is available in the economic sphere. It may be objected that the general economic principles governing power production and consumption have not yet been formulated, and until they are formulated effective discussion of economic data is really impossible; but in the technical sphere the broad principles along which development is now taking place were not formulated in the first place. They were defined by purely empirical means and resulted from material experience. It was merely a case of trial and error.

The World Power Conference should find in the economic cycle its most valuable and most effective source of activity, and it should concentrate on this to the exclusion of almost everything else. It should examine all the possibilities of assessment on an economic basis; examine all the factors which govern the economic expansion of power production and consumption and link it up with general international industrial activity. It should aim at the standardisation of statistical forms and arrange for the exchange of essential data, drawn up in such a way that international comparisons can be carried out without difficulty.

HUGH QUIGLEY.

The Bristol Meeting of the British Association.

LOCAL ARRANGEMENTS.

AN interval of thirty-two years has passed since the British Association last met in Bristol. The 1930 meeting on Sept 3–10 under the presidency of Prof. F. O. Bower will be held in that city under conditions differing in many respects from those of the year 1898. In 1898 there was no University of Bristol and the Sections were housed in a scattered variety of buildings adapted for the purpose. Since that time, however, through the munificence of the Wills family, the University can provide within its walls accommodation for the reception room and general offices as well as for practically all the Sections. Moreover, the main buildings as architectural features form a landmark in the history of provincial universities.

A large attendance of members is anticipated, and amongst the foreign guests who have accepted invitations are the following in order of the Sections: *A*, Profs. Heisenberg, Siegbahn, F. Bloch, Van Vleck, Mulliken, Bureau; *B*, Prof. J. M. Hildebrand; *C*, Prof. Delepine; *D*, Prof. Van de Lange; *E*, Prof. A. E. Douglas; *F*, Prof. A. Plant; *G*, Prof. A. E. Kennelly, Herr Direktor W. E. Doerr; *K*, Profs. T. H. Goodspeed, F. A. F. Went, D. H. Campbell, W. J. V. Osterhout.

Two evening receptions will be given, one by the Lord Mayor in the Museum and Art Gallery on Sept. 4, and one by the Council of Clifton College on Sept. 8. In addition, garden parties will be offered by the University in the grounds of Wills Hall, by the Zoological Society of Bristol in the Clifton Zoo, and by the Hon. Mrs. Smyth at Ashton Court. Numerous visits to works, including the Avonmouth Docks, Messrs. Wills' tobacco factory, and Messrs. Fry's chocolate works, have been arranged.

The evening discourses are two in number. The first, on Sept. 6, is by Prof. E. V. Appleton on wireless echoes, and the second, by Dr. R. E. Slade, on the nitrogen industry and our food supply. In addition, public lectures have been arranged in Bristol and the surrounding district, including addresses by Sir Daniel Hall, Sir Josiah Stamp, and Sir Richard Gregory. A memorial lecture to a famous Bristol anthropologist, Dr. Beddoe, will also be given by Sir Arthur Keith.

The Bristol district is rich in features of historic, archæological, and scientific interest. In fact, owing to the wide choice of material considerable difficulty has been experienced in arranging excursions which do not omit points of special importance; but it is believed that all tastes have been catered for.

One interesting feature of the week will be a series of short tours during the day of historic Bristol and of the Avon Gorge and its vicinity. Also the list of sectional excursions is unusually large.

Like many large cities of to-day, Bristol is not blessed with a surplus of hotel accommodation, but the ancient city of Bath and also Weston-super-Mare are in easy distance of Bristol by car or train, and have special features which may appeal to many for the week of the meeting.

Obituary.

MR. VICTOR BRANFORD.

VICTOR BRANFORD, whose death on June 22 is widely regretted, was of an old East Anglian family; and his ancestry included descent from a sister of Sir Isaac Newton. In hard times his father had to part with his property, and he applied himself ably to a veterinary career, first as professor in Edinburgh, and then as consulting expert to the Army at the Cape. Victor and two of his brothers were so distinguished in mathematics at the University of Edinburgh as to be advised by Prof. Chrystal to take up that career; but he next took to chemistry and then to zoology and botany, and was for several years a successful coach. He also took active interest in the surveys of Edinburgh and Scotland then beginning at the Outlook Tower as a school and laboratory of social studies, and mainly prepared its comprehensive and comparative chart of general history.

Thus embarked on social study and exposition, Branford wrote for various magazines and reviews; and for a time he acted as editor of the *Dundee Advertiser*. He next camped for a season in the Highlands, spent some time on biology and social science at the University of Montpellier, and made observant visits to Switzerland and Italy, and later to South and North America, thence acquiring that combination of geographic observation with historic, economic, and social interpretation which characterised at once his practical life and his scientific career. Thus, turning to social finance, first as accountant and then as bankers' agent in the city, he early realised the important position and future of Paraguay, and became active towards its development, as a director and chairman of its railway, etc. From 1904 his ever-widening social knowledge and insight made him the active leader among the founders of the Sociological Society, and also its indefatigable secretary, first as editor of its 'Papers', and then of its *Sociological Review*, from its outset until the present number; and writing many of its most important contributions.

Branford's lectures in American universities were published as "Interpretations and Forecasts"; and his "Papers for the Present" led to "The Making of the Future" Series, with "The Coming Polity" and other volumes; which were next followed by "Living Religions" and by his comprehensive masterpiece of social synthesis and prevision, in glowing exposition—"Science and Sanctity". With Mrs. Branford (*née* Gurney), he established Leplay House as a home for the Sociological Society, and as part of the 'Sociological Trust', to which the residues of their socially expended fortunes have been essentially devoted, after provision for their two adopted sons. Here, then, is one of those still too rare careers—broadly akin to those of his old friends and the Society's successive presidents—Sir E. Brabrook, Frederic Harrison, Lords Bryce, Avebury, and Balfour, and Sir F. Younghusband—one and all conducting important affairs with many-sided scientific insight and socially philosophic advance, at once widely educative and inspiringly suggestive, since with ideas and purposes, thought and action harmonised in strenuous and generous lives.

Branford's still too rare preparation in mathematics, physical and biological science, through geography and history, and with active participation in current events, thus made his career of that high success which happily follows the sower and planter after his life-work is done; since anticipating that movement from the physical and natural sciences towards the social, which is again in progress.

P. G.

News and Views.

THE seventh annual report of the Grand Council of the British Empire Cancer Campaign, which was presented at the annual meeting on July 14, indicates that the organisation continues to give useful support to cancer research in a variety of ways and at a number of centres. About £28,000 has been expended on topics which cover the whole range of the cancer problem, including the treatment of human cancer with radium at one end and fundamental work on tissue growth and plant viruses at the other. No striking new discovery of importance is announced in the summary of the different inquiries given in the report, but everywhere there is gratifying progress of the detailed kind that is useful and interesting to specialists. At the Fulham Cancer Hospital, Drs. Kennaway and Hieger have been tracking down the carcinogenic activity of tar through the fluorescent spectra of active preparations (see NATURE, June 21, p. 932), and it looks quite likely that they may succeed in identifying the elusive substance or substances to which tar, shale oil, and the like owe their property of causing malignant tumours of the skin. At Leeds, Dr. Berenblum has continued his study of various skin irritants and has reached the rather remarkable conclusion that concurrent irritation with two different agents may be less effective than either of them by itself. From Sheffield, Prof. Mellanby reports that the greasiness of an animal's skin has a considerable influence on the facility with which repeated applications of tar cause cancer, which is perhaps one of the reasons why cancer of the skin is so much more frequent in the lower than in the higher social grades. On the whole, the theory that cancer is caused by a virus capable of transmission from one individual to another seems to be losing ground. Attention is being concentrated more on (1) the action of external irritating agents and the relation between cancer and occupation; and (2) the efficacy of radium and penetrating X-rays in the treatment of established human cases of the disease.

PROF. ELLIOT SMITH has recently expressed the opinion (*Times*, June 26) that Peking man, furnishing a connecting link between *Pithecanthropus* and the Piltdown skull, "added stability to our conception of the qualities likely to be found in the earliest common ancestor of all three, the as yet undiscovered Pliocene Man". He went on to say that Peking man "afforded new and emphatic testimony of the closeness of the kinship of man and anthropoid apes". Prof. Elliot Smith's views afford an interesting commentary on those put forward by Prof. Fairfield Osborn in his presidential address to the American Association for the advancement of Science in December last (see NATURE, Jan. 11, pp. 53-57). Prof. Osborn, accepting the Upper Pliocene date claimed by some for the Piltdown skull, regards it as confirming his prophecy of the discovery of a large-brained tertiary man, and also as supporting his conception of a 'Dawn Man' separating from the anthropoid stock in pre-Miocene times before the specialised adaptation of the Miocene anthropoids to arboreal conditions. In holding these views Prof. Osborn is in opposition to the theory of Darwin and his followers that man has arisen from an anthropoid ape not higher in the scale than a chimpanzee, which, however, he admits is held by "all the leading and most brilliant men of our time". The case against Prof. Osborn's view that the evolution accompanying the change from arboreal to terrestrial conditions on the generally accepted ape-man hypothesis involves an impossible reversion from the highly specialised characters of the miocene anthropoids to the more generalised characters of the human stock is ably stated by Prof. W. K. Gregory in *Human Biology* for May last. He there points out certain considerations against Prof. Osborn's inferences from the change in the relative length of the limbs in man and in the anthropoids, and suggests that he has ignored the essentially gorilla-like underlying character of the human hand and foot notwithstanding differences in form.

IN taking *Eoanthropus* as his big "brained" tertiary man, Prof. Osborn cited as evidence of Piltdown man's ability to make use of that brain and of his skill with his hands the flints of tertiary age discovered in East Anglia by Mr. Reid Moir. In a letter we have received from Mr. Lewis Abbott, he suggests that the arguments of Prof. Osborn and other palæontologists might be much reinforced did they make greater use of the collateral evidence afforded by archæology and what is called by some 'lithoclassiology'—a term which we cannot regard with complacence. Mr. Abbott rightly dwells upon the importance of the East Anglian evidence in any discussion relating to the antiquity of man, and especially of tertiary man, and enumerates some of the finds which might have gone to strengthen Prof. Osborn's case. He refers to the first "indisputable" find—the stiletto made from the base of a deer's antler found in the Corraline Crag at Allborough, Suffolk, some fifty years ago. A well-made flint implement was found in the Foxhall Crag pit, Ipswich, in 1888. This is the pit which was afterwards the site of Mr. Reid Moir's discoveries. At Thorpe Neswick several worked flints were found while digging out the rib of an elephant, and were accepted by the late H. B. Woodward—a very cautious observer—as of human workmanship. Mr. Abbott also refers to the finds made by Mr. Savin and others in the Cromer Forest Bed. These flints were first brought to light at Runton in 1888 on the same occasion as the finds at the Foxhall pit, during the East Anglian Excursion of the International Congress of Geologists, when the party had been joined by the principal East Anglian geologists. Mr. Savin resumed work on the Cromer Forest Bed in 1895, and an exhibition of his finds was held at Burlington House, arousing much interest. These finds, Mr. Abbott points out, show that evidence

for tertiary man had been obtained from the Forest Bed thirty-one years, and from the Corraline Crag thirty-nine years, before the date claimed by Prof. Osborn.

THE Ministry for Social Welfare in Austria has been carrying out observations with the aid of Prof. Conrad, Prof. Hausmann, and others, on the climatic conditions of sanatoria, in order that these should be placed in the best positions; for example, at mountain altitudes, where the maximal degree of sunshine and snowshine and cool dry air free from much wind are obtainable. Measurements of the ultra-violet radiation and of the cooling power of the air as indicated by the kata-thermometer, have been taken in addition to the usual meteorological measurements. In Britain the most sunshine and driest climate are obtained on the south-east, but sanatoria are scattered all over the country. No doubt the most ideal conditions are afforded by the Alpine climate, but excellent results can be obtained in the various parts of Britain by open air treatment. Shelters can be arranged to mitigate wind and artificial sunlight used to make up for deficiency of light. Even in Salford, rickety, weakly children have been made robust and healthy by being put to live in an open air shelter and playground, well clothed and fed, and given no artificial heat other than that used for drying clothes and warming food. For adults who cannot be disciplined as children, there is advantage in treatment at an isolated Alpine sanatorium. If cases of tuberculosis of the lungs went there in the early stages of the disease and stayed for a couple of years, so as to avoid catarrhal infections which result from coming home, cure would result in almost all. Mischief is caused at the sanatoria in popular Alpine resorts by the winter visitors carrying thither catarrhal infections. Isolation from such infection is a chief requirement while the warm sun and calm, cold, clean air of the mountains works its effect.

THE presidential address of Mr. Edwin Thompson, chairman of the Water Committee of the Liverpool Corporation, at the annual meeting on July 9 of the British Waterworks Association, was an interesting discursive survey of various matters connected with the supply of water to cities and towns generally, with some allusion in particular to certain notable features and incidents, historic and economic, in the genesis and development of the waterworks of the City of Liverpool. In the course of his address, Mr. Thompson touched upon the chemical analysis of water, river pollution, supplies from wells, methods of purification, hardness, water for power purposes, per capita consumption, domestic fittings; in fact, on quite a number of topics of importance to municipal authorities. Among points of interest may be noted his statement that the consumption of water in Liverpool is 36 gallons per head per day, and his confident anticipation "that the time is not far distant when the demand will be much greater than it is to-day and that it will become a very serious consideration". He went on to contrast the low quantitative standard of British supplies with that obtaining in America (200 gallons per head per day) and the defects in Great Britain in regard to fittings for domestic water supply. Liverpool, it appears, was probably one of the first authorities to require no additional payment for water for water-closets and baths, the extra charges for these purposes being done away with in 1860. The cost of providing and maintaining all communicating pipes supplying domestic services in the Liverpool area of distribution is more than £7500 per annum, and for this there is no direct charge. Finally, Mr. Thompson gave it as his opinion that, in spite of national shortcomings in other directions, "when it comes to the question of the purity of public water supplies Great Britain stands pre-eminent".

THE Water Power Resources Committee in its final report issued in 1921 recommended that investigation should be made into the problem of compensation water to riparian interests and appointed a sub-committee to inquire into the problem. The present method was adopted some seventy years ago and based on purely empirical lines. The procedure is to deduct from the average annual rainfall over the catchment area one-fifth or one-sixth in order to arrive at the rainfall that might be relied on during a period of three consecutive dry years. From the remainder 14 inches was deducted to cover losses due to evaporation and absorption. The amount thus reached, called the available yield, was divided between the needs of public water supply and riparian interests in certain proportions, generally two to the former, and one to the latter. The sub-committee (Assessment of Compensation Water, Ministry of Health, 1930) proposes to retain the method of estimating rainfall over three dry years by deducting 20 per cent from the long period average, but to alter the basis of allowance for evaporation and absorption. It is proposed that this loss should be measured for every river by the difference between the rainfall and the run off as ascertained by stream gaugings, which should measure all flows of the stream for a period of seven years. This period should be prior to or during the construction of impounding works. From this a method is suggested for arriving at the assessable flow on which the amount of compensation water should be determined in relation to the use of the stream by riparian interests.

FROM a communication in the *Times* by the curator of Sir John Soane's Museum, the welcome news is forthcoming of the recovery of thirty-two large drawings by Sir Christopher Wren, the details of which refer to Whitehall Palace (1698), Windsor Castle (1705), and Greenwich Hospital (1694–99). The drawings had found a home at All Souls, Oxford, though no record existed respecting their acquisition. The first dispersal of the collection of "Drawings of Architecture of the late Sir Christopher Wren", together with a series of antique marbles, gems, medallions, and other articles, took place in the Great Piazza, Covent Garden, in April 1749. A sale catalogue mentions the recovered drawings; also, a note therein gives the purchaser's name as Dr. Stack, F.R.S. This interested person would appear to be identifiable as Dr. Thomas Stack, who was elected into the Royal Society on

Jan. 26, 1737 [1738 N.S.], signing the charter book on formal admission a little later. At that time Sir Hans Sloane was president of the Society. If one may judge from a paper of his in the *Philosophical Transactions* for 1739, he seems to have been of a credulous turn of mind. Perhaps better opportunity was given in work connected with the writings of the celebrated Dr. Richard Mead (Newton's physician). He translated from the Latin, Mead's "Treatise concerning the influence of the Sun and Moon upon Human Bodies" (1748) and "Medical Precepts and Cautions" (1751). Posterity now connects him, however indirectly, with All Souls, Oxford.

DURING the World Power Conference held in Berlin last month a visit was arranged to the new high-tension testing room of the well-known porcelain factory of Messrs. Ph. Rosenthal and Co., Ltd., in Bavaria. The rapid increase in the high-tension voltages used in practice has made necessary the use of high-tension testing pressures of two million volts. In Germany 220 and 360 kilovolts are at present in use, and for the European grid Dr. Oliven has proposed 400. As the firm manufactures high-tension insulators it was necessary to test with very high pressures so as to increase the knowledge of sparking phenomena. It had the benefit of the experience gained in similar laboratories in other countries. The building is of reinforced concrete; it has no windows and has a flat roof. It was necessary to make the room lightproof, so that photographic studies could be made. Two independent sets are installed, one for alternating current and the other for direct current impulse testing. The firm has succeeded in building a single transformer which produces two million volts. The height of the transformer is 26 feet and the voltage produced is measured by the sparking gap between two hollow copper spheres, each eight feet in diameter and weighing 1600 lb. The direct current impulse plant is the largest in existence. When the condensers are connected in series a voltage of 2,200,000 is produced. The spherical electrodes, five feet in diameter, are arranged so that the spark gap is vertical, and thus floor space is saved. Photographs of the outside and inside of the testing laboratory are given in the *Electrician* for July 4. It is said to be a most impressive sight to see the flash-over on an insulation chain, composed of 14 large insulators, the spark attaining lengths up to 12 feet.

IT is announced by Science Service, of Washington, D.C., that a bill is shortly to be reported out from the House committee on the Library which will allow the President of the United States to decorate men and women who, while in the employ of the Federal Government, have "made outstanding contributions to the advancement of scientific knowledge or the application of its truths in a practical way for the welfare of the human race, and to citizens who, while in the employ of the Federal Government, have rendered conspicuous service to humanity at the voluntary risk of life or health over and above the ordinary risks of duty." There will be two medals. For the scientific worker who has made a specific contribution to the knowledge of the world, there will be the Thomas Jefferson Medal of Honour for Distinguished Work in Science. This medal is named after President Jefferson, who was an early patron of science. The other medal will be known as the Jesse W. Lazear Medal of Honour for Distinguished Self-Sacrifice for Humanity, and will be awarded to those who risk life and health that the cause of science may be advanced. This medal is named after Dr. Lazear, who, as a member of the famous Yellow Fever Commission, allowed an infected mosquito to bite him, giving him a fatal infection with the disease, which has been conquered through the information that this and similar heroic sacrifices have given to medical science. Only three medals in each class will be awarded each year by terms of this bill, and the National Academy of Sciences will pass on names recommended to it by heads of departments and independent offices of the Government. It is conceivable that one person might be awarded both medals, either in one year or in different years. Recipients of these medals would, in addition, receive 1000 dollars each. The bill will probably pass at the next session of the 71st Congress, beginning in December.

MESSRS. Adam Hilger, Ltd., have just published a new edition of their general catalogue, containing particulars of apparatus in sections D to N of their complete list and a statement of the contents of supplementary catalogues of more specialised manufactures. It includes a considerable number of items, marked as now appearing for the first time, of which a few may be specially noticed. In Section E (spectrographs) there is a description of a 1-metre vacuum grating spectrograph following the lines laid down by Sawyer (*J.O.S.A.*, 15, p. 303; 1927) and also embodying features not appearing in his design, such as an efficient means of raising or lowering the plate-holder and of withdrawing and replacing the shutter of the plate-holder *in vacuo* so that the instrument may be used in a well-lighted room. The slit system is arranged so that gas discharge spectra may be photographed without using a window. In the same section an X-ray crystallograph is described, designed for chemists, metallurgists, geologists, and others who desire the analysis of crystalline structure in comparatively short periods of time and with the smallest amount of unfamiliar technique. Section F (accessories for spectrometers and spectrographs) includes a new apparatus for sparking solutions in which the liquid drops steadily from an upper tube into the spark gap. It would have been of advantage if it had been stated whether the window supplied was of glass or quartz. Arrangements for carrying out de Gramont's method of sparking materials, including powders, are also provided, and a special powder has been prepared containing fifty elements in such proportions as to show only about seven spectrum lines, including the *raies ultimes*, of each element. This should greatly facilitate spectrum analysis. A star-plate measuring machine, accommodating plates up to seven inches square, is described and illustrated in

Section L (micrometers, etc.), and Section M (polarimeters and refractometers) contains particulars of an ultra-violet étalon refractometer requiring only a thin film of liquid. The catalogue as a whole shows a very adequate provision for all types of spectroscopic and allied investigations.

IN his seventeenth annual report to the board of trustees of Mellon Institute of Industrial Research of the University of Pittsburgh, Dr. E. R. Weidlein has summarised the activities of the institution during the fiscal year ended Feb. 28 last. The sum of £186,000 was contributed by industrial fellowship donors in support of research—an increase of £26,000 over the preceding year. The total amount of money appropriated to the Institute by companies and associations for the nineteen years ended Feb. 28, 1930, was 6,749,273 dollars. Throughout the year 71 industrial fellowships, requiring the services of 209 full-time research men, were in operation. Sixty-one industrial fellowships—21 multiple fellowships and 40 individual fellowships—were active at the beginning of the new fiscal year. Eight are being sustained by industrial associations. The industrial research personnel consists of 21 senior industrial fellows, 88 industrial fellows, 34 full-time fellowship assistants, and a number of part-time assistants. Especially notable results have been forthcoming from the following investigations: air pollution, bricklaying, carbonated beverages, cooking utensils, food varieties, heat insulation, iodine, laundering, organic synthesis, petroleum production, and vitrified sewer pipe. Ten fellowships completed their research programmes: beds, cast iron (two fellowships), chrome plating of aluminium, gum, hats, industrial alcohol, licorice, stearic acid, and surgical supplies. Nine fellowships became active during the fiscal year: can, fatty acid uses, garment, hemp paper, nicotine, oxygen, rosin oil, steel treatment, and wood by-products. Five new fellowships have been accepted and their operation will be begun during the early part of the new fiscal year. The Institute's department of research in pure chemistry has continued its work on acidic carbohydrates occurring in plants and on other problems in the province of sugar chemistry. Of the 61 fellowships now active, 15 have completed more than ten years of work.

IN pursuance of its policy of founding meteorological and geophysical observatories in high latitudes, the Soviet Government last year sent an expedition in the icebreaker *Sedov* to found an observatory in Franz Josef Land. After some trouble with pack-ice Cape Flora was reached and eventually Hooker Island, where a site was chosen on the west coast in lat. 80° 19′ N., long. 52° 48′ E. Prof. R. Samoilowitch gives an account of the work of the *Sedov* in *Petermanns Mitteilungen*, Hefte 5/6, 1930, with a track chart and a map of Hooker Island. The *Sedov* pushed north to the Victoria Sea and visited Rudolf Island before returning to Archangel. This station is the most northerly observatory functioning.

FROM the Annual Report of the National Museum of Wales it is easy to discover the secret of the recent progress of that institution. Here is a national museum in more than name, for its governing body embraces the widest interests and the nation unites behind it with a will. During the year the Building Fund received from private donors £10,487, and £57,000 has been accumulated towards the erection of much-needed new galleries and a lecture room. The total aimed at is £150,000, and of this the Government has promised £50,000; pending the raising of this large sum, the Government has permitted a proportional expenditure of grants, and the building of gallery and reserve accommodation in an east wing is being proceeded with. In the Museum itself the gradual purchase of new exhibition cases is making itself noticed, both in permitting the addition of new objects of interest and in improving the general appearance of the exhibits by allowing the elimination of old ill-assorted cases.

THE city of Vancouver, British Columbia, has reason to thank its Art, Historical, and Scientific Association for the efforts made to increase public interest in the Museum and Art Gallery. The publication of the quarterly *Museum and Art Notes* should be good propaganda, for the journal contains a proper blend of articles of general interest and of more definite scientific value. The results are apparent enough in the response of the public. The Curator's report for 1929 (contained in the December *Notes*) shows an attendance of 86,228, an increase of almost 10,000 in two years, and the acting president's address states that although every section, art, natural history, mineralogy, Indian, etc., has attracted its following of students, residents, and tourists, the outstanding feature has been the greatly increased use of the Museum by school children, both individually and in classes conducted by the teacher and, where requested, by the curator. But there is a fly in the ointment: valuable collections have been lost to the museum because of lack of space and funds to exhibit them suitably, and material which has been given by generous donors is crowded out of the galleries. More accommodation is required, and the city authorities would do well to consider with sympathy this clamant need of one aspect of the educational progress of the citizens.

THE annual special issue of *The Chemist and Druggist* published on June 28 contains among other historical articles the fourth instalment of Dr. Charles Singer's "Sketches in the History of English Medicine", which deals with the beginnings of the scientific method in the seventeenth century, as exemplified by Harvey, Paré, Sydenham, and the Royal Society, the text being liberally interspersed with contemporary portraits and illustrations of books and instruments. In addition to giving an appreciation of the works of Fabricius of Acquapendente, Harvey, Paré, and Sydenham, as well as an account of the famous medical school at Padua, where Harvey pursued his studies, and of contemporary British pharmacy, of which Thomas Johnson was an eminent representative, Dr. Singer points out that it was in the seventeenth century that the study of tropical medicine in Great

Britain first originated, owing to the discovery of new lands bringing men into contact with new diseases. The earliest English work on this subject was published in 1598 by George Wateson, under the title of "The Cure of Diseases in Remote Regions", to which Hakluyt alludes in his "Voyages" published two years later. In conclusion, Dr. Singer refers to the change in the chemical outlook achieved by Robert Boyle, who not only liberated chemistry from alchemy, but also made chemistry independent of medicine, with which it had hitherto been too closely associated, to the detriment of both.

WE welcome the appearance of a new series of the *Quarterly Journal of Mathematics*, a formerly well-known journal, published by the enterprise of the Clarendon Press. The old *Quarterly Journal* published as a private venture at Cambridge appeared regularly until the War, but only at rare intervals from 1916 until its death on completion of the fiftieth volume in 1926. It is to be hoped that a subject index to the whole fifty volumes will be published in due course. Opportunity has been taken to increase the size of the page in beginning a new series. The style of printing is a great improvement on the former and only possible by the use of fine-quality paper. A strong editorial board is behind the new enterprise, and from the contents of the opening part we foresee that this journal will soon become a recognised medium for the publication of first-class mathematical research. The new journal also incorporates the old-established *Messenger of Mathematics*.

THE University of Brussels, on the proposition of the Faculty of Science, has conferred the degree of doctor *honoris causa* on Sir William J. Pope.

AN Imperial Horticultural Conference, called by the Imperial Bureau of Fruit Production, East Malling Research Station, Kent, under the ægis of the Imperial Agricultural Bureaux, will be held in the Conference Hall of the Royal Society of Arts on Aug. 5-7. The main purpose of the Conference will be to discuss the best methods of approach to horticultural problems and the technique involved. The opening address will be delivered by Sir Robert Greig, chairman of the Imperial Agricultural Bureaux, and papers have been promised, among others, by several workers from the Dominions. The work of the Imperial Bureau of Fruit Production will be described, and groups of papers are to be devoted to horticultural research in the Dominions, applications of pure science to horticultural problems, soil and climate surveys, and fruit storage. The discussions will be open to the public.

THE proposal to establish a college for postgraduate medical study in London has advanced a stage, for the Minister of Health, Mr. Arthur Greenwood, has appointed a provisional organisation committee to proceed with the action necessary to secure the institution of a British Postgraduate Hospital and Medical School. This committee is to consider and report on the action requisite to lead up to the planning and construction of the School, the form of government appropriate for it, and the relation of the School to the London County Council and University of London. The chairman of the committee is the Right Hon. Viscount Chelmsford, and the committee consists of representatives of the Ministry of Health, the London County Council, the University of London, and a number of distinguished medical members, with Mr. M. Heseltine, of the Ministry of Health, as secretary.

THE fifth Pacific Science Congress is to be held in Canada on May 23–June 4, 1932, under the auspices of the National Research Council. Meetings will be held in the cities of Victoria and Vancouver, B.C., and a short tour is planned to follow the congress meetings so that the delegates may see something of the Dominion. The Congress has a twofold purpose, namely, (1) to initiate and promote co-operation in the study of scientific problems relating to the Pacific region, more particularly those affecting the prosperity and well-being of Pacific peoples; (2) to strengthen the bonds of peace among Pacific peoples by promoting a feeling of brotherhood among the scientific workers of all the Pacific countries. The first Pacific Science Congress was held in Honolulu in 1920; the second in Sydney and Melbourne, Australia; the third at Tokio; and the fourth in Batavia and Bandoeng, Java, in 1929. Thus, when the next Congress is convened in Canada, it will be the first of these meetings to be held on the eastern side of the Pacific Ocean.

AN executive committee to organise the fifth Pacific Science Congress, headed by Dr. H. M. Tory, president of the National Research Council of Canada, has been appointed. There are two vice-presidents: President L. S. Klinck, of the University of British Columbia, and Dr. Frank D. Adams, emeritus dean of the Faculty of Graduate Studies, McGill University, Montreal. The treasurer is Mr. S. P. Eagleson, secretary-treasurer of the National Research Council, and Mr. S. J. Cook, also of the National Research Council staff, is general secretary. The office of the Congress is in the National Research Council Building at Ottawa, Canada. There are to be two main divisions of the Congress. The division of biological sciences will be headed by Dr. C. M'Lean Fraser, professor of zoology in the University of British Columbia; the division of physical sciences will be under the chairmanship of Dr. R. W. Brock, dean of the Faculty of Applied Science, University of British Columbia. The Congress will bring to the Dominion and to the study of Pacific problems, in which Canada has a great interest, an international body, including among its members many distinguished men of science from different parts of the world, as well as many others who will influence the development of improved scientific and commercial relations between the Dominion of Canada and the other countries bordering on the Pacific Ocean.

A VALUABLE index to the contents of the forty completed volumes of the *Mémoires de la Société de Physique et d'Histoire Naturelle de Genève*, from 1821 to 1930, has been compiled by John Briquet, and is

published as the final fascicule of Volume 40. It is not a subject index in the ordinary sense, for there is no alphabetical arrangement of the subjects of the papers, but a general alphabetical list of authors is followed by authors' lists grouped according to the various branches of science. In addition, a table shows the year of publication of each part, and a separate list indexes the biographical notices which have appeared, 234 in number.

APPLICATIONS are invited for the following appointments, on or before the dates mentioned :—A deputy chief engineer and an assistant engineering superintendent of works under the Metropolitan Water Board—The Chief Engineer, Metropolitan Water Board, 173 Rosebery Avenue, E.C.1 (July 21). A junior assistant in the pathological departments of the Royal Victoria Infirmary and the University of Durham College of Medicine—The House Governor and Secretary, Royal Victoria Infirmary, Newcastle-upon-Tyne (July 23). An assistant lecturer in agriculture under the Cornwall County Council Education Committee—The Secretary for Education, County Hall, Truro (July 24). A chief assistant under the Scottish Society for Research in Plant-Breeding, for work on virus disease of potatoes—The Secretary, Scottish Society for Research in Plant-Breeding, 8 Eglinton Crescent, Edinburgh (July 29). A professor of education in Rhodes University College—The Secretary, Office of the High Commissioner for the Union of South Africa, Trafalgar Square, W.C.2 (July 31). A chief agricultural lecturer and adviser under the Dorset County Council, County Agricultural Committee—The Clerk of the County Council, County Offices, Dorchester (July 31). An assistant lecturer in physics in the University of Birmingham—The Secretary, The University, Birmingham (Aug. 1). A research assistant in the department of mathematics of the Imperial College of Science and Technology—The Registrar, Imperial College of Science and Technology, South Kensington, S.W.7 (Aug. 7). An assistant professor of anatomy in the University of Manitoba—The Dean of the Faculty of Medicine, Medical College, Winnipeg, Canada (Aug. 8). A principal of the Stranmillis Training College, Belfast—The Secretary, Committee for the Training of Teachers, Ministry of Education, Parliament Buildings, Belfast (Aug. 16). Research studentships at the London School of Hygiene and Tropical Medicine in, respectively, entomology and protozoology — The Secretary, London School of Hygiene and Tropical Medicine, Keppel Street, W.C.1 (Sept. 1). A Samuel Turner research fellow for work on cancer and the pathology of growth, in the University of Liverpool—The Registrar, The University, Liverpool (Sept. 30). A graduate mistress with good qualifications in botany, at Newport, I.W., Secondary School—The Director of Education, County Hall, Newport, I.W.

Our Astronomical Column.

The Planet Saturn.—Mr. W. F. Denning writes: "Saturn is now favourably situated in some respects for observation, being visible nearly all night. The rings are now widely open and their northern side is presented to the earth. The apparent diameter of the planet is at present 16·4″. It was in opposition on July 1 at a distance of about 838,500 miles from the earth. Being placed amongst the southerly stars of Sagittarius, its altitude will be very low and only 16° when passing the meridian on July 20 at 10.40 P.M. Telescopic definition will not often favour the observer under the conditions, though in southern latitudes the object will attain a greater height and induce more successful results. The belted aspect of Jupiter's disc is repeated in the case of Saturn, and from their character and the changes affecting them, it seems probable that the atmospheric phenomena are very similar on these large planets. On Saturn, however, they appear less conspicuous and are not so frequently noticed, but this is due in a large measure to the fact of their being fainter and smaller than the features of Jupiter."

Nature of Hagen's Dusky Nebulosities.—Much controversy has raged about the reality of these difficult objects. Father Hagen has been able to collect a considerable body of visual evidence in support of their existence, going back to Sir W. Herschel, and including some well-known observers of the present time. A good many astronomers have felt the weight of the objection that the objects cannot be photographed either on ordinary plates or on red-sensitive ones.

Prof. J. Hartmann makes the suggestion in *Astr. Nach.*, No. 5716, that they may consist of diffused sodium clouds. He notes that, in addition to the well-known stationary lines of calcium, some stars show the *D*-line of sodium as stationary. The *D*-line comes in a region of the spectrum where neither ordinary plates nor red-sensitive ones have much sensitivity; on the other hand, it comes near the maximum of visual sensitivity. The colour of the Hagen clouds has been variously described as brown, yellow, and red. It is difficult to assign an exact colour to very faint objects, so this would not be inconsistent with the wave-length of the *D*-line.

Prof. Hartmann proposes himself to take photographs with a camera of focal ratio $\frac{1}{5}$, using plates as sensitive as possible to this region and a suitable light filter (OG1 on the list 4213 of Schott und Gen.; 2 mm. thick). The exposures will last several hours. He asks that similar photographs should be taken in Europe and North America. He notes that if the light is really monochromatic, it would not be much more difficult to photograph the spectrum of the clouds than the clouds themselves. This would serve to verify his conjecture as to the wave-length.

The Planet Pluto.—Harvard Announcement Card, No. 137, gives the following positions of Pluto deduced by Mr. Ross from plates exposed at Yerkes Observatory.

U.T.	R.A. 1930·0.	N.Decl. 1930·0.	Mag.
1921. Jan. 29·0896	$6^h\ 31^m\ 21{\cdot}9^s$	19° 43′ 14″	15
1927. Jan. 6·25	7 4 3·2	21 13 3	15

The positions are in good accord with the recently published orbits.

Prof. P. Stroobant has remeasured the image of Pluto photographed at Uccle 1927, Jan. 27, $21^h\ 27^m\ 41^s$ U.T. using six comparison stars. The new position for 1927·0 is $7^h\ 1^m\ 59{\cdot}965^s$ N. 21° 17′ 44·0″. This should be substituted for the previously printed value $7^h\ 1^m\ 59{\cdot}7^s$ N. 21° 17′ 59·7″, which was inexact. The new value accords well with the calculated orbit.

Research Items.

Tubuai.—An account of Tubuai, one of the Austral Islands, based upon material collected by the Bayard Dominick Expedition, is given by Mr. Robert T. Aitken in *Bull.* 70 of the Bernice P. Bishop Museum of Honolulu. This island lies about 400 miles south of Tahiti and is evidently of volcanic origin. The material culture of the inhabitants is characterised by the taro, coconut, manioc, and banana, and by fish rather than animal foods. The dwellings are Polynesian in design. The islanders fish with the spear and use the outrigger canoe propelled by paddle and sail, but not with the pole. They weave in coconut leaf and lauhala. Their material culture is thus closely related to that of modern Tahiti. The mythology is distinctly Polynesian, containing elements found in New Zealand, Tahiti, and Hawaii. In the social organisation of former days, there were definitely recognised districts, each occupied by a leading man or chief with family, relatives, and followers. There was constant warfare between districts. Powerful leaders from other islands, especially Raivavae, invaded the island and conquered the families of the various districts. The modern language is almost entirely a Tahitian dialect introduced by missions. A few words remembered from pre-mission days indicate that the former dialect approached more nearly to the old Polynesian language. Archæological remains point to a former religious ceremonial life differing from that of Tahiti and similar to that indicated by similar remains in Rurutu and Raivavae. Remains of ancient villages suggest a much larger population in olden times. It is clear from local records that the influence of Raivavae on Tubuai has been very great and that there was frequent interchange of culture and blood.

Peruvian Textiles.—Miss Lila M. O'Neale and Dr. A. L. Kroeber have made an intensive study of the textiles of ancient Peru based upon the collection of the University of California. Some 650 pieces have been examined, and though about 1000 more await investigation, it has been thought expedient to summarise the results to date. These are now published as No. 2, vol. 28 of the *Publications in American Archæology and Ethnology* of the University. These prehistoric textiles are derived from sites on the Peruvian coast from about 300 miles north of Lima to about 250 miles south of that city. In time they cover the whole of Peruvian prehistory from Early Nasca and the primitive fishing period down to Inca. No material from the Highlands was available. The chronological sequence is based primarily on pottery, secondly on building, head deformation, and other cultural traits. The following inferences are drawn: (1) Certain habits persisted, characterising certain regions; (2) changes in period manifest themselves in style rather than in technology and in the preferences given to certain techniques rather than in invention; (3) the fundamental technological control of the art was established at the beginning of the discovered record. In regard to the last it appears, for example, that cotton and wool are used in all periods. The percentage of pieces containing all wool fabrics is as a matter of fact highest in the early period while all cotton fabrics are highest in the latest period. The free use of wool in the early period means that the textile art was then already elaborate and that trade between coast and interior was regular, as the latter alone produced wool. A second point indicating the unity of the art was the loom, which throughout was of the type attached to the weaver's belt. Nearly all the fundamental weaves appear already in Early Nasca. This also holds for the dyes. As regards the decorative designs, these changed to correspond approximately with the designs of the pottery—from typically semi-realistic (pre-Tiahuanacu) to stiffly representative (Tiahuanacu-epigonal) to purely geometric and conventionalised (Late).

North Atlantic Scopelid Fishes.—Dr. Å. V. Tåning, in his "Synopsis of the Scopelids in the North Atlantic" (*Vidensk. Medd. fra Dansk Naturh. Foren.*, Bd. 86, 1928), surveys those forms which are met with in the Atlantic north of the Equator. The material, which consists of "many tens of thousands of specimens", was collected by the *Dana* and other Danish vessels under the guidance of Prof. Johs. Schmidt. The author has examined for comparison many others from various localities, including some from several European museums. Fifty-seven species or subspecies are noted in the present work, nineteen of which are new. The scopelids, which possess photophores in different positions on the body, are classified chiefly by these organs, and the present survey consists of keys to the species of each genus, giving a clear diagnosis and the distribution in each case.

Californian White Sea Bass.—Mr. S. S. Whitehead, in his paper "Analysis of Boat Catches of White Sea Bass (*Cynoscion nobilis*) at San Pedro, California" (Division of Fish and Game of California. *Fish Bulletin* No. 21. Contribution No. 86 from the Californian State Fisheries Laboratory, 1930), summarises the information regarding depletion in the White Sea bass fishery. This fish is important commercially, with an increasing demand. It may reach a length of four to six feet and weigh 50-60 pounds. It was found that the best way of understanding existing conditions was by estimating the catches per month. The averages for both boat catches per month and boat catches per trip were decidedly downward during the period 1918–28. Thus the availability of the White Sea bass has decreased each year, which, unless the fish have changed their habitat, means depletion. The reduction may be due to natural fluctuations over a period of years, or to adverse spawning seasons, or an increase of natural enemies, or to over-fishing. Whatever be the cause, the conclusions are that the White Sea bass fishery needs protection in order to ensure it against extinction in the future.

Halticine Beetles.—Dr. D. Ogloblin of Poltava, Russia, has published in *Eos*, **6**, 1, April 10, 1930, Madrid, an interesting study of thirty-five of Motschulsky's species of Halticine beetles. At one time it was thought that these were lost, but now it is known that they, or at least some of them, exist in the Zoological Museum of the University of Moscow. Entomologists who have to deal with Motschulsky's species suffer from the lack of an exact knowledge of the condition of his types. Dr. Ogloblin's study will remedy this to a certain extent, because, besides many text-figures, his paper is accompanied by an excellent plate of twelve coloured illustrations which were all drawn by the author from the cleaned and remounted types. Dr. Ogloblin is to be congratulated on his work, and it is hoped that he will have more opportunities to publish further studies of Motschulsky's types. The present paper has been edited by Mr. S. Maulik.

Japanese Monograph on *Rhizopus*.—The genus *Rhizopus* was originally separated from *Mucor* in 1820

by Ehrenberg, but the species of this genus are so variable in culture that their systematic study has always presented great difficulties. Yoshihiko Yamamoto has grown as many species as possible in pure culture under different conditions, obtaining species from other workers in the group also; his results are presented in a systematic monograph published in the *Journal of the Faculty of Agriculture*, Hokkaido Imperial University, vol. 28, part 1, March 1930. As a result of this very complete re-examination of the group, fifteen species are accepted, described, and figured.

Cyanogenesis in Plants.—The production of prussic acid in plants is a phenomenon which has considerable economic importance in view of casualties from this cause amongst grazing stock, or even in the case of cyanogenesis in crushed feeding cakes from some sources. The function of cyanogenetic compounds in the normal plants is still completely obscure and a subject of considerable interest, so that the review of the literature of cyanogenesis in plants, by Muriel Elaine Robinson, in *Biological Reviews*, vol. 5, April 1930, will be useful to workers in very varied fields. Prussic acid has now been obtained from plants from about fifty different families, whilst some ten different cyanophoric glucosides have been isolated in crystalline forms; five of these have been prepared synthetically. Seven of these glucosides are derivatives of benzaldehyde cyanhydrin, two others contain ketone groupings. Three of these glucosides, amygdalin, prunasin, and prulaurasin, seem to be restricted to the Rosaceæ, sambunigrin to the Caprifoliaceæ and dhurrin to the Graminaceæ, but linamarin has been found in several families which are widely separated in natural systems of classification. The concentration and seasonal variation of prussic acid in the plant show considerable differences; in general, the concentration seems to be greatest in young growing organs, but there are curious anomalies and so far, the few studies of distribution and seasonal variation of cyanophoric glucosides have thrown no clear light upon their rôle in the plant.

Chloride Manuring for Tobacco.—Although it is uncertain whether or not chlorine is an essential plant nutrient, W. W. Garner and others have shown (*Jour. Agric. Res.*, **40**, p. 627) that manuring with chloride has a far-reaching effect on tobacco and may alter the quality of the cured leaf considerably. Field tests were made using chloride and sulphate of potash. Although the plant absorbed potash equally well from both salts, the chlorine ions were taken up much more readily than the sulphate ions, and on light, sandy soils an average increased yield of ten per cent was obtained with applications of 20-30 lb. of chlorine per acre. The soils used were very deficient in magnesium, an element of particular importance for the tobacco crop, and since an application of potassium chloride was found to increase the magnesium content of the plants, it would seem that the stimulating action of the chlorine was probably due to an increase in the availability of the magnesium. Further, the addition of chloride resulted in an increased water content of the leaf, thus enabling the plant to resist desiccation, protecting it against the type of injury known as 'drought spot', a fact which adds materially to its commercial value. On the other hand, an excess of chlorine induces an abnormally high moisture content of the leaf and is therefore liable to injure its combustibility and keeping qualities. In addition, it interferes with normal carbohydrate metabolism, bringing about an accumulation of starch and a thickening of the leaf. These adverse effects may be caused by applications of 40-60 lb. of chlorine per acre and are most likely to occur on light soils, with limited buffering properties. From the economic point of view the chlorine nutrition of tobacco is of the greatest importance, for upon it, either directly or indirectly, the commercial value of the crop may depend.

Cosmic Dust and Meteorites.—It is usual, in considering the cosmic dust, to assume that the velocities of its particles vary in the same way as those of the molecules of a gas (Maxwell's law), but that the masses of the particles are all equal. Levi-Civita, in *Atti della Pontificia Accademia delle Scienze Nuovi Lincei* (March 1930) and *Rendiconti della R. Accademia Nazionale dei Lincei* (April 1930), considers it reasonable to suppose that the masses vary in the same way as the velocities. The results obtained are applied to estimate the effect of the impact of meteorites on a planet moving in its orbit.

Pleochroic Haloes in the Archæan of Uppsala.—The inaugural dissertation of Erik Wiman on "Studies of Some Archæan Rocks in the Neighbourhood of Upsala" (published in the *Bull. Geol. Inst., Upsala*, vol. 23, 1930) contains a series of measurements of pleochroic haloes around zircon and apatite in biotite and hornblende from the Uppsala and Arnö granites. In the Uppsala granite haloes with the radius 0·038 mm., corresponding to ThC, are abundantly present. In one case a radius of 0·057 mm. was found. The Arnö granite, however, contains numerous larger haloes with radii 0·055—0·056—0·057—0·060 mm., the value 0·057 being most characteristic of this series. The author adopts this contrast as a means of distinguishing the two granites. Of greater significance is the question of the origin of the larger haloes, for such large radii have not previously been recorded. They are found both in biotite around zircon and in hornblende around apatite, and Wiman thinks that they may point the way to the discovery of a new radioactive substance. They can scarcely be ascribed to the longer α-rays from radium C (Philipp and Donat: *Zeit. f. Physik*, vol. 52, p. 759, 1928), as in that case they should have been previously observed elsewhere.

Fundamental Physical Constants.—During the past year, doubt has arisen as to the accuracy of the standard values of the electronic charge (e) and Planck's constant (h). A welcome contribution to this problem has now been made by Prof. R. A. Millikan himself, in a paper in the second issue of the *Physical Review* for May. Prof. Millikan considers that the only changes which need be made to the numbers which he gave in 1917 are the almost trivial ones which arise from new determinations of the velocity of light, and of the absolute value of the ohm; taking these into account gives, for e, $(4{\cdot}770 \pm 0{\cdot}005) \times 10^{-10}$, for h, $(6{\cdot}547 \pm 0{\cdot}010) \times 10^{-27}$, and for Avogadro's number, $(6{\cdot}064 \pm 0{\cdot}006) \times 10^{23}$. Prof. Millikan also discusses, from the experimental point of view, the most probable value of the spectroscopic fine-structure constant ($1/\alpha$ or $hc/2\pi e^2$), which quantum theory predicts to be 137, and finds that it is highly improbable that this can be a whole number—there is of course no question that its value is *approximately* 137. Using his new values for e and h, and Michelson's redetermination of the velocity of light ($2{\cdot}99796 \times 10^{10}$), Prof. Millikan finds for $1/\alpha$ the value 137·29, which is very close indeed to the quantity $8\pi\,(8\pi^5/15)^{1/3}$, or 137·348, predicted by Lewis and Adams in 1914 from their theory of ultimate rational units.

Magnetic Properties of Mesomorphic Substances.—Amongst the articles in the 1929 volume of Conférences of the Conservatoire National des Arts et Métiers

(Paris, Hermann et Cie, 1930; 35 francs) is one by Prof. G. Foëx, on the magnetic properties of mesomorphic materials (liquid crystals). These substances, which although fluid are optically anisotropic, are diamagnetic. Those which belong to the nematic class have, however they are formed, a susceptibility definitely less than that of either the related solid or true liquid phase; the smectic class, on the contrary, has a definite lower susceptibility only if formed by cooling the isotropic parent liquid in a magnetic field. The variation with temperature of the susceptibility of a nematic liquid is large, and somewhat similar to that of a ferromagnetic body near its Curie point; Prof. Foëx indeed defines the nematic phase as "a liquid with a molecular field". One curious property of the nematic liquids is that they solidify in a magnetic field to a crystalline mass in which the molecules have one axis orientated. Prof. Foëx's reference to the similarity between nematic liquids and ferromagnetic solids is perhaps of special significance in view of Heisenberg's theory of the latter, which correlates their magnetism with the exchange properties of electrons on quantum theory.

Theory of Magnetism in Iron.—If a telephone receiver is connected with the output circuit of an amplifier and an electromagnet is in series with the amplifier, then if a magnet is brought gradually up to the electromagnet and the amplifier is very sensitive, a crackling noise is heard in the telephone. The German physicist Barkhausen, who first noticed the effect about ten years ago, attributed the noises to sudden changes in the magnetisation of the iron. If this is true, it seems to prove that sudden changes in the magnetisation of the iron occur not by single atoms but by much larger groups of atoms. A paper giving the results of research in this subject by R. M. Bozorth is published in the April number of the *Bell Laboratories Record*. He verifies Barkhausen's results and concludes that the ordinary theory of magnetisation must be modified. Instead of accounting for a steady change in magnetic state proceeding atom by atom, the theory must be based on very large groups of atoms making sudden changes simultaneously. For different kinds of magnetic material the sizes of these groups are not radically different, but they seem to vary in size at different points on the magnetisation curve. At saturation on either end of the hysteresis loop, the groups are small, but they increase in size with decreasing magnetisation. A maximum is reached near the steepest part of the curve, where the total magnetisation is about zero. An oscillogram is shown verifying an amplified Barkhausen effect with a 1000 cycle per second timing wave for comparison.

Ionisation of Electrolytes.—Although the hypothesis of the complete ionisation of strong electrolytes is widely accepted, the assumption in some cases is invalid. In the May number of the *Journal of the Chemical Society*, H. E. Blayden and C. W. Davies examine the experimental data for the solubilities and conductivities of thallous chloride. They find that (as in other known cases) the numerical value of the constant in the Debye and Hückel formula is not the theoretical value 0·505. In the present case it is 0·38. The irregularities in the solubility curves found on the assumption of complete ionisation disappear when allowance is made for incomplete ionisation, and the activity coefficient then becomes independent of the nature of the other ions present up to concentrations of decinormal.

Reaction between Hydrogen Sulphide and Silver.—The blackening of silver by exposure to air containing hydrogen sulphide is well known, but the exact nature of the reaction has not been completely elucidated. In the March number of the *Journal of the American Chemical Society*, S. Lilienfeld and C. E. White describe some experiments on the subject. It had previously been shown that the reaction does not occur with dry gas. It was found that phosphorus pentoxide is not suitable for drying hydrogen sulphide, as it oxidises the gas to sulphur dioxide. Silica gel and aluminium oxide prepared by heating the gel at 180° for a week were found to be satisfactory, the latter removing practically every trace of water. It was found that, in presence of air, no hydrogen was evolved in the reaction between silver and hydrogen sulphide, and that no reaction occurred between silver and pure hydrogen sulphide. The presence of oxygen is necessary for the reaction, and attention is directed to the fact that ordinary silver may contain dissolved oxygen. An oxidation of hydrogen sulphide in presence of oxygen, with liberation of sulphur, is suggested.

Hydrogen Chloride in different Solvents.—The original assumption of Arrhenius that the properties of an acid are due to the dissociation of hydrogen ions: $HCl = H^{\cdot} + Cl'$, was modified many years ago by Lapworth and others so as to take account of the undoubted influence of the basic character of the solvent, and Hantzsch had suggested that in aqueous solution the hydrogen ion is really $H_3O^{\cdot}$: $HCl + H_2O = H_3O^{\cdot} + Cl'$. The effect of a solvent in promoting ionisation was also supposed by J. J. Thomson and Nernst to increase with its dielectric constant. In the May number of the *Journal of the Chemical Society*, Wynne-Jones describes some experiments on hydrochloric acid in nitrobenzene, a solvent of high dielectric constant but no marked basic character. If the dissociation is primarily determined by the dielectric constant, nitrobenzene would be a good ionising solvent for hydrochloric acid. This was not found to be the case, the acid behaving as a normal undissociated substance. These results support the view (originally due to H. E. Armstrong and to Lapworth, but attributed in the paper to Brönsted) that the behaviour of an acid is largely determined by the basic character, not by the dielectric constant, of the solvent. In the case of salts, the dielectric constant is the important factor.

Cytochrome as a Biological Oxidation Mechanism.—An interesting paper upon this subject, by Keita Shibata and Hiroshi Tamiya, is published in the *Acta Phytochimica*, vol. 5, No. 1, April 1930. They find that the oxygen-carrying properties of the pigment can function without dependence upon special oxidase or reductase systems that may form part of the respiratory mechanism of the cell. The linkage of cytochrome with oxygen is a ferro-linkage taking up molecular oxygen; naturally, therefore, the presence of potassium cyanide strongly inhibits the oxygen-carrying properties of cytochrome. By various treatments, such as boiling, drying, addition of oxidising agents, etc., the oxygen-carrying properties of cytochrome can be destroyed by a 'denaturing' of the iron to hæmochromogen (Fe'') or hæmatin (Fe''') derivatives. Cytochrome, it is suggested, is very essential to plants living naturally in air, but not to plants which are normally submerged. Owing to the striking capacity cytochrome shows for taking up oxygen, the respiration of cytochrome-containing plasma is, within wide limits, independent of the oxygen tension in the atmosphere surrounding it, whilst, on the other hand, organisms poor in cytochrome show a striking sensitiveness to variations in the oxygen content of the medium. Cytochrome, hæmochromogen, and hæmatin are found to be present in many of the lower animals.

Laboratory Induction Furnaces.

THE Metropolitan-Vickers Electrical Co., Ltd., has developed small induction furnace equipments which are particularly suited for laboratory work. They were originally designed for the Company's own research laboratories, but they are now made commercially. The Imperial Chemical Industries, Ltd., has ordered one which will melt a charge of twenty pounds of metal and is rated at 20 kilowatts. The equipment supplied to the University of Manchester is designed for charges varying from a half to two pounds of metal and is rated at five kilowatts. Two equipments supplied to the University of Sheffield are of rather smaller size, and are used for melting charges of only a few hundred grams of metal *in vacuo*.

The high frequency current required to operate these furnaces is obtained by means of a water-cooled oscillator valve. As the frequency is 500,000, the furnaces can melt very small charges. Whilst a quarter of a ton of steel could be melted with current at a frequency of 500, for small charges much higher frequency is essential. To melt the full charge requires from twenty to thirty minutes, but small charges can be melted in two minutes. So great is the rate at which heat energy is generated that half a pound of steel will evaporate if left in the furnace field for five minutes.

In Fig. 1 a ten-pound ingot of steel is shown being poured from a furnace in the Research Department of the Metropolitan-Vickers Electrical Co., Ltd. The tilting gear shown in the figure is used with the larger furnaces. The three-phase valve rectifier unit is supplied at 10,000 volts by a suitable transformer. It is controlled either by a contactor or by push buttons on the furnace table.

At the back of the furnace table are the tuning condensers and a panel on which is mounted a neon lamp to indicate when the set is oscillating and an ammeter to read the current in the oscillatory circuit. The rectifying valves are protected by a filament voltage relay which prevents the high pressure being applied before the filament voltage has the correct value. A relay is also provided in the water circulation system which trips the contactors of both the main and filament circuits in the event of a failure of the water supply.

Even with charges so small as 20 gm., the weights

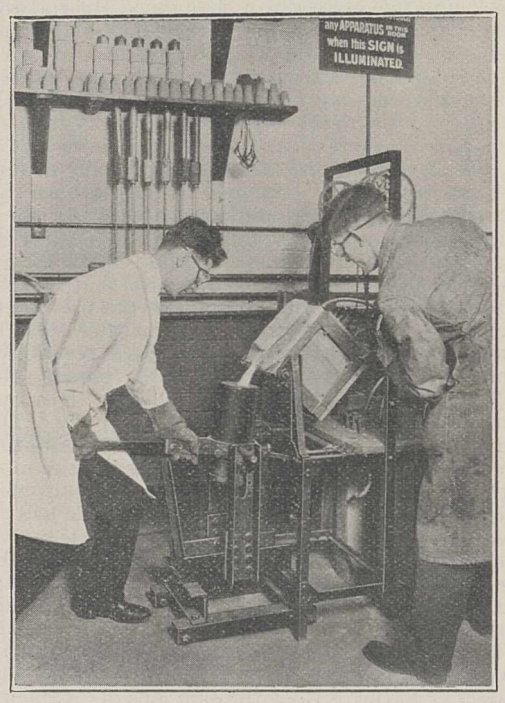

FIG. 1.

of the alloys agree to within 0·3 per cent with the weight of the constituent metals. Valuable work on the alloys of zirconium was carried out, using one of these furnaces. It is described in a paper read recently to the Institute of Metals by T. E. Allibone and C. Sykes.

Astronomy and Physiology in the "Encyclopædia Britannica".

ASTRONOMY.

THE treatment of a particular department of knowledge in a comprehensive work is less illuminating than might at first be imagined. One's first idea is that one might learn from it the conspicuousness of that department in the whole field of thought. Actually, all that it can reveal on that matter is the editor's opinion. As a text-book, a popular handbook, or a source of inspiration, it is equally unsatisfactory. Disconnected, heterogeneous in diction, style, and direction of approach, abounding in repetitions, it has all the potential faults and few of the virtues of those mediums of expression. The value and significance of the treatment are to be found in the individual article rather than the *ensemble*.

Nevertheless, few additions to popular astronomical literature would be more welcome than a volume containing the collected articles on astronomy in the "Encyclopædia Britannica". It would be infinitely more valuable than current productions of writers with no first-hand knowledge of astronomy who claim a faculty of exposition which they imply has been denied to the working astronomer. Such a volume would be an excellent example of the most neglected branch of scientific literature, the anthology. But if it is to be issued, it should be issued quickly, and the authors should have an opportunity of revising their work.

The task of the departmental editor, though sufficiently exacting, gives little scope for originality. The subject-matter must be distributed under the titles most likely to be looked for, not those of a technical classification. Relative lengths must be assigned to the several articles, and suitable authors must be chosen. The subjects must be treated clearly, concisely, and from the point of view of the general scientific world rather than that of the individual writer. These requirements are in the main excellently fulfilled in "Astronomy", although the last might perhaps have been met a little more strictly. An unsophisticated reader of the articles "Cosmogony" and "Star", for example, would scarcely suspect that there were ideas afloat of the genesis of the solar system and the constitution of the stars other than those so admirably presented there. The initials at the end of an article, for the key to which the reader has to turn elsewhere, are intended as a guarantee of authority rather than a license to express personal predilections, and it would have been better if the universal survey had been maintained throughout.

One excellent innovation is a separate 'article' consisting of a list of the astronomical articles in the

"Encyclopædia". Let no one imagine, however, that astronomy is confined within the boundaries there represented. Besides permeating a few articles, such as "Astrophysics" and "Celestial Mechanics", which might fairly have appeared in the list, the breath of astronomy penetrates more or less deeply the domains of physics, geology, history, philosophy, biography, and indeed almost every realm of thought. He who would gauge the influence of astronomy in human affairs must take the whole encyclopædia for his province.

The specifically astronomical articles are naturally of unequal merit, but they are almost, if not quite, all worthy of the traditions of the "Encyclopædia Britannica"—more than worthy in one respect, for we cannot applaud too heartily their newly-acquired intelligibility to the layman. It has at last been realised that an encyclopædia is a work for the intelligent non-specialist, and with all due respect (and very great respect is due) to some of the classical articles of the past, it must be admitted that they were ugly ducklings in a company where all but the scientific stock were of familiar breed. At the same time, it is pleasing to note that two of the least recondite of former articles have been reproduced; namely, those of Miss Clerke and Sir David Gill on "History of Astronomy" and "Telescope", respectively. These well-known articles could scarcely have been improved upon as a whole, though it seems to us that in two respects they might have been made more suitable for their present purpose. If their date of origin had been given, it would have explained the intangible but very real archaism of the point of view of the writers, which it is impossible altogether to remove by definite alteration of the text; and secondly, amendments might have been made a little more freely without disrespect to the memories of the authors. For example, we feel that it is scarcely fair to repeat that Galileo failed to identify Saturn's rings through lack of "sagacity", and it is unfortunate also that in a historical article the dates of Hipparchus, Ptolemy, Tycho, Kepler, and Galileo should be omitted when those of a host of lesser men are given.

On the other articles, only the most general comments can be made. The definition of the field of astronomy as "the world beyond the earth" seems inconsistent with the inclusion of "Earth" in the list of astronomical articles. The clear description of astronomical photometers in the article, "Photometry" would have been much more easily followed if diagrams had been provided such as those of physical photometers and chronographs. In the matter of technique of exposition, we would direct particular attention to the paragraph "The Demand for Data" in the article, "Astronomy," which comes as near as is humanly possible to our conception of the ideal—a clear statement of a general principle, with vivid examples (*not* illustrations). If every expositor were compelled never to generalise without providing at least one example of the particular, he would not only clear his own mind of much cant, but also would enlighten readers whom otherwise he would only mystify.

Another well-conceived innovation is a list of astronomical societies, though it would have been more dignified generally, and in the case of foreign titles more useful, if abbreviations had not been introduced. The British Astronomical Association appears as the "British Astronomical Society"—a curious blunder which can scarcely have been the unaided work of an astronomer. Indeed, there are other defects which suggest the operation of influences not scientific. It is improbable that the author of the article "Chromosphere" would confuse another astronomer's initials with his own, and the inscriptions under some of the illustrations show a decided laxity of expression when compared with the corresponding articles. The unsigned article "Planet" suffers in a different sense, for its illustrations, which are referred to in various places throughout the "Encyclopædia", are non-existent. Author's proof-corrections appear to have been treated with scant courtesy; to mention one of the least serious examples, the name "Rutherfurd" appears in two articles as "Rutherford," although, in one of them at least, the error was twice corrected in proof.

Such blemishes go beyond the limit of excusable fallibility, but perhaps the most astonishing feat of the publishers—or whoever is responsible—is the 'cutting' of certain articles, without intimation to the authors before publication, because of "congestion in the later letters". It is apparently this procedure that has led, in at least one instance, to the alteration of a true statement into a false one. Cutting admittedly is a necessary process if it is done for an intelligible reason and by a competent agent, but what are we to make of the reason assigned here? If the language is such that the later letters require even a hundred times as much space as the earlier ones, why in the name of all that is rational should they not have it? "The Democracy of Letters" is certainly a familiar phrase, but surely it has never before received such a literal interpretation.

The "Encyclopædia Britannica" remains the leading work of its kind, but it does so in spite, not because, of the arrangements made for its production.

H. D.

Physiology.

In the selection and presentation of the physiological subjects dealt with in the new edition of this monumental work, the perfection attained proves that the publishers could not have made a happier choice of associate-editor for the physiology section. The enormous development of the science of physiology since the appearance of the thirteenth edition has necessitated the inclusion of matter which is entirely new, and no pains have been spared in bringing the subject right up-to-date. Many of the new articles introduced deal with those branches of the science which have undergone advancement at the hands of Anglo-American workers who have themselves written the articles. As a consequence, two happy results accrue to the reader: he is assured of a much considered and authoritative statement on the subject and of reading of a refreshing nature imbued with the enthusiasm of the research worker.

The contributors, in nearly all cases highly specialised in their respective fields, are to be congratulated on rendering their subjects intelligible to the general reader by expressing themselves in the universal language of science. Remarkably few printers' errors have crept in and none which lead to confusion; the abbreviation error $1\mu\mu$ for $1m\mu$ which appears so commonly in medical writings has unfortunately been adopted for expressing wave-lengths of light in one of the articles.

Articles of a general character, formerly a characteristic feature of the 'Encyclopædia', have been advisedly curtailed, since in a scientific subject they may either suffer from being too vague for the general reader or lack the precision expected by the scientific inquirer. The article on physiology by Prof. J. Barcroft is, however, valuable for its orderly statement of some of the main principles governing the bodily functions, while Prof. J. C. Drummond presents in historical form the development of the comparatively new subject of biochemistry.

The special articles introduce a novel feature of

high educational value and will be greeted with pleasure by workers in the ancillary sciences, since they present a wealth of information presented in a language shorn, so far as accuracy of expression permits, of many of the technicalities inherent to high specialisation. Main headings are, as is usual, arranged in alphabetic order; no better start can be made than by looking up the master organ—the brain—the article on which begins a new volume and is written by the leading authority on the physiology of the nervous system. The account given by Sir Charles Sherrington is so fascinating that the reader is impelled to look up the subsequent articles on the spinal cord and the sympathetic system from the same pen; they may be read with equal delight by the general, the scientific, the psychological, and the physiological inquirer; the evolution of a superman is considered in retrospect under the sub-heading of "Had man had wings".

Prof. Barcroft, in his interesting and inimitable style, outlines the present position of the physiology of the blood, of respiration, and of excretion, and gives the most orderly exposition of the subject of anoxæmia yet published; this should not be missed by any aviator, mountaineer, or medical man. Subjects of interest more limited to physiology and medicine deal with the heart, vascular system, hormones, etc., and these articles give excellent summaries of knowledge to date. Articles of wider general interest, in particular to psychologists and physicists, will be found: hearing by Dr. Wilkinson, vision by Sir Herbert Parsons, light and radiation by Sir Leonard Hill, animal equilibrium by Dr. E. D. Adrian, sleep by Dr. G. Anrep. Not only physiologists and biochemists but also industrial psychologists, athletes, and gymnasts will profit from the article by Prof. A. V. Hill on muscle and muscular exercise. Amongst other articles possessing a wide appeal there may be mentioned hunger and thirst by Dr. W. B. Cannon, tissue culture by Dr. A. Carrel, and insulin by Prof. J. J. R. Macleod; all are distinguished by the stamp of authority and are presented in an interesting manner.

The publishers have not stunted the work in any particular. The text is supplemented by clearly annotated diagrams, and plates are beautifully reproduced on art paper, some in colour. Indeed, all concerned in the production of the physiology section of this gigantic work are deserving of high praise.

Recent Work on Vitamin D.

I.

SINCE the discovery three years ago that ergosterol is converted into vitamin D on exposure to a source of ultra-violet light, to which reference has already been made in these columns (see NATURE, vol. 120, p. 955; Dec. 31, 1927), a considerable amount of work has been carried out on the chemistry of the changes undergone by this compound under various conditions. Although the details of the process of its conversion to vitamin D have attracted most attention, it is only recently that the isolation of the vitamin in a pure state has been reported. Coincident with these investigations, opportunity has been taken to study the effects upon the animal economy of administering very large doses of the vitamin, since even 'impure' preparations of vitamin D are much more potent than its richest natural source, cod-liver oil, and can be given without the complicating effect of accompanying substances, although it may be necessary to distinguish between the actions of vitamin D, other products of the irradiation, and unchanged ergosterol together present in the preparation used.

BIOLOGICAL ASSAY.

In the absence of a simple chemical test for vitamin D or the isolation of the vitamin as a pure chemical compound, recourse must be had in all experiments to the animal test. The animal commonly used is the rat; the diet, one which will in the course of a few weeks produce rickets, and the criterion of cure or healing the change brought about in the calcification at the growing ends of the bones on administration of vitamin D: a modification of this test is to give the vitamin prophylactically instead of curatively. The degree of calcification is estimated chemically, by the ash or calcium content of the bone, histologically, by splitting the end longitudinally and staining with silver nitrate, when the newly deposited calcium salts appear as a line in the metaphyseal cartilage (hence the term 'line test'), or by means of X-ray photographs. It is possible, however, to use other tests: thus under certain conditions vitamin D can be shown to produce an increase in the growth rate, or to bring about a change in the pH of the fæces.

K. M. Soames and J. C. Leigh-Clare (*Biochem. J.*, vol. 22, p. 522; 1928) point out that the common diets used to produce rickets in rats are not only free from vitamin D, but are also deficient in salts, vitamin A, and sometimes protein and vitamin B: they consider that the diet should contain all known requirements except the constituent under test. On a complete synthetic diet free from vitamin D, rickets cannot be produced in the rat, but that calcification is defective is shown by the low ratio of ash to organic residue in the fat-extracted bone, for example 0·9 instead of 1·5 (on the diet plus vitamin D); on a diet low in phosphorus in addition to vitamin D this ratio is 0·5 or less. Vitamin D was given in the form of cod-liver oil and irradiated cotton-seed oil, and besides bringing about normal calcification it also increased the growth rate: under these conditions, therefore, growth can be used as a criterion for the presence of vitamin D. The diets used were of the common synthetic type, vitamin A being given as wheat embryo or hog millet, sources free from vitamin D.

H. N. Green and E. Mellanby (*ibid.*, p. 102) have found that, as in dogs, the degree of rickets developed by rats depends also upon the nature and amount of the cereal in the diet. For testing this point they gave the animals a diet containing 75 per cent of the cereal with caseinogen, sodium chloride, marmite, lemon-juice, and dried cabbage. Oatmeal and whole meal flour are more rachitogenic than barley meal or white flour, with maize meal intermediate. The effect can be antagonised by an adequate supply of vitamin D and also to a great extent by increasing the calcium, though not the phosphorus, intake. The nature of the interfering substance in cereals and the mechanism of its action are not definitely known, but L. Mirvisch (NATURE, vol. 124, p. 410; Sept. 14, 1929) has recently shown that a factor can be extracted from oatmeal with weak hydrochloric acid which lowers the blood calcium of rabbits to the extent of 35 per cent in twenty-four hours.

The usual method of comparing the activity of different samples is to find the amount which will produce a definite degree of healing of rickets or the amount which will just prevent its onset. The drawback of this method is that it presupposes that every animal or a certain number of a group will always respond in precisely the same way to the same dose; but it is notorious that animals vary considerably

among themselves, even when all conditions of diet, maintenance, etc., are kept as constant as possible and an inbred stock is employed. It is for this reason that standards for biological remedies have been set up, the potency of the unknown preparation being determined in terms of this standard; in this way, variations due to the animals are to a large extent eliminated, since the response of a group to the standard and to the unknown varies usually in the same direction; comparable results can therefore be obtained with the same preparations at different times and in different laboratories. K. H. Coward (*Quart. J. Pharmacy*, vol. 1, p. 27; 1928) has adopted as standard of reference a preparation of irradiated ergosterol, of which 0·0001 mgm. is defined as containing one antirachitic or vitamin D unit; the comparison is made by means of the 'line' test and the test doses are fed for 10 days after 3-4 weeks on a preparatory rachitogenic diet. In her animals, this dose of the standard preparation brings about complete healing, whilst $\frac{1}{2}\frac{1}{0}$ of it may produce early definite signs of calcification in the metaphysis.

The sensitiveness of the test is also indicated by some results obtained by Fosbinder, Daniels, and Steenbock, which were confirmed by Coward (see *Biochem. J.*, vol. 22, p. 1221; 1928). The former authors found that $3{\cdot}2 \times 10^{13}$ molecules of vitamin D were formed when 'impure cholesterol' was exposed to radiation of 2650 A. for 22·5 sec., by calculation from the energy absorbed; this corresponds to 2×10^{-8} gm. vitamin D on the assumption that the molecular weight of the vitamin approximates to that of cholesterol. This amount fed over ten days produced a positive 'line' test. Coward found that 2×10^{-7} gm. of a sample of irradiated ergosterol fed over ten days also gave a positive test: if it may be assumed that only 10 per cent of the preparation consisted of vitamin D, Coward's result agrees with that of Steenbock.

E. Poulsson and H. Lövenskiold (*Biochem. J.*, vol. 22, p. 135; 1928) point out that methods using chemical or histological criteria do not take account of the degree of rickets present when the test doses are first administered, except in so far as certain animals of the litter may be killed and examined at the end of the preparatory period, but this procedure does not guarantee that the others are suffering from the same degree of rickets, since variation is found even amongst the animals of the same litter. By taking X-ray photographs of living rats, however, it is possible to follow the healing or not of rickets when a dose of the substance under test is fed, the base line, so to say, for each animal being its own condition at the end of the preparatory period. In practice, the latter lasts twenty-five days and the test doses are given for six days. The unit is defined as that amount which will bring about a marked degree of healing of rickets.

H. Jephcott and A. L. Bacharach (*ibid.*, vol. 20, p. 1351; 1926; vol. 22, p. 60; 1928) found that on Zucker's 'patent flour' diet the *p*H of the fæces of rats becomes alkaline and that with the administration of a source of vitamin D the reaction shifts back to the acid side of neutrality again: the estimations must be made by the electrometric method. After 10-21 days on the diet, the fæcal *p*H is 7·3 or higher: within a few days of giving an adequate amount of vitamin D the *p*H has fallen to 6·7. The amount necessary to bring about this change is taken to be 10 *p*H units.

A number of authors have examined the *p*H of the intestinal contents or fæces under various conditions and in different animals and have not always succeeded in demonstrating the alkaline change in rickets or the acid change with its healing. Thus T. Redman (*ibid.*, vol. 22, p. 15; 1928; vol. 23, p. 256; 1929) using the quinhydrone electrode, found no relationship between the *p*H of the fæces and the condition of rickets in children, although there was a tendency for the *p*H (and calcium output) to fall with treatment. Working with S. G. Willimott and F. Wokes (*ibid.*, vol. 21, p. 589; 1927), however, it was found that the changes could be demonstrated in rats maintained on rachitogenic diets. Bacharach and Jephcott, in a recent paper, reply to certain criticisms of their method, and point out that it is a means of measuring vitamin D, and that the changes in *p*H do not indicate either the development or cure of rickets (*J. Biol. Chem.*, vol. 82, p. 751; 1929). In performing the test, it is essential to give only vitamin D (in solution in an oil), and not a preparation which may alter the ratio of the constituents of the diet, more especially its salt content. The test is specific for the vitamin only under well-defined conditions: its advantage is that the preparatory and test periods are of shorter duration than is necessary when the degree of calcification is taken as the criterion.

Congress of Experimental Phonetics.

THE first Congress of the International Society of Experimental Phonetics was held at Bonn on June 10-14. It was specially characterised by the variety of the addresses and demonstrations from all parts of the science of speech.

Particularly striking was the demonstration of a Röntgen speech film by Dr. Gutzmann, Berlin, in which the movements of the larynx, hyoid bone, and tongue appeared with great clearness. W. Lenk, Vienna, demonstrated a speech film apparatus suitable for laboratory use. Dr. Moses, Cologne, presented the results of the application of the science of experimental phonetics to character. Prof. Scripture, Vienna, presented his theory of the nature of the vowels. The vowels were also discussed by Dr. Van der Elst, Utrecht, and Dr. J. Schmidt, Bonn. Miss Janvrin, London, presented the results of an experimental analysis of a record of verse spoken by John Galsworthy himself.

The pathology of speech was treated in three addresses, namely: Prof. M. Isserlin, Munich, problems of the pathological physiology of speech (aphasia); Dr. Berger, Münster, phonetic investigations of the genuine and simulated results of the Lombard test; Dr. L. Kaiser, Amsterdam, registration of pathologically altered voices.

Linguistic phonetics was represented by the following: Prof. E. Blancquaert, Ghent, comparative investigations of Nederland dialects; Dr. L. Hegedüs, Gödöllö, experimental phonetic investigations on the melody of Hungarian; Prof. J. Feltes, Luxemburg, concerning the characteristic phenomena of assimilation in Luxemburg speech; Dr. E. W. Peters, Tartu, experimental investigations of the Esthonian language.

In an address entitled "What is Experimental Phonetics?" Prof. Scripture showed that experimental phonetics is approaching the ideal established by the exact methods of chemistry, psychology, and biology.

The exhibition included various oscillographs, film apparatus, graphic registration apparatus, harmonic analysers, and numerous other devices.

The Congress was attended by more than a hundred

people. An account of the proceedings will be published as a separate volume at the price of 10 shillings.

At a meeting of the Council, the secretarial bureau was definitely located at 73 Welbeck Street, London, W.1, and arrangements were made to send the following publications free of charge to the members: *Zeitschrift für Experimentalphonetik*, *Bulletin of the International Society of Experimental Phonetics*, *Bulletin de la Société Internationale de Phonétique Expérimentale* and *Sprachneurologische Mitteilungen*. The membership fee was fixed at 10 shillings per annum.

Prof. Hugo Pipping, Helsingfors, has been made an honorary member of the Society.

University and Educational Intelligence.

A VACANCY having arisen for the Busk studentship in aeronautics for 1930–31, the trustees hope to make an appointment shortly. The studentship is of the value of about £150, tenable for one year from Oct. 1, and is open to any British subject of British descent who has not attained the age of twenty-five years on Oct. 1 next. The object of the studentship is to enable the holder to engage in research or preparation for research in aeronautics, and specially in those subjects, such as stability problems, meteorological questions bearing on flight, or the investigation of gusts, treated either experimentally or mathematically, in which Edward Busk was specially interested. Forms of application, to be returned not later than July 26, can be obtained from Prof. B. Melvill Jones, Engineering Laboratory, Cambridge.

THE Air Ministry announces that five hundred aircraft apprentices, between the ages of fifteen and seventeen years, are required by the Royal Air Force for entry into the Schools of Technical Training at Halton, Bucks, and at Cranwell, near Sleaford, Lincs. They will be enlisted as the result of an open competition and of a limited competition which will be held shortly by the Civil Service Commissioners and the Air Ministry respectively. Boys in possession of an approved first school certificate may be admitted without other educational examinations. The scheme offers a good opportunity to well-educated boys of obtaining a three-years' apprentice course of a high standard and of following an interesting technical career. Particulars can be obtained upon application to the Royal Air Force (Aircraft Apprentices' Dept.), Gwydyr House, Whitehall, London, S.W.1. The sons of officers, warrant officers, and senior N.C.O.'s of the three services will receive special consideration.

THE Teachers Registration Council, which came into existence in 1912 and now functions as the executive of the Royal Society of Teachers, views with concern the slowing down during the past five years in the flow of applications for membership. In 1914 there were 5150 applications. During the three succeeding periods of five years the applications numbered, respectively, 25,780, 44,470, and 4680. In a communication addressed to members in May last, Lord Gorell, president of the Society, observes that up to the present the Council's work has not received that measure of official recognition which is necessary to make a register of teachers effectual as a means of protecting the public from unqualified practitioners, and "the time has come when a serious effort should be made to induce the Board of Education and local authorities to attach due weight to registration in the appointment of teachers to posts of responsibility". It is the Council's aim to secure in the first instance that no one save registered teachers shall exercise professional supervision over the work of other teachers, but the Board of Education can scarcely be expected to adopt this policy while a large proportion of those qualified for registration remain outside the Society. The president therefore suggests that every member should secure at least one recruit during the next three months. The registration fee is to be increased to £3 on July 1, 1931. It appears that the revenue of the Council from all sources from 1912 to 1929 was £123,293 and the expenditure £98,566. Twenty-one cases of registered teachers accused of conduct likely to bring discredit upon the teaching profession have been investigated and nineteen names have been removed from the register.

ON June 7 the inauguration of the new president, Dr. Karl Taylor Compton, of the Massachusetts Institute of Technology, took place in the presence of a large gathering of delegates from educational institutions in the United States and abroad. Sir William Bragg represented the Royal Institution. Addresses were delivered by the retiring president, Dr. S. W. Stratton, who now becomes chairman of the corporation of the Institute, and by the new president, Dr. Compton. At a subsequent dinner, at which many of the *alumni* of the Institute were present, Mr. Gerard Swope, president of the General Electric Co., and a graduate of the Institute, announced the formation of a fund for the purpose of helping needy students of promise to obtain their education at the Institute. In his speech he said, *inter alia*, that they were embarking upon a new plan of organisation in dividing the administration between a chairman and president. For some time the question of increased pay for the teaching staff has been under consideration and also further facilities for research, and it has been decided to increase the tuition fees next September from 400 to 500 dollars, but as the cost of educating a student is between 700 and 800 dollars a year this would mean that, unless more money was forthcoming, the intention of raising stipends could not materialise. He announced that, though only a few had been approached, the fund has already exceeded the sum of 4,200,000 dollars, which will be paid over a ten-year period. The instalment payments will keep it going until the loans made to students have been repaid after graduation. The subscriptions are in the form of donations, and include 500,000 dollars from Mr. George Eastman, who has previously been a generous benefactor, a like sum from C. Hayden, A. P. Sloan, and E. S. Webster, and also large sums from others, among whom was Mr. Swope. Among the announcements made by the new president was the proposal to construct a new chemical and physical laboratory to provide for the increased numbers taking these subjects.

Historic Natural Events.

July 20, 1723. Storm.—The "Journal of Étienne Azambourg", a farmer of Enfournet, Dépt. du Cher, records a "flood of water from a storm and frightful thunder" which ravaged the whole district about 2 to 3 P.M. Vines were stripped and uprooted, and the wind and rain destroyed the grapes, causing enormous loss.

July 20, 1921. Whirlwind in Ceylon.—About 7.30 A.M. a tornado passed directly across the school at Veyangoda, Ceylon, which collapsed with 70 or 80 boys in it. One was killed and another seriously injured. Neighbouring houses were also damaged. The whole track was only about three miles long, and very narrow.

July 22, 1801. Hurricane at the Bahamas.—A terrible hurricane devastated the Bahamas. At Nassau, although the ships in the harbour had their masts struck and anchors down, they all broke loose and were driven on shore, and of the ships at sea, apart from those which were sunk, 120 were counted at one time lying as wrecks on the coast. The sea broke through the sand hills south of Fort Montague, flooding the land, and enormous damage was done.

July 22, 1907. Thunderstorms over the British Isles.—In North London a certain amount of damage was done by heavy rain, but in South Wales and the west of Ireland the storms appear to have been really exceptional. In Wales heavy rain and hail fell on the Black Mountains; the hailstones varied in size from a walnut to a hen's egg. On the Llanthony Road they were five feet deep, and near Tredrenow they completely blocked the river, turning it from its course across the road and the adjoining land, so that trout and other fish were left on the fields. In south-east Clare, Ireland, there were extensive floods, which washed away roads, carried off sheep and pigs, and destroyed whole fields of crops. Five large stone bridges were carried away, and in one place a dead ass was left in a tree, fifteen feet above the ground, by the flood.

July 22, 1925. Thunderstorm over England.—Violent thunderstorms occurred at many places, including London, on the night of July 22–23. Hail occurred in places, especially in eastern London, where the hailstones were reported to be as large as a man's fist. Very many windows were broken, and corrugated iron was cut through by the hail. The amounts of rain and hail were very heavy.

July 24, 1818. Hailstorm in Orkneys.—A great storm of hail traversed a path 20 miles long and 1½ miles broad, at the rate of 4 miles an hour. At each place it lasted 9 minutes, during which time 9 inches of hail fell. During the passage of the storm the barometer fell 1·15 in.

July 25, 1743. Great Heat in Pekin.—Between July 14 and 25 Pekin suffered from glowing heat. Temperature rose to 121° F. and 11,000 men suffered from sunstroke.

July 25, 1910. Eruption of Usu-san (Japan).—An interesting, though by no means violent, eruption began in the small volcano of Usu-san in Hokkaido, the northern island of Japan. It was preceded by frequent earthquakes, 638 being recorded between July 22 and 25, in consequence of which all the inhabitants were removed from the district and there was no loss of life. The eruption consisted of small outbursts of ashes, without any lava, from a number of craterlets along a curved band north of the volcano. On Aug. 6 it was found that the land on the northern flank of the volcano was rising, and a portion 3000 yards long and 625 yards wide was uplifted until it became a new mountain. By the beginning of November, the elevation amounted to 510 feet, but, about this time, a reverse movement set in, and in April 1911 the height was 120 feet less than in the previous November.

July 26, 1798. Atmospheric Refraction.—At about 5 P.M. the coast of France became clearly visible from the shore at Hastings, Winchelsea, and neighbouring parts of the south coast of England, and appeared to be only a few miles away, although the distance is actually 40 to 50 miles. The various features of the French coast were easily recognised, and with a telescope even the buildings on shore. This phenomenon continued fully developed until after 8 P.M., when it gradually faded away.

Societies and Academies.

LONDON.

Physical Society, June 26.—**M. C. Johnson**: The effect of photosensitised mercury vapour on the walls of silica vacuum tubes. An investigation is made into some phenomena occurring at the gas-solid interface in the well-known experiments in which mercury atoms absorb energy from the radiation λ 2537 and then transfer that energy to other gas molecules at collision. It is shown that a combination of both condensation and liberation of gas at the surface of the apparatus must be taken into account, if the effects of irradiation of a gas mixture are to be traced by any of the usual methods of observing pressure changes.—**H. R. Nettleton and F. H. Llewellyn**: A sensitive rotating-coil magnetometer. This paper describes a sensitive rotating-coil magnetometer in which the flux due to the earth's field or to a magnet is neutralised by that due to a current passing through a fixed concentric compensating coil which forms with the rotating coil a variable mutual inductance. It shows how the first-order correcting term due to the length of the magnet may be made to vanish if the angle of contact be suitably chosen, and that the second-order correction may be eliminated by a correct choice of the dimensions of the coil.—**L. Hartshorn**: The frequency errors of rectifier instruments of the copper oxide type for alternating current measurement. Alternating current milliammeters containing copper oxide rectifiers possess frequency errors of an unusual type. The errors are almost independent of the instrument reading, and thus the percentage errors are inversely proportional to the current to be measured, and may be very large for small currents. It is shown that the errors are due to the capacities of the rectifiers, which, in milliammeters, are of the order $0{\cdot}09\mu F$.—**D. S. Perfect**: A method of eliminating the effects of magnetic disturbance in highly sensitive galvanometers. The paper describes a method of making correction for the chaotic fluctuations, of magnetic origin, to which the zero of a highly sensitive moving-magnet galvanometer is susceptible. The method consists in the employment of a second galvanometer with properties adjusted as nearly as possible to identity with, and placed as close as possible to, the first. No current is passed through the second galvanometer, which acts in this respect as a dummy the sole function of which is to record the zero changes.—**M. C. Marsh**: The thermal insulating properties of fabrics. One of the chief properties of a fabric is its thermal insulation, which prevents excessive heat-loss from the body. The paper gives a critical review of methods used in the past for measuring the thermal insulating properties. These are discussed with the view of making a new apparatus for the study of the subject.—**Wm. Band**: Classical quantum theory and X-ray excitation by canal-rays and alpha-particles. This paper shows, by application of the classical quantum theory and simple equations of energy, that it is not possible for canal-rays of normal experimental energy to remove K-electrons from the atoms of a metal target either by capture or by simple removal into free space.—**A. T. Mackay**: Diffusion from an infinite plane sheet subject to a surface condition; with a method of application to experimental data. The solution of the partial-differential diffusion equation for the infinite plane sheet is found by operational methods subject to a surface condition analogous to Newton's law of cooling.—**S. Tolansky**: Intensity modifications in the spectrum of mercury. The modifications produced in the spectrum of mercury

by the use of high-frequency discharges have been studied from λ7000 to λ2400, and the lines λ4916 and λ5461 have been examined with high resolving power for fine structure.

DUBLIN.

Royal Dublin Society, May 27.—**W. R. G. Atkins** and **E. Wyllie Fenton**: The distribution of pasture plants in relation to soil acidity and other factors. *Cynosurus cristatus*, *Lolium perenne*, and *Dactylis glomerata* are unimportant in soils of greater acidity than *p*H 5·5. Wild white clover is the main leguminous constituent of acid pastures, not more acid than *p*H 5, above which acidity *Ulex spp.* only occur. In dry soil at *p*H 8 in Cornwall *Medicago sativa* persisted well for six years, also *M. lupulina*. When allowed to roam freely, sheep and cows were found to graze only slightly on pastures with soil acidity exceeding *p*H 5. Extraction with dilute potassium chloride leads to large errors in determining soil *p*H values.—**W. R. G. Atkins** and Miss **F. A. Stanbury**. Photo-electric measurements of illumination in relation to plant distribution. Pt. 3. Certain spruce, larch, oak, and holm oak woods. Simultaneous measurements were made of the illumination in and outside the woods, the ratio of total vertical to diffuse vertical illumination being also determined. From these the daylight factors were calculated. Under *Ilex aquifolium* the daylight factor was only 0·6 per cent and nothing grew. In the spruce and holm oak woods values such as 1-3 per cent were common, with 3-16 per cent in the larch wood and 2-11 in the oak wood.—**C. P. Martin**: The raised beaches of the east coast of Ireland. The pre-glacial raised beach described by Wright and Maufe on the south coast of Ireland extends round on to the east coast and as far north as Co. Down. The Neolithic raised beach extends as far south as Co. Wexford. The dating of the Neolithic raised beach by human implements found in association with it is unreliable.

June 26.—Report of the Irish Radium Committee for the year 1929. 14,730 mc. of radon were issued for therapeutic purposes. Reports from medical users give particulars of treatment of some 370 cases.—**M. Grimes**, Miss **V. C. E. Kennelly**, and **H. A. Cummins**: A study of fungi found in butter.—Miss **V. C. E. Kennelly** and **M. Grimes**: *Pœcilomyces hibernicum*; new species.

PARIS.

Academy of Sciences, May 19.—**M. D'Ocagne**: Pascal's arithmetical machine. This old machine has been put into working order, by simple replacement of worn or corroded parts. It is noteworthy that in Dr. Roth's machine (1841), one of the improvements claimed as new was realised in Pascal's machine.—**V. Grignard** and **J. Dœuvre**: The transformation of *l*-isopulegol into *d*-citronnellal. The isopulegol was passed over 50 cm. of glass wool, at 500° C., under a pressure of 25 mm. The β form of citronnellal was obtained with a good yield.—**Jean Baptiste Senderens**: The catalytic dehydration, in the gas phase, of the fatty alcohols in the presence of alkaline bisulphates. Fused sodium bisulphate acts on *n*-propyl alcohol vapour at 125°-140° C., giving water and propylene. Isopropyl alcohol reacts in the same way at 105°-110° C. The results obtained with methyl, ethyl, and isobutyl alcohols are also described.—**Jean Effront**: The chemical nature of amylose. Amylose is not a homogeneous product. At the temperature of the formation of starch paste, the starch undergoes a profound depolymerisation. During the ageing of starch solution, a molecular polymerisation is produced, giving rise to different hexosanes.—**W. Vernadsky**: Natural waters rich in radium. An account of the various amounts of radium found in various natural waters. The highest proportion found hitherto is in the subterranean waters accompanying a petroleum deposit at Novyj Groznyj in the Caucasus, amounting to more than 1×10^{-8} Ra per cent.—**Marcel Vasseur**: The equations of Laplace.—**A. Lokchine**: The influence of an elliptical hole in a beam which undergoes bending.—**G. Maneff**: The electromagnetic energy in the field of gravitation.—**Henry Favre**: An optical method for determining the internal tensions in solids of three dimensions.—**A. Bogros**: The structure of the lithium line 6708.—Mlle. **C. Chamie** and **Marcel Guillot**: The centrifugation of hydrochloric acid solutions of polonium. Photographic impressions of groupings of polonium atoms can be obtained with sufficiently active solutions of normal hydrochloric acid strength; and these give no precipitate on centrifugation. It has still to be proved whether these groups pre-exist in the solution or whether they are formed in contact with the surface on which they are photographed.—**E. Herzog** and **G. Chaudron**: Study of the mechanism of the corrosion of the duralmins by sea water. Under oxygen pressures up to 90 atmospheres the losses of weight of the alloys in salt solution are proportional to the pressure. The corrosion is very rapid and the corrosion requiring five or six months at the ordinary pressure can be obtained in 24 hours under high pressures of oxygen.—**P. Cordier**: A new diarylalkyloxysuccinic anhydride.—**Fr. de Rudder** and **H. Biedermann**: The pyrogenation of methane. The effects of the variables temperature (900° C. to 1500° C.), pressure (20 mm. to 760 m.) and time of contact with hot tube (15 sec. to 0·01 sec.) have been studied independently. The temperature appears to be the most important factor. The presence of catalysts does not affect the reaction.—Mme. **Ramart-Lucas**, Mlle. **Biquard** and **Grunfeldt**: The configuration of molecules in space. The absorption in the ultra-violet of the groups CH_3 and CH_2. The saturated normal fatty acids, $C_nH_{2n+1}CO_2H$, possess for ultra-violet light an absorption coefficient which is practically independent of n. In the region 2500–2200 A. the groups CH_3 and CH_2 cannot be regarded as chromophores.—**A. Wahl** and **Jonica**: The influence of substitutions on the colour shades of the sulphonated derivatives of stilbene.—**A. Duparque**: The causes of the differentiation of coals.—**Jean Lombard**: The Cretaceous of the Gabon coast line.—**Marcel Mascré** and **Maurice Herbain**: New experiments on the precipitation of nitrogenous substances in serums in the presence of formaldehyde.—**Henri Jean Frossard**: Arterial pressure and its measurement by the pulse method.

VIENNA.

Academy of Sciences, Mar. 20.—**J. Pollak**, **M. Heimberg-Kraus**, **E. Katscher**, and **O. Lustig**: The action of chloro-sulphonic acids on cyclic hydrocarbons. Sulpho-chlorides and other products were obtained from benzol, toluol, xylol, di-phenyl, and naphthalene.—**M. Holly**: Synopsis of the fresh-water fishes of the Cameroon.—**M. Beier**: Zoological expedition to the Ionian Isles and the Peloponnesus, 9th part, Crustacea. Amphipoda by **S. Karaman** and Decapoda by **O. Pesta**.—**A. Tornquist**: Perimagmatic types of east alpine ore deposits.—**B. Knaster**: One-dimensional non-comparable continua.—**K. Menger**: On laminable tri-graphs and powers of non-laminable graphs.—**K. Menger** and **G. Nöbeling**: The *n*-leg theorem in locally connected continua.—**G. Nöbeling**: A refinement of the *n*-leg theorem.—**G. Nöbeling**: *N*-dimensional universal spaces (2).

Official Publications Received.

BRITISH.

Transactions of the Edinburgh Geological Society. Vol. 12, Part 2. Pp. 189-288+plates 27-43. (Edinburgh.) 7*s.* 6*d.*

The Tea Research Institute of Ceylon. Bulletin No. 4: Annual Report for the Year 1929. Pp. 32. (Kandy.)

Rubber Research Institute of Malaya. Annual Report, 1929. Pp. 99. (Kuala Lumpur.) 1 dollar.

Natal University College. Magazine Commemoration Number, 1909–1930. Vol. 22, June. Pp. 108. (Pietermaritzburg.)

Report of His Majesty's Astronomer at the Cape of Good Hope to the Secretary of the Admiralty for the Year 1929. Pp. 8. (Cape Town.)

The Proceedings of the Physical Society. Vol. 42, Part 4, No. 234, June 15. Pp. viii+293-354. (London.) 7*s.* net.

Transactions of the Institute of Marine Engineers, Incorporated. Session 1930, Vol. 42, June. Pp. 295-390+xxxvi. (London.)

Journal of the Society for the Preservation of the Fauna of the Empire. New Series, Part 11. Pp. 55+2 plates. (Hertford: Stephen Austin and Sons, Ltd.) 1*s.* 6*d.*

Journal of the Chemical Society. June. Pp. iii+1277-1511+x. (London.)

Canada. Department of Mines: Geological Survey. Memoir 160: The Disappearance of the Huronian. By T. T. Quirke and W. H. Collins. (No. 2207.) Pp. iv+129. 20 cents. Memoir 161: Lardeau Map-area, British Columbia. General Geology, by J. F. Walker and M. F. Bancroft; Mineral Deposits, by H. C. Gunning. (No. 2209.) Pp. iv+142. Memoir 162: Peat Bogs in Southeastern Canada. By Vaino Auer. (No. 2230.) Pp. ii+32. Economic Geology Series, No. 6: Fluorspar Deposits of Canada. By M. E. Wilson. (No. 2210.) Pp. vii+97. 20 cents. (Ottawa: F. A. Acland.)

Transactions and Proceedings of the Royal Society of South Australia (Incorporated). Vol. 53. Edited by Prof. Walter Howchin, assisted by Arthur M. Lea. Pp. iv+414+11 plates. (Adelaide.) 23*s.*

Transactions of the Royal Society of Edinburgh. Vol. 56, Part 2, No. 20: The Genus Dictyoconus and its Allies; a Review of the Group, together with a Description of three new Species from the Lower Eocene Beds of Northern Baluchistan. By Lieut.-Col. L. M. Davies. Pp. 485-505+2 plates. 3*s.* 6*d.* Vol. 56, Part 2, No. 21: A Study of Apothecial Development in the Leaf-spot Disease of Red Clover. By Dr. S. G. Jones. Pp. 507-519. 1*s.* 6*d.* (Edinburgh: Robert Grant and Son; London: Williams and Norgate, Ltd.)

Abstracts of Dissertations approved for the Ph.D., M.Sc. and M.Litt. Degrees in the University of Cambridge for the Academical Year 1928–29. Published by Authority. Pp. 96. (Cambridge: At the University Press.)

FOREIGN.

Memoirs of the Geological Survey of China. Series A, No. 6: The Geology of the Kalgan Area. By Prof. George B. Barbour. Pp. xi+148+14 plates. (Peking.)

Koninklijk Magnetisch en Meteorologisch Observatorium te Batavia. Verhandelingen No. 22: On the Distribution of Earthquakes in the Netherlands East Indian Archipelago. 2: 1920–1926, with a Discussion of Time Tables. By Dr. S. W. Visser. Pp. 116. (Weltevreden: Albrecht and Co.)

Smithsonian Miscellaneous Collections. Vol. 82, No. 7: The Atmosphere and the Sun. By H. Helm Clayton. (Publication 3062.) Pp. 49. (Washington, D.C.: Smithsonian Institution.)

Norges Svalbard- og Ishavs-Undersøkelser. Meddelelse. Nr. 9: Moskusoksen i Øst-Grønland. Av B. Lynge. Pp. 19. Nr. 10: Dagbok ført av Adolf Brandal under en overvintring på Østgrønland 1908–1909. Pp. 73. Skrifter om Svalbard og Ishavet. Nr. 29: Franz Josef Land, Natural History, Discovery, Exploration and Hunting. By Gunnar Horn. Pp. 54. 5.00 kr. Nr. 30: Beiträge zur Kenntnis des Oberdevons Ost-Grönlands, von Anders K. Orvin; Oberdevonische Fischreste aus Ost-Grönland, von Anatol Heintz. Pp. 46+4 Tafeln. 4.00 kr. (Oslo: Jacob Dybwad.)

Bulletin of the American Museum of Natural History. Vol. 61, Art. 2: Report on the Diptera collected at the Station for the Study of Insects, Harriman Interstate Park, N.Y. By C. H. Curran. Appendix: Tipulidæ and Ptychopteridæ, by Charles P. Alexander. Pp. 21-115. (New York City.)

Japanese Journal of Geology and Geography: Transactions and Abstracts. Vol. 7, Nos. 3-4. Pp. iii+73-113+15. (Tokyo: National Research Council of Japan.)

Instituts scientifiques de Buitenzorg: "'s Lands Plantentuin". Treubia: recueil de travaux zoologiques, hydrobiologiques et océanographiques. Vol. 7, Suppl., Livraison 5: Fauna Buruana; Aves. Von H. C. Siebers. Pp. 165-303. 2.50 f. Vol. 11, Livraison 4. Pp. 373-507 2.50 f. Vol. 12, Livraison 1. Pp. 119. 2.50 f. (Buitenzorg: Archipel Drukkerij.)

Publications de l'Observatoire de Genève. Rapport sur les concours de réglage de chronomètres de l'année 1929. Par Georges Tiercy. Pp. 32. (Genève.)

Proceedings of the Academy of Natural Sciences of Philadelphia, Vol. 82. On the Genus Nyctiperdix; Relationships and Distribution of the Bare-throated Francolins; Geographical Variation in Cinnyricinclus Leucogaster. (Fifth, Sixth and Seventh Preliminary Papers on Birds collected during the Gray African Expedition, 1929.) By W. Wedgwood Bowen. Pp. 145-167. (Philadelphia.)

U.S. Department of Commerce: Coast and Geodetic Survey. Special Publication No. 162: Tides and Currents in Chesapeake Bay and Tributaries. By F. J. Wright and H. E. Finnegan and G. L. Anderson. Pp. vi+145. 65 cents. Special Publication No. 165: Slope Corrections for Echo Soundings. By A. L. Shalowitz. Pp. 24. 10 cents. (Washington, D.C.: Government Printing Office.)

National Research Council. Transactions of the American Geophysical Union, Tenth Annual Meeting, April 25 and 26, 1929, Eleventh Annual Meeting, May 1 and 2, 1930, Washington, D.C. Pp. 314. (Washington, D.C.: National Academy of Sciences.)

Department of the Interior: U.S. Geological Survey. Bulletin 788: Topographic Instructions of the United States Geological Survey. Index. Pp. v+421-432. Bulletin 811-A: The New World or Cooke City Mining District, Park County, Montana. By T. S. Lovering. (Contributions to Economic Geology, 1929, Part 1.) Pp. vi+87+25 plates. 50 cents. Bulletin 812-C: Geology and Coal Resources of the Meeker Quadrangle, Moffat and Rio Blanco Counties, Colorado. By E. T. Hancock and J. B. Eby. (Contributions to Economic Geology, 1929, Part 2). Pp. iv+191-242+plates 19-30. 30 cents. Bulletin 812-D: Geology and Oil Resources along the Southern Border of San Joaquin Valley, California. By H. W. Hoots. (Contributions to Economic Geology, 1929, Part 2.) Pp. vi+243-338+vi+plates 31-48. 50 cents. Bulletin 813-C: Mining in the Forty-mile District, Alaska. By J. B. Mertie, Jr. (Mineral Resources of Alaska, 1928.) Pp. ii+125-142. 5 cents. Bulletin 816: Geology of the Eagle-Circle District, Alaska. By J. B. Mertie, Jr. Pp. v+168+12 plates. 50 cents. Professional Paper 158-I: Borate Minerals from the Kramer District, Mohave Desert, California. By Waldemar T. Schaller. (Shorter Contributions to General Geology, 1929.) Pp. ii+137-173+plates 22-27. 20 cents. Professional Paper 165-A: Lithologic Studies of Fine-grained Upper Cretaceous Sedimentary Rocks of the Black Hills Region. By William H. Rubey. (Shorter Contributions to General Geology, 1930.) Pp. iv+54+5 plates. 25 cents. Professional Paper 165-B: A Flora of Green River Age in the Wind River Basin of Wyoming. By Edward Wilber Berry. (Shorter Contributions to General Geology, 1930.) Pp. ii+55-81+plates 6-15. 20 cents. Water-Supply Paper 606: Surface Water Supply of the United States, 1925. Part 6: Missouri River Basin. Pp. vi+252. 30 cents. Water-Supply Paper 619: Geology and Water Resources of the Mokelumne Area, California. By H. T. Stearns, T. W. Robinson and G. H. Taylor. Pp. xii+402+21 plates. 1.25 dollars. Water-Supply Paper 624: Surface Water Supply of the United States, 1926. Part 4: St. Lawrence River Basin. Pp. v+163. 20 cents. Water-Supply Paper 625: Surface Water Supply of the United States, 1926. Part 5: Hudson Bay and Upper Mississippi River Basins. Pp. v+170. 20 cents. Water-Supply Paper 626: Surface Water Supply of the United States, 1926. Part 6: Missouri River Basin. Pp. vi+228. 25 cents. Water-Supply Paper 627: Surface Water Supply of the United States, 1926. Part 7: Lower Mississippi River Basin. Pp. iv+98. 15 cents. Water-Supply Paper 636-F: Water-Power Resources of the Umpqua River and its Tributaries, Oregon. By Benjamin E. Jones and Harold T. Stearns. (Contributions to the Hydrology of the United States, 1929.) Pp. vi+221-320+plates 15-25. 40 cents. Water-Supply Paper 637-A: Surface Water Supply of Minor San Francisco Bay, Northern Pacific and Great Basins in California, 1895–1927. By H. D. McGlashan. (Contributions to the Hydrology of the United States, 1930.) Pp. vi+68. 10 cents. (Washington, D.C.: Government Printing Office.)

The Science Reports of the Tôhoku Imperial University, Sendai, Japan. First Series (Mathematics, Physics, Chemistry), Vol. 19, No. 2. Pp. 155-264. (Tokyo and Sendai: Maruzen Co., Ltd.)

CATALOGUE.

Ephedrine B.D.H. Pp. 10. (London: The British Drug Houses, Ltd.)

Diary of Societies.

FRIDAY, JULY 18.

BRITISH PSYCHOLOGICAL SOCIETY (Æsthetics Section) (at Bedford College for Women), at 5.30.—Mrs. Ursula Roberts (Susan Miles): The Nature of Prose.

FRIDAY, JULY 25, TO *THURSDAY*, AUGUST 7.

GEOLOGISTS' ASSOCIATION.—Summer Field Meeting in the St. David's District, Pembrokeshire.

COLLOQUIUM.

JULY 19 TO 30.

ST. ANDREWS MATHEMATICAL COLLOQUIUM (in University Hall, St. Andrews).

Prof. H. F. Baker: Rational Curves and Surfaces.
Dr. H. W. Richmond: Arithmetical Properties of Curves and Surfaces.
Prof. C. G. Darwin: The Wave Mechanics.
Prof. H. W. Turnbull: Elementary Mathematics from the Higher Standpoint.
Dr. A. C. Aitken: Recent Developments in Symmetric Functions, Determinants, and Algebraic Equations.
Theory of Functions.
Prof. E. T. Whittaker and others: Informal Talks.

CONFERENCES.

JULY 20 TO 25.

INTERNATIONAL CONGRESS OF MICROBIOLOGY (at Institut Pasteur, Paris).—In three sections, devoted respectively to Medical and Veterinary Microbiology, Ecology and Immunology, and Botany and Parasitology.

JULY 21 TO 24.

BRITISH PHARMACEUTICAL CONFERENCE (at Cardiff).

Monday, July 21, at 8 P.M. (in City Hall).—Civic Reception.

Tuesday, July 22, at 10 A.M. (in Technical College).—J. T. Humphrey: Chairman's Address.
Science Meeting.
At 4.30.—Education Meeting.

Wednesday, July 23, at 10 A.M. (in Technical College).—Science Meeting.
At 2 (in Technical College).—Science Meeting.

Thursday, July 24, at 10 A.M. (in Technical College).—Closing Session.